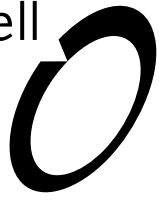


Boffa Miskell



# Mount Munro Wind Farm

Landscape Effects Assessment

Prepared for Meridian Energy

12 May 2023



## Document Quality Assurance

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# Executive Summary

Meridian Energy Limited engaged Boffa Miskell Limited to assess the landscape and visual effects of a proposed wind farm at Mount Munro.

The proposed wind farm occupies an area of elevated working rural landscape approximately 5km south of Eketahuna and 1.5 km east of State Highway 2 at its nearest point. The site straddles the boundary of the Tararua and Masterton Districts and respective Horizons and Greater Wellington Regions. The site is zoned rural and falls outside any identified Outstanding Natural Features or Outstanding Natural Landscapes.

The proposed wind farm encompasses up to 20 turbines located along a series of low open hills which will continue to be managed as pasture as part of a larger working farm. Each proposed turbine has a hub height of up to 92 metres, blade rotor diameter of up to 136m and tip height of up to 160 metres and will be located within a defined Turbine Envelope Zone which ensures the wind farm will have a coherent order along a primary ridgetop and adjoining lower rounded ridge to the north-west. The location of individual turbines and associated access and earthworks has also been assessed to confirm this can respond well to the underlying topography and limit the potential for wider landscape effects.

Physical effects will result from earthworks necessary to create the access roads and turbine platforms and associated laydown areas during construction. Roads have been located to ensure potential views of cut and fill batters are largely contained within the site and will be reinstated in pasture following construction. The main accessway on the primary ridgetop has been located within the folded landform, thereby largely internalising available views. Turbine platforms and secondary access will generally occupy elevated gently rolling ridgelines to minimise earthworks and limit external views. Vegetation removal will be minimal and is primarily limited to existing pasture and small areas of regenerating native shrubs within Turbine Envelope and Turbine Exclusion Zones required for access track earthworks and to form turbine platforms.

Views towards turbines will be available from a range of near and more distant viewpoints. Generally, in proximity to the site proposed turbines may appear prominent in open views. In many locations within closer proximity to the site however, views are restricted by intervening landform and/or established vegetation, with full open views primarily limited to transient views from roads. Between approximately 2 and 5 km, the potential for prominent views and consequent visual effects will diminish. Beyond 5 km, including views from within residential areas of Eketahuna, views towards the wind farm generally become subsumed in long distance views encompassing the surrounding rural landscape with no more than minor visual effects. Over the range of distances from the site, views of earthworks generally remain more limited and internalised due to screening by landform.

Primary views of the windfarm from surrounding dwellings are typically limited given the folded landform and the nature and extent of planting typical of this rural landscape. However, the scale and elevated locations of turbines means that turbines will be prominent in some views. The potential for very high visual effects is limited to a single dwelling located internally within the site and associated with the project. Beyond the site, the potential for open views of the wind farm has also been identified from four dwellings that are less than 1.5 kilometres of the site, within which the proposed wind

farm will appear prominent in primary views with a corresponding high level of effect. Notwithstanding this, in such views, turbines will also remain part of the wider surrounding working rural landscape character within which their acceptability and nature of effect may vary on account of each observer's individual preference and change over time.

Potential cumulative effects remain very limited given the distance of the Mount Munro wind farm between other wind farm sites, and the nature of the surrounding landscape. The nearest consented wind farm at Castle Hill is located over 13km away and is unlikely to be visible in the context of the site. Over longer distances wind farms along the Tararua Range remain well separated from the site with any cumulative views no more than a series of very briefly glimpsed distant views travelling along SH2.

Any potential for significant landscape or visual effects are limited and solely occur within the context of private views within the more immediate vicinity of the site. The nature of such effects relating to windfarms are complex and often change over time, particularly following construction. There are also opportunities to respond with specific mitigation measures which have an ability to reduce the overall level of identified effects from individual private properties. Beyond such localised areas, the proposal will remain visible to varying degrees which dissipate from the site. In landscape terms, physical impacts generally remain limited and well contained and enable the overall development to remain integrated within this local setting, including its inherent working rural landscape character.

Overall, the site is appropriate in terms of its capacity to absorb the parameters of the windfarm as proposed. Whilst wind turbines will be highly visible from some surrounding rural areas, the landscape's inherent working rural character will be maintained and result in relatively limited visual effects.



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Appendix 2: Statutory Provisions

Appendix 3: Visual Effects from Dwellings within 2km of Nearest Turbine

Graphic Supplement (bound separately)

# 1.0 Introduction

## 1.1 Scope of the report

- 1.1.1 Boffa Miskell Limited (BML) has been engaged by Meridian Energy Limited in August 2021 to undertake a Landscape and Visual Effects Assessment (LVEA) for a proposed 20-turbine wind farm at Mount Munro in the Wairarapa.
- 1.1.2 The proposed wind farm and associated transmission facilities will be sited over several properties located 5km south of Eketahuna (otherwise referred to as the 'Site' in this report). The Site is situated on the boundary of the Tararua and Masterton Districts and the Horizons and Greater Wellington Regions.
- 1.1.3 This report assesses the landscape and visual effects of the proposed wind farm, including likely visual amenity effects on the surrounding viewing audience and associated landscape character.

## 1.2 Assessment Process

- 1.2.1 This assessment has been undertaken with reference to Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines<sup>1</sup> and its signposts to examples of best practice, which include the Quality Planning Landscape Guidance Note<sup>2</sup> and the UK guidelines for landscape and visual impact assessment<sup>3</sup>. A full methodology is outlined in **Appendix 1** of this report. In summary, the effects ratings are based upon a seven-point scale which ranges from very low to very high.
- 1.2.2 Several site visits were undertaken to assess the existing Site within its landscape context. This commenced with a site walk over in November 2021 to visit the vicinity of proposed turbines and to identify representative views from within the surrounding landscape. Further site visits were undertaken in May 2022 to ascertain the potential visibility of the proposal from nearby residences using publicly accessible viewpoints and in March 2023 to visit dwellings within the vicinity of the proposed wind farm for which potential visual effects were identified and access arrangements had been agreed. During the site visits, weather conditions were fine and clear.
- 1.2.3 In addition to site visits, the LVEA was assisted with Unmanned Aerial Vehicle (UAV) surveys undertaken in November 2021 and August 2022 to provide current aerial photography and prepare a digital 3d surface model within the area of landscape that the wind farm is proposed. High resolution panoramic photographs were also obtained during the site visits from surrounding public and private viewpoints and used to prepare accurate visual simulations which assisted with this assessment. Visual simulations have been prepared in accordance with best practice guidelines<sup>4</sup> with simulations from representative public viewpoints included within the Graphic Supplement. A summary of the methodology employed is included in **Figure 10**.

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<sup>1</sup> NZILA (2022) Te Tangi a te Manu Aotearoa New Zealand Landscape Assessment Guidelines

<sup>2</sup> <https://www.qualityplanning.org.nz/node/802>

<sup>3</sup> Landscape Institute and Institute of Environmental Management and Assessment (2013) Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA3)

<sup>4</sup> Best Practice Guide: Visual Simulations BPG 10.2, NZILA

## 2.0 Existing Environment

- 2.1.1 The Site is situated on the boundary of the Tararua and Masterton Districts and the Horizons and Greater Wellington Regions. The Site lies to the west of the Tararua Ranges and forms a part of the hill country to the east of Kōpuaranga River, around 5km south of Eketahuna, see **Figure 1**.
- 2.1.2 The surrounding land use is predominantly rural, with sheep, beef and dairy farming forming much of the local land use. The Pūkaha National Wildlife Centre is located to the southwest of the Site, approximately 4km from the nearest potential wind turbine location. This forms an area of restored native forest and a captive breeding site, home to endangered wildlife which remains physically and visually separated from the Site.

## 2.2 Landscape Context

- 2.2.1 Land within the western part of the Site and continuing to the north lies within the Manawatū-Whanganui Region. The Tararua Range lies to the northwest of the Site and physically separates the western and eastern parts of the region. Together with the Remutaka Range to the south and the Ruahine Range to the north, the Tararua Ranges form part of the North Island's axial range which stretches from the south Wairarapa Coast to beyond the Manawatū Gorge. This sequence of mountain ranges is highly expressive of the underlying geological forces that created New Zealand and has a defining effect on the weather for much of the lower North Island. These features also form a significant part of the Region's identity with both the Ruahine and Tararua Forest Parks recognised as outstanding natural landscapes in the Horizons One Plan.
- 2.2.2 The rolling hill country of which Mount Munro forms a part, lies to the east of the Tararua Range and is physically separated by the Pahiatua Basin which generally extends north-east from Pūkaha / Mount Bruce accommodating the general alignment of State Highway 2 into the southern Hawkes Bay. Mount Bruce (710m asl) forms the southern extent of this basin landform and is separated from Mount Munro (470m asl) by a tributary of the Mākākahi River in the vicinity of the Opaki Kaiparoro Road.
- 2.2.3 Within the Site, the broader landform continues along an elongated south-west to north-east running ridgeline to another high point to the northeast of Mount Munro of 510m asl, before falling towards a tributary of the Mākākahi River in the vicinity of the Wairarapa Railway Line. A lower lying ridgeline to the north-west follows this same orientation and extends between local high points of 388m and 452m asl before falling towards the Mākākahi River and associated terraces along the eastern edge of the Pahiatua Basin. A broader sequence of rolling and folded hill country separating contained rural valleys generally continues to the east of the Site towards the coast.
- 2.2.4 Land within the eastern part of the Site and land to the south-east lies within the Wellington Region and the north-western part of the Wairarapa District. This area comprises the northern valleys and hills associated with Mauriceville, Mauriceville West, the Kopuaranga River and the ridgeline and western slopes of Te Rangitumau, see **Figure 2: Landscape Context**. This area is often historically connected with both the Hawke's Bay Region to the north and the Wairarapa to the south.

- 2.2.5 Within the Mauriceville character area<sup>5</sup>, Te Rangitumau is recognised as the ancestral mountain for Māori of the central and upper Ruamahanga River valley. The summit of Te Rangitumau is located approximately 16 kilometres south-east of the Site. Several important papakainga and pa sites are located within this area. The Kōpuaranga valley was heavily cultivated and was also the location of the main pre-European track going north towards Eketahuna and other northern villages.
- 2.2.6 European settlement and clearance of the pre-existing native forest known as Seventy Mile Bush (Te Tapere Nui o Whatonga) began in the early 1860s. A temporary camp for settlers at Kōpuaranga, known as the 'Scandinavian Camp', provided short term accommodation for the Danes, Swedes, Norwegians and other settlers, who came to the area under a New Zealand government subsidised scheme to farm, clear the bush or build the road to Napier. A predominantly Scandinavian settlement was established at Mauriceville West when the railway was constructed through the Kōpuaranga River valley. Mauriceville became the focus of the community and remains so today with the lime company and school currently located there.
- 2.2.7 Eketahuna lies around 5km to the north of the Site and is the main town centre for the area. Aside from this, dwellings, mostly single level, are distributed throughout the surrounding area and are frequently surrounded by shelterbelts, hedgerows, and amenity planting to provide wind protection and enclosure. Sheep and beef farming are the primary land uses in the area.

## 2.3 Site Description

- 2.3.1 In the local context, the Site is located between the Wairarapa Railway line and State Highway 2 and east of the Mākākahi River. Old Coach Road and Opaki-Kaiparoro Road extend along part of the south-west boundary of the Site with rural land accessed along Hall Road and Smiths Line extending to the east.
- 2.3.2 Topographically, the Site is formed of two ridgelines – the main ridgeline being formed by Mount Munro (470m) to the southwest rising to a higher point to the northeast at 510m. The secondary ridgeline lies to the northwest of the main ridge and is formed by three lower lying rounded landforms, separated by tributaries to the Mākākahi River. The landform of the Site is steep to rolling, with some areas of sharper, more defined ridgeline and scarp in the northeast.
- 2.3.3 Land use and vegetation cover of the site is predominantly open pastoral land consistent with a broader working rural character with some small areas of regenerating native bush and wetland areas within the lower slopes of the gullies.

## 2.4 Mana Whenua Values

- 2.4.1 Ngāti Kahungunu (Te Taiwhenua o Tāmaki Nui-a-Rua), Ngāti Kahangunu ki Wairarapa and Rangitāne o Tāmaki Nui-a-Rua and Rangitanē ki Wairarapa are identified as having interest in the area.<sup>6</sup>

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<sup>5</sup> Boffa Miskell (2010) Wairarapa Landscape Study: Landscape Character Description.

<sup>6</sup> Source: <https://www.tkm.govt.nz/>

- 2.4.2 Under the Greater Wellington Natural Resources Plan, the Kōpuaranga River as a tributary of Te Awa Tapu o Ruamāhanga (Ruamāhanga River) is identified in Schedule B as a Ngā Huanga o ngā Taonga Nui a Kiwa, for mana whenua Rangitāne o Wairarapa and Ngāti Kahungunu ki Wairarapa.
- 2.4.3 Based on this, the proposed activities that occur in and around the Kōpuaranga River and Mount Munro area are relevant and may potentially affect iwi cultural values and other associative values to be addressed be mana whenua. Mount Munro is not mentioned in any of the District or Regional Plans or Policy Statements as having any heritage sites and is not identified on any local maps as being a place of interest or significant heritage.

## 3.0 Relevant Statutory Provisions

- 3.1.1 The Site is situated on the boundary of the Tararua and Masterton Districts and the Horizons and Greater Wellington Regions, see **Figure 3**. As part of this assessment, there are a number of planning provisions that are relevant to this project. Specifically, they include:
- The Resource Management Act – notably Section 6 matters (Outstanding Natural Landscapes).
  - National Policy Statement for Renewable Electricity Generation
  - National Policy Statement on Electricity Transmission
  - Horizons One Plan
  - Greater Wellington Natural Resources Plan
  - Tararua District Plan
  - Wairarapa Combined Plan
- 3.1.2 Details of the Regional and District Plan objectives, policies and rules which are relevant to the landscape are provided in **Appendix 2**. A summary of this has been outlined below.

## 3.2 Resource Management Act

- 3.2.1 The RMA provisions relevant to landscape and visual effects addressed in this report are in respect of:
- Section 6(a) – the preservation of the natural character of... wetlands, lakes and rivers and their margins
  - Section 6(b) - The protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development
  - Section 7(c) – the maintenance and enhancement of amenity values
  - Section 7(f) – the maintenance and enhancement of the quality of the environment.

### 3.3 National Policy Statement for Renewable Electricity Generation

- 3.3.1 The National Policy Statement for Renewable Electricity Generation (NPS) is guidance for local authorities on how renewable electricity generation should be dealt with in Resource Management Act 1991 (RMA) planning documents. These documents include regional policy statements, regional plans and district plans.
- 3.3.2 The NPS promotes a more consistent approach to balancing the competing values associated with the development of New Zealand's renewable energy resources when councils make decisions on resource consent applications. This gives greater certainty to applicants and the wider community.

### 3.4 Horizons One Plan

- 3.4.1 The Horizons One Plan was notified in 2007 and is the "one stop shop" resource management planning document for the Horizons Region. It combines the Regional Policy Statement, Regional Plans and Coastal Plan.
- 3.4.2 Section 3.4.2 of the Plan relates to Energy, with Policy 3-6 relating to Renewable Energy. Under this policy the Regional Council and Territorial Authorities must have particular regard to the benefits of the use and development of renewable energy resources, the Region's potential for the use and development of renewable energy resources, the need for renewable energy activities to be located where the resource is located and the logistical or technical practicalities associated with developing, upgrading, operating or maintaining an established renewable electricity generation activity.
- 3.4.3 Under Policy 3-7 The Regional Council and Territorial Authorities must have particular regard to the efficient end use of energy in consent decision-making processes for large users of energy.
- 3.4.4 Section 6.4.2 relates to Landscape and Natural Character. Under Policy 6-6 the natural features and landscapes listed in Schedule G Table G.1 must be recognised as regionally outstanding and must be spatially defined in the review and development of district plans. No identified outstanding natural features and landscapes have been identified in relation to the Site or its immediate surroundings.
- 3.4.5 Under Policy 6-8 Natural Character is to be preserved and protected from inappropriate subdivision, use and development and restored and rehabilitated where this is appropriate and practicable. Policy 6-9 relates to the management of natural character. Under this policy subdivision, use or development must generally be considered appropriate if it is compatible with the existing level of modification to the environment and will provide for the restoration and rehabilitation of natural character where that is appropriate and practicable.

### 3.5 Wellington Regional Policy Statement

- 3.5.1 The Wellington Regional Policy Statement (RPS) became operative on the 24th April 2013 and provides the current framework for the sustainable management of the Region's natural resources.



- 3.5.2 Within the RPS, Objective 17 is relevant to the Region’s outstanding natural features and landscapes. Under this objective, Policies 26 and 50 require the identification, protection and management of outstanding natural features and landscapes. Objective 18 refers to the Region’s special amenity landscapes with policies 27 and 28 referring to their identification and management. No outstanding natural features and landscapes or special amenity landscapes have been identified within the Site in accordance with the RPS. Section 3.3. of the RPS relates to Energy, including the development and benefits of renewable energy.

### 3.6 Greater Wellington Proposed Natural Resources Plan

- 3.6.1 Policy 12 requires that when considering proposals that relate to the provision of regionally significant infrastructure, or renewable energy generation activities, particular regard will be given to the benefits of those activities.
- 3.6.2 Policy 13 provides for the use, development, operation, maintenance, and upgrade of regionally significant infrastructure and renewable energy generation activities.
- 3.6.3 Policy P20 requires that Kaitiakitanga shall be recognised and provided for by involving mana whenua in the assessment and decision-making processes associated with use and development of natural and physical resources.
- 3.6.4 Policy P24 requires that significant adverse effects on areas of natural character outside the coastal marine area are avoided, remedied or mitigated. Policy P48 requires that adverse effects of activities on all other natural features and landscapes are avoided, remedied or mitigated.
- 3.6.5 Policy P48 requires the protection of outstanding natural features and landscapes by: (a) identifying outstanding natural features and landscapes within the region, and (b) avoiding adverse effects of activities on outstanding natural features and landscapes, and (c) avoiding significant adverse effects and avoiding, remedying or mitigating other adverse effects of activities on all other natural features and landscapes.
- 3.6.6 Outstanding Natural Features and Landscapes in proximity to the Site are identified on **Figure 2**.

### 3.7 Tararua District Plan

- 3.7.1 The area of the Site which falls within the Tararua District is zoned Rural. Desired characteristics of the Rural Management Area are “characterised by a predominance of rural land uses including farming, forestry and natural open space, in addition to a variety of residential, community, commercial and industrial activities which either serve and support the rural function of the area or cannot be located in an urban area because of the nature of the activity. The level of amenity and environmental quality expected by the community in these areas reflects the predominantly rural character of such areas.”
- 3.7.2 Section 2.3 of the Plan relates to Rural Land Use Management, with Section 2.3.2 relating to sustainable and efficient Rural Land Use. Objective 2.3.2.1 aims “To achieve sustainable rural land use and efficient use of resources”. Objective 2.3.4.1 of the Plan aims “To ensure a high level of environmental quality and amenity throughout the rural areas of the District”.

- 3.7.3 Objective 2.6.4.1 of the Plan is “To protect natural features and landscapes, trees and areas of indigenous vegetation and habitats of indigenous fauna that are of district, regional or national significance from inappropriate subdivision, use and development.”
- 3.7.4 Objective 2.8.4.1 of the plan is “To recognise the potential of the District’s Rural Management Area for renewable electricity generation and wind farms in particular.”
- 3.7.5 Policy 5.3.7 relates to Renewable Electricity Generation facilities. The provisions seek to ensure that resource consent applications for such activities are considered on a case-by-case basis in order that the community benefits of generation are recognised and that the actual and potential environmental effects of generation are managed. The provisions also seek to provide guidance as to the information to be included in resource consent applications for generation facilities, including wind farms, and the matters that the Council will consider when making decisions about any such applications. Details of these considerations and policies relating to landscape, wind energy and the rural environment are outlined in **Appendix 2**.

### 3.8 Wairarapa Combined District Plan

- 3.8.1 The three Wairarapa District Councils (Masterton, Carterton and South Wairarapa) have prepared a Combined District Plan, under the Resource Management Act 1991. The area of the Site which falls within the Wairarapa Combined District Plan is zoned Rural.
- 3.8.2 There are no policies for the Rural zone specific to renewable energy generation (as these are provided for on a district-wide basis), but in respect of the Rural zone, the Plan notes that:
 

*Parts of the rural environment, particularly higher landforms, have considerable potential for wind energy generation in the Wairarapa. While the development of wind energy generation has the potential to introduce significant new structures into the rural landscape, with some consequential effects, it is expected that there will be appropriate sites for such facilities, and that the effects of their development and operation can be managed to maintain rural amenity values. Where generation facilities are established, it will be important to manage subdivision and development in the vicinity to minimise the potential for reverse sensitivity conflicts.*
- 3.8.3 Section 4.3.1 Objective Rur1 of the Plan for the Rural Zone aims “To maintain and enhance the amenity values of the Rural Zone, including natural character, as appropriate to the predominant land use and consequential environmental quality of different rural character areas within the Wairarapa.”
- 3.8.4 Section 4.3.4 Objective Rur2 aims “To enable primary production and other land uses to function efficiently and effectively in the Rural Zone, while the adverse effects are avoided, remedied, or mitigated to the extent reasonably practicable.” This objective recognises that many activities are appropriate in a rural setting and can establish and function without compromising the core primary production activities in the rural area.
- 3.8.5 Section 9.3.1 Objective Lan1, which is a district-wide objective, is to “To identify and protect the Wairarapa’s outstanding landscapes and natural features from the adverse effects of inappropriate subdivision, use and development”

- 3.8.6 Section 16.3.1 Objective NUE2, which is also a district-wide objective, is “To move the Wairarapa towards a sustainable energy future by encouraging energy efficiency and the generation of energy from renewable sources.”
- 3.8.7 Relevant policies in relation to the Rural Zone, Landscape and Renewable Energy are outlined within **Appendix 2**.

### 3.9 Outstanding Natural Landscapes/Features and Special Amenity Landscapes

- 3.9.1 Within the Horizons Region, the Tararua State Forest Park and the highest ridges and hilltops of the Ruahine and Tararua Ranges are identified as Regionally Outstanding Natural Features and Landscapes under Schedule G within the One Plan. The Tararua State Forest Park has the following characteristics/values:
- (i) Visual and scenic characteristics, particularly its prominence throughout much of the Region and its backdrop vista in contrast to the Region's plains
  - (ii) Ecological values, including values associated with mature indigenous forest, remnant and regenerating indigenous vegetation and important habitat
  - (iii) Contribution to the national conservation estate
  - (iv) Recreational values, especially tramping
  - (v) Historical values associated with early recreation
  - (vi) Cultural values.
- 3.9.2 The highest ridges and hilltops of the of the Ruahine and Tararua Ranges have the following characteristics/values:
- (i) Visual, natural and scenic characteristics of the skyline of the Ruahine and Tararua Ranges, as defined by the series of highest ridges and highest hilltops along the full extent of the Ruahine and Tararua Ranges, including the skyline's aesthetic cohesion and continuity, its prominence throughout much of the Region and its backdrop vista in contrast to the Region's plains
  - (ii) Importance to tangata whenua and cultural values
  - (iii) Ecological values including values associated with remnant and regenerating indigenous vegetation
  - (iv) Historical values
  - (v) Recreational values.
- 3.9.3 The Wairarapa Landscape Study (Boffa Miskell, 2010) was developed to assist in developing planning measures for managing landscape change in the Wairarapa District and used to inform the proposed Combined Wairarapa District Plan. The two-part study provides a comprehensive assessment of the Masterton, Carterton and South Wairarapa districts, the findings of which are relevant to the Site are mapped in **Figure 2**. The Wairarapa Landscape Study – Evaluation (Boffa Miskell, 2010) identifies the Wairarapa's outstanding natural landscapes/features (ONLFs) and significant amenity landscapes (SALs) which have been included in the Draft Wairarapa Combined District Plan. The Site is not identified as an ONLF or SAL. Within the study, the following ONFL and SAL areas are closest to the Site.

#### Pūkaha Mount Bruce ONFL

3.9.4 Approximately 2.7km southwest of the nearest proposed turbine location, Mount Bruce (Pūkaha) ONFL falls within the northern plains Character Area in the 2010 Landscape Study, straddling both Masterton and Tararua Districts. The boundary of the ONFL follows the boundary of the Pūkaha Mount Bruce Reserve, encompassing 883 hectares, approximately 30km north of Masterton. The evaluation of the ONFL identifies the following landscape values:

- The last sizable remnant of 70 Mile Bush
- Advanced secondary regeneration including tall emergent podocarp species
- Nationally & internationally recognised captive breeding programme
- Prominent from SH2 due to its elevated location, continuity of vegetation cover and large scale
- High natural values
- Highly regarded by local, and national communities for education and conservation contributions
- High significance for tangata whenua as important site for food gathering, knowledge and medicine
- Historical associations with prominent conservationist, Elwyn Welch

#### Rimutaka and Tararua Ranges

3.9.5 Around 8.7km southwest from the nearest proposed turbine, the Rimutaka (Remutaka) and Tararua Ranges ONFL falls within the Western ranges Character Area. The Tararua Ranges extend from the Manawatu Gorge 100km south to SH2 (Rimutaka Hill Road, north of Upper Hutt), while the Rimutaka Ranges extend from the SH2 to Turakirae Head. Key attributes from the evaluation are:

- Complete sequence of intact native forest (lowland to alpine)
- Large block of uplifted greywacke rock; physically separates Wairarapa from Hutt Valley and Kapiti Coast
- Dramatic size, scale and extent of ranges
- Highly natural, contiguous vegetation cover (except toe of slope); undeveloped and provides point of reference and important backdrop to the plains
- Particularly dramatic with varying lighting conditions, distinctive skyline and snow in winter
- Widely recognised landscape feature in Wairarapa and Wellington region
- Highly significant to tangata whenua
- Historical links - Rimutaka rail incline, Rimutaka road formation, and early tramping huts in New Zealand.

#### Hidden Lakes ONFL

3.9.6 Around 12.8km south of the nearest proposed turbine, The Hidden Lakes ONFL falls within the Northern Plains Character Area. The extent of the area takes in two QEII

covenants, the two lakes. The high point of the ridge enclosing the lakes is known as Rerenga. Key attributes are:

- Range of interesting and unique landforms, including hummocky areas, steep escarpments, and two freshwater lakes
- Fringed by semi-mature native vegetation, dominated by totara, kowhai and titoki
- Supports an abundance of bird life – especially large numbers of tui and wood pigeons when the kowhai are in flower
- The lakes are particularly vivid, being enhanced by their vegetated setting and the steep cliffs as a backdrop
- Recognised as a 'hidden treasure', secluded and isolated
- Historical reminder of 1855 earthquake and dynamic nature of the landscape
- Significance to tangata whenua as historical site of Tirohanga Pa prior to its destruction

#### Te Rangitumau SAL

3.9.7 Around 14km southeast of the nearest proposed turbine, Te Rangitumau is located on the boundary of the Northern Plains and Mauriceville Landscape Character Areas. The boundary of the SAL approximately follows the toe of the landform about the 400m contour. The evaluation of the SAL states that:

- Moderate ecological values as the landform is almost entirely grazed
- Landform itself is largely unmodified, except for the radio tower and access track
- Dramatic scale, and distinctive profile which is identifiable from various vantage points throughout northern Wairarapa
- Tightly cropped vegetation reveals and accentuates the underlying topography
- Well known landmark for local community
- Extremely significant to tangata whenua (especially Rangitane) as their 'ancestral mountain'.

### 3.10 Summary of Statutory Context

3.10.1 The Site is situated on the boundary of the Tararua and Masterton Districts and the Horizons and Greater Wellington Regions. The Site lies to the west of the Tararua Ranges and forms a part of the hill country encompassing extending east of the Mākākahi River and encompassing the Kōpuaranga River, around 5km south of Eketahuna.

3.10.2 The Site is zoned Rural Management Area under the Tararua District Plan and Rural under the Wairarapa Combined District Plan.

3.10.3 Objectives in the Tararua District Plan for the Rural Zone aim to “ensure a high level of environmental quality and amenity throughout the rural areas of the District” and to protect natural features and landscapes, trees and areas of indigenous vegetation and habitats of indigenous fauna”. The Plan also recognises the potential of the Rural

Management Area “for renewable energy generation and wind farms in particular”. Policy 5.3.7 of the Plan seeks to ensure resource consent applications for renewable energy generation ensure that the actual and potential environmental effects of generation are managed.

- 3.10.4 Objectives NUE1 and NUE2 in relation to Networks Utilities and Energy Wairarapa Combined District Plan notes that higher landforms in the district have “considerable potential for wind energy generation”. It notes that there will be “some consequential effects” which can be “managed to maintain rural amenity values”. Objectives within the plan for the Rural zone also aim to “maintain and enhance the amenity values of the Rural Zone, including natural character” (Objective 4.3.1), ensure that “primary production and other land uses function efficiently and effectively in the Rural Zone”(4.3.2), “identify and protect outstanding landscape and natural features from the adverse effects of inappropriate subdivision, use and development”(9.3.1) and encourage energy efficiency and the generation of energy from renewable sources” (16.3.1).
- 3.10.5 Within the Horizons Region, the Tararua State Forest Park and the highest ridges and hilltops of the of the Ruahine and Tararua Ranges are identified as Regionally Outstanding Natural Features and Landscapes under Schedule G within the One Plan.
- 3.10.6 There are no ONFLs or SALs which apply to the Site. The Wairarapa Landscape Study identifies the Wairarapa’s outstanding natural landscapes/features (ONLFs) and significant amenity landscapes (SALs). The nearest areas to the Site are Mount Bruce (Pūkaha, 2.7km southwest of the nearest turbine site), the Tararua/Rimutaka Forest Ranges (8.7km southwest), Hidden Lakes ONFL (12.8km south) and Te Rangitumau SAL (14km southeast).

## 4.0 Proposal Description

### 4.1 Project details

- 4.1.1 Meridian Energy Limited (Meridian) first started investigating a project at Mount Munro over ten years ago, resulting in the lodgement of a Resource Consent application in 2011 which was subsequently withdrawn in 2013 due to lack of electricity demand. Meridian's long-term interest in the Site hasn't diminished. Meridian is now seeking to consent an updated layout for the Mount Munro Wind Farm.
- 4.1.2 The Site is identified in the Meridian Energy Project Description accompanying the Application as a Class 1 wind site with a capacity for 20 turbines (90 MW).
- 4.1.3 The Site comprises three landowners, one of whom farms the majority of the Site. The third landowner's property is just within the boundary of the project. Sheep and beef cattle are reared across the farms.
- 4.1.4 Meridian Energy is seeking consent for the following:
  - 1. A Turbine Envelope Zone within which all turbines and any infrastructure will be located.

2. A Turbine Exclusion Zone where any infrastructure but no turbines will be located.
  3. A transmission corridor and substation to electrically connect the wind farm to the national electrical grid.
- 4.1.5 The location of these elements in relation to the Site and its immediate surroundings are illustrated on **Figure 4**.
- 4.1.6 Advancements in wind turbine technology have led to a redesign of a previous 2011 wind farm layout, and it is now proposed to use more efficient and taller turbines. Up to 14 closely spaced turbines will be located on the main ridge, with two further groups, each of up to 3 turbines on lower hills to the northwest of the main ridge (a total of up to 20 turbines).
- 4.1.7 Despite the flexibility the Turbine Envelope Zone provides in terms of possible turbine layouts, the narrow ridge limits, in practical terms, the extent to which any turbine can be moved. Five scenarios (turbine layouts) were developed in order to assess the potential impacts of the whole Turbine Envelope Zone, with an indicative turbine layout illustrated within the accompanying graphic supplement.
- 4.1.8 A turbine make and model has not been specified at this stage. For the purpose of this assessment of Landscape Effects, the turbine parameters used are:
- 136m blade diameter
  - 92m hub height
  - 160m blade tip height.
- 4.1.9 For other modelling and simulations, the turbine will also have the following characteristics:
- The turbines must be of an upwind, horizontal axis, three-bladed, variable speed pitch regulated design on tubular/ conical towers
  - Each wind turbine comprises a tower, a nacelle, and a rotor hub with three blades.
  - The colour of the turbine will be light grey which is uniform over the blades, hubs, nacelles and towers. A low reflectivity finish will be used on the blades specifically to limit the amount of blade glint. This is the same colour and finish used at Meridian's West Wind, White Hill, Mill Creek, Te Uku and Te Apiti Wind Farms.



## 4.2 Technical Details

4.2.1 Potential landscape and visual effects may arise from the excavation and construction of up to 20 turbine foundations, crane pads and laydown areas, erection and operation of up to 20 wind turbines, with a 136m blade diameter, 92m hub height and 160m blade tip height, construction of internal access roads, installation and operation of a wind monitoring mast, construction/installation and operation of temporary construction compound and further permanent buildings and structures in relation to the wind farm, construction and operation of a terminal substation, internal substation and internal transmission network and a 3.5km long transmission line and installation and operation of a temporary concrete batching plant within the Turbine Envelope or Turbine Exclusion Zones during the construction period.

4.2.2 A summary of the main aspects of the proposal which have been assessed is set out below.

### Foundation, Crane Pad & Laydown Area

4.2.3 Each turbine will require a flat area for the foundation, crane pad, and blade laydown area onto which the turbine can be erected. This hardstand area will measure approximately 136m long by 60m wide (including the access road) and require cuts of up to 25.5m along a central ridge which is generally screened from external view.

### Internal Rooding

4.2.4 Construction of an internal road network will be required to install and service the wind turbines. To assess the potential effects, the location of the ridge roads and access roads described below is illustrated on **Figure 4**.

4.2.5 The specified widths below are the widths of the *full bearing capacity part of the road* and don't include feathered edges, drains, or removal of banks on the road shoulders to enable the transport of turbine blades etc:

- The wind farm ridge roads will be between 8 and 11 m in width. These roads will have relatively gentle slopes, but due to the topography will result in cut and fill batters which will be re-established in pasture following construction. The combined length of these roads will be approximately 6.0 km.
- The "access roads" that run from the bottom of the hill to the wind farm ridges via relatively steep slopes will be between 6 m and 8 m in width. The combined length of these roads will be approximately 5.5 km. Two main access roads will likely be built for safety and practicality reasons: one for the heavy components and one for light traffic/service vehicles.

### Terminal Substation

4.2.6 The connecting Substation (Terminal Substation) for the wind farm will be located at the bottom of the hill, near the existing 110kV Transpower line, on the western side of the corner of Kaiparoro Road and SH2, see **Figure 4**. It will take the Internal Transmission Line from the wind farm and house all the electrical protection equipment to enable connection into the National Grid via Transpower's 110 kV transmission lines. This will have a footprint of 100 x 125m and height of 7m with exception of poles and gantries up to 18m. The main transformer (33 kV to 110 kV) will be housed here or at the Internal Substation. The Services/O&M building (up to

6.5m in height) may also be housed on this Substation, and potentially up to two small control buildings, both up to 7m in height.

#### Internal Substation and Internal Transmission Network

- 4.2.7 The internal wind farm 33kV network will be underground from the turbines to a point near the southwest most turbine on the main ridge. Here the cables will be collected into a small internal substation/switching station (Internal Substation). This will have a footprint of 70m x 90 m and height of up to 7m with the exception of poles and gantries up to 20m and a lightning rod up to 23m. The internal network between turbines will be buried, most likely under access roads.

#### Transmission Connection between Substations

- 4.2.8 The Terminal Substation will be connected to the Internal Substation by a 33kV, dual circuit 33 kV, or 110 kV line of approximately 3.5 km in length. The poles for the transmission line could be concrete or steel and up to a total height of 20m.

#### Turbine Unit Transformers

- 4.2.9 The transformers that step the voltage up at each turbine generator to the internal network voltage of 33kV will be located either inside the tower's base or outside the tower (in a kiosk or mounted on a pad). If located outside the tower, the transformer of approximately 4.5 metres long, 3 metres wide and 2.7 metres tall will be situated in a position that minimises any visual effects when viewed from outside of the project area (wherever practicable).

#### Wind Monitoring Tower

- 4.2.10 The Site will require one permanent wind monitoring tower (mast), similar to the current mast. This will be up to 92 m tall, guy-wired and a lattice type tower. The location of this monitoring mast will depend on the final locations of the wind turbines.

#### Site Access

- 4.2.11 The Site Entrance will be located at the end of Old Coach Road on a dedicated section of land. This area will host a number of activities. During construction this will house the construction village; including temporary site offices (described further below), amenities, security, parking, and a laydown area (for deliveries of turbine components and for holding these until delivery up to final turbine locations).
- 4.2.12 After commissioning, the entrance area could be used for Operations, and could house the Services/O&M building, and/or continue to function as a storage area for spares and large components required for repairs.

#### Services/O&M Building

- 4.2.13 A permanent Services/O&M building will be located either at the Site entrance area, or at the Substation or the corner of Kaiparoro Rd and SH2. The building will be approximately 35 m x 20 m, and approximately 6.5 m high.

## Portacom Buildings

4.2.14 Several temporary portacom single storey buildings are proposed within the Site Entrance area, including:

- kitchen and chiller portacom structures.
- temporary offices.
- a security office, located at the eastern end of the Site Entrance area.

The portacom structures will be removed upon the completion of the construction phase.

## Concrete Batching Plant

4.2.15 The Site will include a temporary concrete batching plant to be located within the Turbine Envelope or Turbine Exclusion Zones during the construction period. The likely structures and facilities, which comprise a typical concrete batching plant, will include:

- Control room and storage buildings;
- Mobile batching plant unit which includes, but is not limited to, hoppers, aggregate storage bins, compressor, cement silos and conveyors (18m long, 4m wide, 7m high (highest point));
- Additional cement storage silo (6m long, 2.4m wide, 2.4m high);
- Water tank;
- Aggregate stockpile area (50m x 20m);
- Generator.

The concrete batching plant will be removed following the construction phase.

# 5.0 Visual Appraisal

## 5.1 Visual Catchment

5.1.1 As part of understanding the potential level of visibility, a ZTV (Zone of Theoretical Visibility) map was prepared. The ZTV has been based on landform information only and does not consider the location and height of vegetation or structures in terms of screening available views. It provides a starting point and a useful tool to guide where field investigations should be undertaken. A ZTV map does not mean that from every location in the identified area turbines will be visible given that from various locations, some more localised variations in landform, shelterbelts and other trees, buildings and structures may obscure the turbines totally or in part. ZTVs need to be supported with ground-truthing and other analysis.

5.1.2 **Figure 5** includes a ZTV analysis within the surrounding landscape and illustrates that visibility of the Site is relatively well-contained by the Tararua Ranges to the northwest

and the surrounding hill country to the south and east. State Highway 2 provides the main publicly accessible views towards the Site, with views also available from the surrounding minor roads in close proximity to the Site. Such views encompass contained enclaves of rural land accessed along Falkner Road to the southwest of the Site, Opaki-Kaiparoro Road to the south and east of the Site and Hall Road and Smiths Line to the east. To the south-east of the Site, the more folded hill country landform of this area limits the potential for views towards the Site.

- 5.1.3 More distant views towards the Site are available from Eketahuna and from within a broad undulating rural basin to the west of SH2. Such views are frequently concealed beyond changes within the intervening undulating landform together with existing vegetation and structures. This includes buildings and other structures within Eketahuna and other elements in the local landscape such as the 110kv transmission line in Kaiparoro Rd. Beyond this, very distant views towards the Site are theoretically possible from Masterton, which is over approximately 25 km away. However, any actual views were unable to be identified during the site visits and any visual effects which may otherwise occur would be very low.

## 5.2 Representative Viewpoints

- 5.2.1 As part of this assessment, representative panoramic photographs were taken from publicly accessible viewpoints to demonstrate the nature of views when looking towards the Site within its wider landscape context.
- 5.2.2 The selection of representative viewpoints was based on the following criteria:
- To provide an even spread of representative viewpoints within the viewshed and from different directions towards the Site;
  - From locations which represent a range of near, middle and long-distance views;
  - Specific viewpoints chosen because they are key or promoted viewpoints within the landscape, have noted visual or recreational amenity or particular cultural associations; and
  - Whilst private views are relevant, public viewpoints have generally been used to provide representative worst case views from private dwellings. Views from dwellings may also be curtailed by building location and orientation, intervening fences, vegetation or other buildings which cannot be assessed without gaining access to private property.
- 5.2.3 The locations of photographs described below are shown on **Figure 5** and briefly described below:
- 5.2.4 **Viewpoint VP1** illustrates a view looking southeast towards the Site from State Highway 2 at the intersection with South Road No 1. From this location, the main ridgeline of the Site is visible to the right of the photograph, with the foreground landform in the centre and left-hand side of the view screening the main ridge beyond. The foreground of intervening rural landscape includes shelterbelts along Falkner Road which typically enclose rural dwellings in this area.
- 5.2.5 **Viewpoint VP2** illustrates a similar but closer view, from Falkner Road. From this location, the lower western ridge appears more prominent and obscures the main ridge beyond. Vegetation along the Makakahi River is visible in the foreground of the

photograph. Similar views to this will be available from some of the residential properties along Falkner Road.

- 5.2.6 **Viewpoint VP3** illustrates a view near the southern Site boundary from the intersection of Falkner Road and Opaki-Kaiparoro Road. Falkner Road forms the left-hand foreground of the photograph, with Opaki-Kaiparoro Road across the centre of the photograph and to the right as it crosses the Makakahi River. Along the skyline, the image illustrates the relationship between the main ridge, in the right of the photograph, with the secondary ridgeline visible in the far-left hand side of the photograph.
- 5.2.7 **Viewpoint VP4** shows a view from the southwest of the Site looking northeast towards the Site from Opaki-Kaiparoro Road. From here, the eastern side of the main Mount Munro ridge forms a prominent landform in the centre of the photograph. Pockets of macrocarpa and a farm dwelling accessible from Hall Road and visible in the right-hand side of the photograph characterise this rural area.
- 5.2.8 **Viewpoint VP5** illustrates a view towards the Site from the northeast along Smiths Line. The main Site ridgeline and lower rolling landform to the northeast of this form the dominant element in the photograph. Smiths Line forms the right-hand side of the photograph and provides access to rural dwellings typically enclosed within established vegetation.
- 5.2.9 **Viewpoint VP6** illustrates a view from South Road no.2, a rural road to the west of the Site. This photograph looks northeast along the road towards the Site which represents a sequence of undulating hill forms which culminate along the skyline associated with Mount Munro in the distance.
- 5.2.10 **Viewpoint VP7** illustrates a view from the public rest layby at Anzac Bridge, just off the State Highway 2 corridor, to the southwest of the Site. Anzac Bridge was constructed as a memorial to local soldiers who lost their lives in the Great War and opened in 1922. In later years plaques have been added to commemorate fallen WWII veterans. In 2006 the bridge was rededicated as a war memorial site and an annual Anzac Day service is held there. From this location, intervening landform between State Highway 2 and the Site obscures views towards the landform of the Site itself.
- 5.2.11 **Viewpoint VP8** illustrates a view from Main Road, Eketahuna. The view from the town centre looks south down State Highway 2 towards the Site, which is visible framed by buildings in the centre of the photograph. Such views in this location include existing vertical infrastructure including lighting poles and transmission lines which form taller vertical elements in the photograph.
- 5.2.12 **Viewpoint VP9** illustrates a more distant view towards the Site from the northwest, from Nireaha Road, west of Eketahuna. The photograph looks towards the Site across the surrounding rural landscape, which forms the horizon in the centre of the photograph. Such views are typically filtered or framed by surrounding shelterbelts such as observed in the foreground. The bush covered slope of Pūkaha/Mount Bruce is visible as a higher ridgeline to the right-hand side of the photograph.
- 5.2.13 **Viewpoint VP10** is representative of the view from the rural landscape to the southwest of Eketahuna and representative of views from the rural area to the northwest of the Site. From here the Site is visible as part of a sequence of low undulating hills along the skyline. Such views include shelter belts characteristic of the surrounding rural landscape.

## 6.0 Assessment of Effects

### 6.1 Introduction

- 6.1.1 Landscape and visual effects result from natural or induced change in the components, character or quality of the landscape. Usually these are the result of landform or vegetation modification or the introduction of new structures, facilities or activities. Landscape effects can also relate to perceived or associative landscape values. All these aspects are assessed to determine their effects on character and quality, amenity as well as on public and private views.
- 6.1.2 In this technical report, the assessment of potential effects is based on a combination of the landscape's sensitivity and visibility together with the nature and scale of the development proposal.
- 6.1.3 Particular effects considered relate to the following:
- Landscape / rural character effects;
  - Visual amenity effects from public and private locations;
  - Potential cumulative effects; and
  - Effects when assessed in relation to statutory provisions.
- 6.1.4 The principal elements of the proposal that could give rise to landscape and visual effects are:
- Excavation and construction of up to 20 turbine foundations, crane pads and laydown areas;
  - Erection and operation of up to 20 wind turbines, with a 136m blade diameter, 92m hub height and 160m blade tip height;
  - Construction of a main ridgeline road of around 6.0km in length and up to 11m in width;
  - Construction of other access roads around 5.5km in length and up to 8m in width;
  - Installation and operation of a wind monitoring mast;
  - Construction and operation of a temporary construction compound at Old Coach Road, including construction/installation and operation of temporary portacom buildings and further permanent services and O&M buildings and a temporary 30,000L fuel storage tank;
  - Construction and operation of a terminal substation, internal substation and internal underground transmission network; and
  - Construction and operation of a 3.5km long 33Kv, dual circuit 33kV or 110Kv overhead transmission line connection between the substations.

## 6.2 Landscape Effects

- 6.2.1 Landscape character is derived from the distinct and recognisable pattern of elements that occur consistently in a particular landscape. It reflects particular combinations of geology, landform, soils, vegetation, land use and features of human settlement. It creates the unique sense of place with changes in characteristics and values defining different areas of the landscape.
- 6.2.2 The Site forms a part of a working rural landscape to the southeast of Eketahuna, characterised by a larger expanse of rolling rural hill country that continues to the east of the Pahiatua Basin and Tararua Ranges. In itself the Site reads as a typical rural hill property. The siting of the proposed wind farm on a series of ridgelines is typical of New Zealand's wind farms which are almost invariably situated on elevated locations along ridges and hilltops where the wind speeds are most favourable.
- 6.2.3 The effect of the proposed development on landscape character will depend on key characteristics of the receiving landscape; the degree to which the proposed wind farm is considered consistent with or at odds with them; and how the proposed wind farm development would be perceived within the setting. Such differences in perceptions are complex and change over time. The potential magnitude of landscape change is also dynamic and may be influenced by:
- the distance to the Site;
  - atmospheric conditions including changes in weather and different times of the day and year; and
  - the appearance and 'fit' of the proposed wind farm within the landscape.
- 6.2.4 Given the scale of turbines and their inherent potential to be highly visible in elevated locations, wind farms can undoubtedly change the character of a landscape. While some people are averse to the changes in character which may result, others may consider the nature of effect to be benign or sometimes enriched by a coherent array of wind turbines utilising the natural element of wind. Notwithstanding differences between individual's preferences and the corresponding nature of effect (described in further detail relating to visual effects below), the proposed wind farm has also been sited to limit broader landscape effects and ensure the landscape's broader established working rural character will continue. It should also be highlighted that visibility and change are not of themselves adverse landscape effects. Rather, adverse effects are the consequences of change on the landscape's values in the context of outcomes anticipated in the relevant planning provisions.
- 6.2.5 When assessing landscape effects, there is an overlap between the perception of change to landscape character and visual amenity; landscape character is derived from the combination and pattern of landscape values and elements within the view. Relevant factors in assessing effects on landscape values are the wind farm's scale and fit within the Site including construction related effects and maintenance of rural character. The effects of the proposed wind farm on landscape character arises from its relationship to these combinations and patterns and forms an outcome for the accompanying landscape values. By comparison, visual effects are effects on landscape values as experienced in views and influences the amenity enjoyed by viewers.



## Effects on Outstanding Natural Features and Landscapes

- 6.2.6 The Site is not located within any identified district or regional landscapes of importance, including any Outstanding Natural Features (ONF), Outstanding Natural Landscapes (ONL) or Special Amenity Landscape (SAL) areas.
- 6.2.7 Within the Horizons Region, the Tararua State Forest Park and the highest ridges and hilltops of the Ruahine and Tararua Ranges are identified as Regionally Outstanding Natural Features and Landscapes under Schedule G within the One Plan.
- 6.2.8 The Wairarapa Landscape Study identifies the Wairarapa's ONLFs and SALs. The nearest such areas to the Site are Mount Bruce (Pūkaha, 2.7km southwest of the nearest turbine site), the Tararua/Rimutaka Forest Ranges (8.7km southwest), Hidden Lakes ONFL (12.8km south) and Te Rangitumau SAL (14km southeast).
- 6.2.9 The Mount Bruce (Pūkaha) area is also recognised for its prominence from SH2 and high natural values. The proposed wind farm will not disrupt the visibility of Mount Bruce from the State Highway (and is not visible within the same view), nor will it modify any of the recognised natural values. It is also noted that, in terms of visual effects from Pūkaha, the dense nature of the bush covering the area means that there is limited intervisibility from the network of walking tracks in this area to the Site.
- 6.2.10 The highest ridges and hilltops of the Ruahine and Tararua Ranges are recognised for their visual and scenic characteristics, ecological values, contribution to the national conservation estate, recreation and historic values, together with their recognised importance to tangata whenua and cultural values. While there will be intervisibility between the Ranges and the Site, they are well separated, the larger landform of the ranges will remain dominant and the proposal will not adversely affect any of the recognised recreation, historic or scenic characteristics of the Ranges.
- 6.2.11 Given the above, potential adverse landscape effects on regionally important landscapes, ONFL and SAL areas are therefore considered to be **low** and insignificant.
- 6.2.12 It is acknowledged that the above areas lie within the area of interest for Ngāti Kahungunu (Te Taiwhenua o Tāmaki Nui-a-Rua), Ngāti Kahungunu ki Wairarapa and Rangitāne o Tāmaki Nui-a-Rua and Rangitāne ki Wairarapa together with other iwi and the proposed construction and operation of the wind farm may potentially affect iwi cultural values and other associative values in relation to the Site and landscapes recognised for their cultural value.

## Effects on Rural Character and Amenity

- 6.2.13 The rural character of the Site forms part of and contributes to the character of the wider landscape. The Site currently reflects pastoral land use, as is much of the land within the immediate area, typical of the rolling hill country to the east and southeast of Eketahuna. It is characterised by a working agricultural land use and the rolling to steep landforms which form part of a broader low-lying backdrop to the Pahiatua Basin and contained valleys extending north of Mauriceville. Natural elements and systems remain present, however they are often manipulated to enhance productivity or overlaid with patterns and processes of human activity. Such working rural land use is often juxtaposed against the larger and more vegetated Tararua Ranges to the west.

- 6.2.14 Outside Eketahuna, rural settlement is scattered and most typically restricted to small clusters and individual dwellings associated with larger working farms. Rural buildings and other utilitarian structures, such as large implement sheds and overhead transmission lines alongside mature shelter vegetation typically accompany such features and form part of the existing character of the surrounding rural landscape. An existing 110kv transmission line also runs through the Pahiatua Basin within approximately 3km of the Site. The degree of impact on landscape character relates in part to the potential change of this character with the introduction of the proposed wind farm.
- 6.2.15 Generally, the proposed wind farm will influence the character of the more immediate locality as illustrated by the visualisations, in **VP1** to **VP5** in the attached **Graphic Supplement**. The proposed wind farm will have the greatest visual influence on areas within approximately 2km of the Site, where the proposed wind turbines have potential to be viewed as a prominent array of dynamic structural elements along a local area of skyline. Where visible, the proposed layout of the wind farm would follow the grain of the underlying topography and represent an ordered layout which would remain reasonably coherent within the Site's underlying sequence of elongated rolling ridgetops. Visually, the underlying farmland will remain legible and dominant.
- 6.2.16 Potential views of the wind farm would typically occur in conjunction with roads, electricity power pylons and other associated agricultural activities including established vegetation which also frequently punctuates the skyline and contributes part of the established working rural character. In this context, ongoing human activity including farming activity which underpins the underlying rural land use will remain clearly apparent and assists with absorbing the nature of the proposal in this working rural context. The wind farm will be in keeping with the working nature of the landscape, the broad landform patterns and the modest settlement density as discussed above, thereby reducing landscape character effects.
- 6.2.17 Turbines have a simple dynamic form, and their light grey low reflective paint finish will make them less distinguishable when hazy or cloudy conditions prevail, conditions not unusual in the hill country. While turbines are mechanical structures, their function also remains clearly associated with harnessing a natural resource. The proposed turbines typically extend well above the local landform and are visible along a skyline some distance from the Site. The effect of such views on landscape character must take account of the landscape's underlying characteristics and values which are limited, with localised levels of importance, and enable the wind farm to remain relatively well embedded within a broader undulating rural hill country context. The potential effects of the wind turbines and other built elements and structures associated with the wind farm including transmission lines and substation are substantially reduced with distance from the Site.
- 6.2.18 The scale and relationship between proposed turbines and their surroundings form a key aspect relating to rural character and amenity effects. The proposed wind turbines are a different order of size to other vertical elements within this area of rural landscape, such as buildings and trees. Notwithstanding this, the actual size of wind turbines can sometimes be difficult to gauge accurately given the absence of any inherent scale references within their form (i.e. wind turbines of different scales typically have the same generic shape). How wind turbines are perceived (and associated visual effects) is generally not proportional to their dimensions. The scale of turbines also influences the speed of rotation of turbine blades, with larger turbines

having a slower and somewhat more graceful speed of rotation. Larger wind turbines also generate more electricity so can be a more efficient use of the landscape resource with fewer numbers of wind turbines overall and less clutter where visible in combination, all other things being equal.

- 6.2.19 Based on the above, within approximately 2km, the introduction of the wind farm is considered to have up to **moderate-high adverse** effects on landscape character. Such effects remain relatively localised within this area of hill country and established working rural landscape context. Whilst some prominent views of turbines may occur within the more immediate rural context of this Site, such effects avoid any identified outstanding or special amenity landscapes and ensure potential for broader effects on any recognised landscape values remains limited. The layout of wind turbines responds well to the underlying landform and will provide a coherent configuration when observed from the surrounding landscape. Where turbines are visible, the ongoing operation of the underlying farmland and associated rural character will also remain clearly evident. The landscape will retain its sense of openness and the wind turbines will not domesticate the landscape in the same way as a proliferation of houses.
- 6.2.20 As distances from the wind farm increase, the scale of change reduces alongside the level of effect. Beyond distances of approximately 2km, viewing distance often combine with changes in topography and intervening landscape features, such as shelterbelts which generally act to reduce the potential prominence of the wind farm and reduce the relative scale of the turbines, resulting in **low to moderate** landscape character effects. Beyond about 5km, where viewing distance, changes in landform and intervening vegetation and surrounding settlement in Eketahuna provide an increasing sense of separation from the wind farm, any adverse landscape character effects will typically be **low** and no more than minor.

#### Physical effects

- 6.2.21 Physical landscape effects result from changes to the landscape fabric of the Site namely earthworks which result in changes to the existing landform and vegetation pattern of the area. Minimal vegetation clearance (small areas of scrub) is proposed as a part of the construction of access tracks. Proposed earthworks are required to create turbine foundations and laydown areas together with earthworks necessary to construct the access roads. Such areas generally avoid areas of tall / woody vegetation however some small areas may require removal for track widening and where fill is required to tie into slopes.
- 6.2.22 The Turbine Exclusion Zone has been located to remain well contained within the Site. The resulting earthworks generally respond to the existing contour to minimise landform effects. This typically restricts impacts along the underlying landform so that it remains limited from external views. Roads and turbine foundations will be designed to follow the main and secondary ridgelines of the Site and minimise the resultant need for cut and benching works. Due to the steep nature of the surrounding scarps, local box cutting will also be used to reduce external views and limit the scale of exposed fill batters extending along more visible slopes. While the earthworks areas are substantial, following completion of the earthworks these areas are able to be seeded and returned to pasture, mitigating longer term adverse effects on landform.

6.2.23 Effects on landform would be **moderate adverse** during construction, reducing to **low adverse** following completion and reseeding of slopes. Effects on vegetation are **low** during the construction period and **neutral** at completion.

#### Summary of Landscape and Rural Character Effects

6.2.24 In landscape terms, the wind farm has the greatest potential effects within approximately 2km of the Site, where turbines have potential to be viewed as prominent elements along the skyline. The wind farm would be viewed in conjunction with roads, an existing transmission line and ongoing agricultural activities which form part of established views. The layout of the turbines within the Turbine Envelope Zone spaced along the ridgelines helps achieve a visually coherent layout and minimises landform disruption. The simple forms of the turbines and light grey colour also assists with reducing landscape effects. Farming activities can continue below the turbines and the Site will retain its underlying rural character.

6.2.25 Moderate physical landscape effects will result from the earthworks necessary to create the access roads, turbine platforms and construction and laydown areas. Roads have been designed to generally follow the main and secondary ridgelines of the Site to minimise the need for cut and benching works. A summary of the identified landscape effects is set out below in Table 6-1:

Table 6-1 Summary of Landscape Effects

Description of Effect		Level of Effect	
		Construction <sup>7</sup>	Operation <sup>8</sup>
<b>Effects on existing landform</b>	<ul style="list-style-type: none"> <li>Construction of the Site access roads, turbine platforms and laydown/construction areas will require earthworks</li> <li>The Turbine Exclusion Zone has been located to follow existing ridgelines and spurs, responding to the existing contour to minimise landform effects</li> <li>While earthworks are locally substantial in some areas, the visual effects of earthworks are largely contained within the Site and limited due to the nature of the surrounding landform</li> </ul>	Moderate adverse	Low adverse
<b>Effects on existing vegetation</b>	<ul style="list-style-type: none"> <li>The Turbine Exclusion Zone has generally been designed to avoid areas of vegetation however some small areas may require removal for track widening and where fill is required to tie into slopes</li> </ul>	Low adverse	Neutral
<b>Landscape Character Effects</b>	<ul style="list-style-type: none"> <li>The windfarm avoids any identified outstanding or significant natural landscapes.</li> <li>The wind farm would exert its greatest influence on land within approximately 2km of the Site, where it would be viewed as a prominent element on the skyline in some views in the context of the ongoing operation of the underlying rural farmland.</li> <li>The layout of the turbines within the Turbine Envelope Zone spaced along the ridgelines helps to achieve a visually coherent layout which appears well integrated within the local topography</li> <li>The effect of the wind turbines would diminish at distances between 2km and 5km due to topography and intervening landscape features, such as shelterbelts and settlement obscuring the wind farm and distance reducing the relative scale of the turbines.</li> </ul>	<p>Low gradually increasing to Moderate-High adverse during operation (within 2km).</p> <p>Low to Moderate between 2km and 5km.</p> <p>Low adverse beyond 5km.</p>	<p>Moderate-High adverse (within 2km).</p> <p>Low to Moderate between 2km and 5km.</p> <p>Low adverse beyond 5km.</p>

<sup>7</sup> Level of Effect assessed as: Very High, High, Moderate-High, Moderate, Moderate-Low, Low, Very Low

<sup>8</sup> Nature of Effect assessed as: Adverse, Neutral or Beneficial

Description of Effect		Level of Effect	
		Construction <sup>7</sup>	Operation <sup>8</sup>
<b>Effects on Regionally Significant landscapes, ONFLs and SALs</b>	<ul style="list-style-type: none"> <li>The nearest ONFL to the Site is Mount Bruce (Pūkaha), which lies 2.7km to the southwest of the Site. The proposed wind farm will not disrupt the visibility of Mount Bruce from the State highway or be highly visible from the walking tracks within the area, nor will it modify any of the recognised natural values.</li> <li>While there will be intervisibility between the Ruahine and Tararua Ranges and the Site, the larger landform of the ranges will remain dominant and the proposal will not affect any of the recognised recreation, historic or scenic characteristics of the Ranges.</li> </ul>	Low adverse	Low adverse

### 6.3 Natural Character Effects

6.3.1 The Site falls outside the coastal environment and contains no rivers or lakes where effects on natural character might need to be considered under s6(a) of the RMA. Some smaller tributaries of the Mākākahi and Mangaroa Streams will be affected by the proposed road alignment including upgrades to existing tracks and the construction of a new route. This will involve installing or upgrading existing culverts and the construction of a new bridge across a tributary of the Mākākahi Stream at the southern end of Old Coach Road. Within the Site, the proposed layout will also affect parts of some seepages and small gullies and parts of six ‘natural inland wetlands’ as defined by the NPS-FM (2020). In all instances the affected waterbodies are already extensively modified and grazed with little or no indigenous riparian planting and have been assessed as low or negligible ecological value<sup>9</sup>.

6.3.2 Based on the modified and elevated rural context within which the proposed wind farm is located, and corresponding limited and localised waterbody effects, it is therefore considered that any adverse effects on natural character will be **very low** and readily addressed in accordance with recommendations as identified in the ecological assessment.

### 6.4 Visual Effects

6.4.1 Visual amenity effects are influenced by several factors including the nature of the proposal, the occupation and activity of the observer and the ability of the surrounding landscape to absorb change. Visual amenity effects are also dependent on the nature of the view including the underlying values of the receiving landscape alongside viewing distance between the observer and the proposal and the complexity of the intervening landscape.

6.4.2 It should be emphasised that a change in a landscape or view does not, of itself, necessarily constitute an adverse landscape or visual effect. Landscape is dynamic and is constantly changing in both subtle and more dramatic transformational ways; these changes are both natural and human induced. What is important in managing landscape change is that the potential for visual effects is sufficiently mitigated to ameliorate or address adverse effects. The aim is to maintain or enhance the

<sup>9</sup> Boffa Miskell (2023) Mount Munro Wind Farm: Ecological Assessment.

environment through appropriate design outcomes whilst recognising that both the level and nature of effects may change over time.

- 6.4.3 When assessing the nature of visual effects of windfarms, there is a considerable body of international research which has been carried out in relation to public attitudes to wind farms and wind turbines, much of which has focused on wind farms with large numbers of turbines developed by commercial generators. Public attitudes to wind farms are complex and dynamic and vary depending on a range of factors, depending on personal philosophy, whether the person is resident in the area, a passer-by or comes to the area for recreation. Perceptions of wind farms can also be influenced by:
- The value a person places on the existing landscape character of a proposed site;
  - The value a person places on using natural resources for the generation of electricity by non-polluting methods; and
  - A person's familiarity with wind farm technology and the environmental consequences of alternative methods of generating power.

#### Public Attitudes to Wind farms

- 6.4.4 Several studies have shown that attitudes to wind power are different to attitudes to wind farms. Negative public opinion can also be high during the planning and construction stages of a wind farm and significantly lower after the wind farm has been built (Karydis, 2013).
- 6.4.5 Surveys of attitudes to wind farms in New Zealand and overseas suggests that communities hold a range of views, from people who are strongly polarised for or against wind farms, to those who hold more neutral positions. Attitudes may also vary depending on whether one is a casual passer-by or an established resident in the vicinity of a wind farm, and the proximity and orientation of such residence to the actual wind farm.
- 6.4.6 Research which reviewed public perceptions of wind power in Scotland and Ireland supported earlier work which found that opposition to wind farms arises in part from exaggerated perceptions of likely impact, and that the experience of living near a wind farm frequently dispels these fears. This research supported the following counter intuitive findings (Warren, 2005):
- (a) that local people become more favourable towards wind farms after construction;
  - (b) that the degree of acceptance increases with proximity to them; and
  - (c) that the NIMBY syndrome (not-in-my-back-yard) does not adequately explain variations in public attitudes.
- 6.4.7 From a 2009 survey carried out in New Zealand, there has been a wide range of factors in submissions lodged in relation to wind farm developments that affected a submitter's decision to support or oppose a wind farm proposal (Graham et al., 2009). There is also a perception that there is widespread support for renewable energy, particularly wind, but that people are not expressing it formally in their submissions (Stephenson, 2010).

- 6.4.8 Various studies have investigated the 'proximity hypothesis' that those living closest to a wind farm will have the most negative perception of it, but such attempts have proved unsuccessful (Devine-Wright, 2005; Stephenson et al 2009). The significance of landscape context is a key factor in attitudes to wind farms and that the impact of wind farms on landscape values is the main determining factor in explaining opposition or support (Stephenson, 2009). The aesthetic quality of the landscape is often a key determinant of such visual preference (Betakova B., 2015).
- 6.4.9 More locally, surveys of residents in Ashhurst (located approximately 2 km from the nearest of Meridian's Te Apiti wind farm turbines) were conducted during December 2003, prior to construction, and in January 2005, several months after the wind farm was fully operational (Shephard, 2005). Most respondents viewed the wind farm favourably and this varied little between the two surveys. In both 2003 and 2005 the presence of the wind farm was approved by 54%, while over that period those who disapproved declined from 22.5% to 18%.
- 6.4.10 Various other factors affect people's perception of wind farms (e.g. local impacts of construction, people's perception of the developer, turbine colour, tower design) (Devine-Wright, 2005; Stephenson, 2009). Turbine manufacturers have directed a lot of attention into turbine design, not just to improve turbine efficiency and output but also in relation to turbine aesthetics (i.e. tapered towers, shape of the nacelle, blade connections to the hub, all components painted the same colour to provide uniformity, etc.) (Gipe, 2002).
- 6.4.11 More recently, a nationwide survey in the United States exploring landowners' post construction changes in perceptions of wind energy supports the finding that those living closer to wind turbines generally have more-positive attitudes to those living further away (Hoen et al. 2019). This supports the view that seeing wind turbines per se does not automatically produce negative attitudes and adverse visual effects.

#### Effects from representative public viewpoints

- 6.4.12 To assess potential visual effects, preliminary wirelines were prepared which represent the massing and location of potential turbine locations within the proposed Turbine Envelope Zone based on five turbine scenarios from eight preliminary representative views. These were used to inform the range of potential different turbines configured within the identified Turbine Envelope Zone in order to address potential adverse effects. A subsequent assessment of visual effects was supported by visual simulations of a likely turbine layout and associated earthworks from each representative viewpoint as identified in **Figure 5** and included in the **Graphic Supplement**.
- 6.4.13 For each viewpoint, one existing and three visual simulation images are provided on two sheets. On the first sheet (Set A) there are two images, both panoramas, with a 90-degree field of view (FoV), which shows the turbines in context of the wider landscape. The second sheet (Set B) shows the location of proposed earthworks (in red) on the top image with a simulation of the earthworks following mitigation on the bottom image. Visual simulations take account of rotors facing towards the dominant north-north-west wind direction and in response to lighting conditions based on the time-of-day photography was obtained.



#### *Near views from the West*

- 6.4.14 **Viewpoint VP1 (Distance to nearest turbine 1.5km)** provides a representative view looking east towards the Site from State Highway 2, most typically experienced by road users as part of a transient view. From here, the proposed main access is largely contained within the folded landform of the Site in the left-hand side of the view. During the construction period, movement of construction machinery and earthworks to create the ridgeline track and access tracks and turbine platforms will be visible as isolated but discernible elements in the view (see **Viewpoint 1B**). Following their construction, the earthworked batter slopes would be returned to pasture cover and reintegrated within the surrounding land use.
- 6.4.15 In the proposed Turbine Envelope Zone, the turbines are visible spread along the main ridgeline, and the lower ridges in the centre of the view. The proposed Turbine Envelope Zone follows the ridge crest to limit landform disturbance. Once operational from here, the wind farm will introduce open views of turbines as distinctive dynamic elements observed arranged along successive ridgelines within the Site. The closest turbines along the western ridge may appear prominent along the sequence of rural landforms and have potential for **moderate-high adverse** visual effects. Notwithstanding this, the overall level of effect would be more limited in transient views.
- 6.4.16 **Viewpoint VP2 (Distance to nearest turbine 1.1km)** illustrates a similar but closer view, from Falkner Road. People who would experience similar views are residents of rural dwellings in fixed views and transient views from users of Falkner Road to the west of the proposed wind farm. During construction, the formation of the northern access track within the Turbine Exclusion will be visible in the left-hand side of the view (see **Viewpoint 2B**), along with movement of machinery and construction activity to form the ridgeline track and turbine platforms. Following construction, the earth worked batter slopes would be returned to pasture cover, integrating it with the surrounding land use
- 6.4.17 Within the proposed Turbine Envelope Zone, the turbines will be visible spread along the ridgeline in the view. Turbines on the main ridge are partially screened by landforms, while the turbines on the western ridgeline are prominent in the view. During construction of turbines, effects of earthworks would remain largely contained within the Site within the rolling landform of the ridgetop. Once erected, turbines would appear as two successive bands integrated along the adjoining landform with potential for **high adverse** visual effects. Such effects are generally reduced from individual dwellings through intervening vegetation which encloses curtilage areas and punctuates the skyline to break up the larger array of turbines which may otherwise remain apparent.

#### *Near views from the South*

- 6.4.18 **Viewpoint VP3 (Distance to nearest turbine 1.1km)** illustrates a view near the southern Site boundary from the intersection of Falkner Road and Opaki-Kaiparoro Road. Falkner Road forms the left-hand foreground of the view, with Opaki-Kaiparoro Road across the centre of the view and to the right. People who would experience this view are users of the rural road, with nearby residents having potentially similar views, though more typically concealed by curtilage planting. During construction, movement of machinery may be a visible element, but earthworks and cut and fill activity will not be a visible element from this location.

6.4.19 The operational view illustrates the separation between the turbines on the main ridgeline and the western ridgeline, with the two separate groups clearly visible. The Turbine Envelope Zone introduces potential for perceived stacking on the western ridgeline from this angle with turbines along the main ridgeline appearing more regularly dispersed along the main ridgeline. There is also potential within the Turbine Envelope Zone for Turbine 14 to appear in between the two ridgelines, however its location within the Turbine Envelope Zone would not change the overall level of effect. Visual effects during construction would be **low** initially, increasing incrementally as turbines are erected. During operation, potential **high adverse effects** may occur as the wind farm becomes operational with dynamic turbines forming a prominent aspect of the view.

*Near Views from the South-East*

6.4.20 **Viewpoint VP4 (Distance to nearest turbine 1.4km)** shows a view from the southeast of the Site from Opaki-Kaiparoro Road looking northwest towards the proposed wind farm. From here, the eastern side of the main ridge of Mount Munro forms a prominent landform in the centre of the view. During construction, earthworks will remain well concealed along the gentle rolling form of the ridgetop, however the movement of construction machinery would be visible as each turbine is erected along the horizon in the view (see **Viewpoint 4B**), creating some additional temporary **low adverse effects**. As turbines are erected along the ridgeline and begin operation, this will gradually increase the overall level of visual effects.

6.4.21 During operation, the turbines will appear ordered as a uniform sequence of dynamic structures extended along the main ridgeline. Beyond this, turbines on the western ridgeline will remain screened by landform from this viewpoint removing potential for any perceived 'stacking' effects. The nearest turbine at 1.4 km will appear prominent along the skyline and form part of a broader ordered array of turbines which will characterise this visible area of landscape. Such views will extend above the established pastoral land use which will remain and result in potential **high adverse effects**.

6.4.22 Further the south of this viewing area, the landform extends into hill country which limits the potential for views towards the Site as illustrated by the ZTV in **Figure 5**. This viewing audience includes users of rural roads and dispersed rural dwellings along Mount Munro Road North and North Road from which more limited adverse visual effects may occur. There will be no identified visual effects during construction or operation of the wind farm in relation to the historic Mauriceville Church, given the nature of the intervening landform and its associated vegetation.

*Near Views from the East*

6.4.23 **Viewpoint VP5 (Distance to nearest turbine 1.4km)** illustrates a view towards the Site from the east, from the rural road of Smiths Line. From here, the convoluted and rounded landforms of Mount Munro including its lower undulating spurs form defining elements of available rural views above which proposed turbines will appear highly visible. During construction, movement of machinery and the staged construction of turbines will be visible along the ridgeline in the view. Earthwork activity will be screened by landform.

6.4.24 The operation view shows the turbines spread along the main ridgeline as prominent elements in the view. The lower part of the turbines, including lower parts of blades of some of the more distant turbines (turbines 1-7) are obscured beyond landform in the

view. During construction, earthworks to construct the main access track below turbine 12 will be visible in the far-right hand side of the view (see Viewpoint 5B). This is proposed to be formed in box cutting with batter slopes returned to pasture cover, integrating it with the surrounding landform following construction. During operation, potential adverse visual effects will be **high**, with the proposed wind farm forming a prominent and dynamic array of turbines which characterise this view.

- 6.4.25 The group of dwellings to the east of this viewpoint in the vicinity of and along Bowen Road are either located within a lower lying valley, where landform obscures views towards the turbine sites, or have their views screened by vegetation. Road users in this area would have oblique intermittent views of the turbines as they travel along the road corridor. Similar to viewpoint 5 above, earthworks during construction would be predominantly screened by landform. Beyond this area further east, the landform becomes more folded with access limited along small gravel roads supporting more limited residential development. In this context potential views towards the Site are more typically restricted to elevated areas within a folded working rural context, as illustrated by the ZTV in **Figure 5**.

*Middle distance views from the west*

- 6.4.26 This area covers the rural area to the west of the Site beyond SH2 and generally extends south of Parkville Road to South Road no.2. Views from this area would be available from rural dwellings and roads, however such opportunities are frequently limited by the undulating landform in combination with established shelterbelts and other vegetation established within this area. **Viewpoint VP6 (Distance to nearest turbine 3km)** illustrates an open view from South Road no.2 and is representative of locations where opportunities to view the Site are available beyond approximately 3 kilometres from the Site. During construction, movement of machinery and exposed areas of earthworks to construct the access tracks will become more difficult to see, as the construction of turbines gradually extends along the ridgeline which remains visible in the view. Earthworks will represent small areas of modification (see **Viewpoint 6B**).
- 6.4.27 Once operational, all proposed turbines will be visible including those along the main ridgeline which dips below the intervening western ridgeline to the left, combined with turbines on the western ridgeline. The proposed Turbine Envelope Zone has the potential to introduce some potential stacking of turbines observed along successive ridgelines observed from this area. Given viewing distances and the integration between the turbines and the successive ridgelines observed, potential visual effects from this open viewpoint will be **moderate adverse**. Any views from rural dwellings are more typically limited by intervening vegetation and therefore reduced.

*Middle Distance views from the south*

- 6.4.28 To the south of the Site when travelling along SH2, the intervening landform between the Site obscures views towards the landform of the Site itself. However, turbine nacelles and blades of turbines may be visible aligned beyond the intervening landform. **Viewpoint VP7 (Distance to nearest turbine 2.2km)** illustrates a view from the public rest layby at Anzac Bridge, just off the State Highway 2 corridor, to the southwest of the Site. Construction activity will be screened from view from this point until turbine towers start to be erected in the view. Once operational, turbine nacelles and blades of turbines will be visible aligned beyond the landform in the right-hand side of the view and generate a perceived wave of turbine blades which sweep along

part of the skyline. Potential visual effects during operation would be **low-moderate adverse**.

#### *Distant views from the North*

- 6.4.29 The proposed turbines will be visible on part of the distant low horizon when viewing south from Eketahuna and its surrounding rural landscape at distances of approximately 5 kilometres. From within Eketahuna, houses and vegetation typically limit the potential for views from dwellings, with views generally possible from the southern edge of town and where open areas or two-storey dwellings allow views out towards the Site. In such views, intervening buildings and vegetation continue to limit the ability to obtain open distant views.
- 6.4.30 **Viewpoint VP8 (Distance to nearest turbine 4.9km)** illustrates a view from Main Road within Eketahuna. The view from the town centre looks south down State Highway 2 towards the Site, which is visible framed by buildings in the centre of the view. During construction, earthworks to form access tracks and turbine platforms would be barely visible as very small distant elements in the view. Once operational, proposed turbines will be visible along part of the distant skyline such as observed within the centre of this view over a distance of approximately 5 kilometres. Buildings and vegetation in the view will obscure a number of turbines in the view, with intervening lighting poles introducing similar albeit more proximate vertical elements which punctuate the skyline. Views from within other parts of Eketahuna are of a similar nature, with surrounding dwellings and vegetation generally limiting the potential for very long-distance open views towards the Site. Accordingly, visual effects for residents of Eketahuna during operation would represent a minor modification to such available views with potential **low adverse** effects.
- 6.4.31 **Viewpoint VP9 (Distance to nearest turbine 5.3km)** illustrates a more distant but open view towards the Site from the north, from Nireaha Road, west of Eketahuna. This view would be experienced by rural road users and nearby rural residents. During construction, areas of earthworks to form access tracks and turbine platforms would be barely visible as very small distant elements in the view. Once operational, the proposed wind farm would be visible along the skyline on the horizon in the centre of the view. Potential visual effects for this area will be **low-moderate adverse**, albeit more typically limited by the nature of intervening vegetation characteristic of the surrounding rural landscape and thereby reduced.
- 6.4.32 **Viewpoint VP10 (Distance to nearest turbine 5.7km)** shows the view north from South Road no.2 to the north of the Site and is representative of a long-distance open view from the rural landscape to the southwest of Eketahuna. During construction, earthworks to form access tracks and turbine platforms would be visible as very small distant elements in the view. The operational view illustrates the turbines spread along the main ridgeline on the horizon in the view through gaps and beyond shelterbelt vegetation. Potential visual effects for rural residents who may experience such views during operation would be **low adverse**, however the majority of such views are typically enclosed and framed by intervening vegetation which reduces potential visual effects.
- 6.4.1 To the north of Eketahuna, views towards turbines within the Site will be experienced by users of State Highway 2 travelling south and residents in this area beyond 5 kilometres. Such views observe turbines on the distant ridgeline and for travellers along the State Highway will be intermittently visible due to roadside vegetation.

Dwellings in this area are frequently surrounded by shelterbelt vegetation, limiting the potential for views towards the Site. Accordingly, any visual effects from this area during operation are anticipated to be **low adverse** and less than minor.

- 6.4.2 The Civil Aviation Authority (CAA) policy for the Lighting and Marking of Wind Turbines (May 2006), states that structures up to 120 metres or higher are a hazard in navigable air space and require aviation obstacle lighting. Obstacle lights, where required, are placed at strategic locations agreed with CAA in order to indicate to aircraft pilots the extent of the wind farm and the location of the highest turbines relative to ground height. Generally, obstacle lights are placed at or above the top of the nacelle. From this position light spill can be managed and directed so as to avoid and/or minimise light effects relative to specific rural dwellings and the surrounding area in general. Given the nature of the Mount Munro wind farm Site and its rural location, obstacle lighting can be positioned to minimise any potential adverse effects.

Table 6-2 Summary of visual effects from representative public vantage points

Viewpoint	Distance from nearest turbine	Number of turbines visible	Potential level of adverse visual effects (construction - earthworks phase)	Potential level of adverse visual effects (operation)
VP1	1.5km	20	Low	Moderate-High
VP2	1.1km	20 (16 in simulated field of view of 90°)	Low	High
VP3	1.1km	19	Low	High
VP4	1.4km	13	Low	High
VP5	1.4km	13	Low	High
VP6	3.0km	20	Very Low	Moderate
VP7	2.2km	14	Very Low	Low-Moderate
VP8	4.9km	9	Very Low	Low
VP9	5.3km	20	Very Low	Low-Moderate
VP10	5.7km	20	Very Low	Low

### Effects from private vantage points

- 6.4.3 To support the assessment from representative viewpoints, dwellings within approximately 2 km were assessed as shown on **Figure 6** to assist with understanding the likely location and extent of visual effects. This aspect, which can be referred to as a residential visual amenity assessment is set out in **Appendix 3**. This formed a desktop exercise using recent aerial photography supported by fieldwork from dwellings from which access was provided to assist the assessment of visual effects. This more detailed residential assessment from dwellings has taken account of the context and amenity of private views including the orientation of primary views towards the Site, range of other available views, use of the property, and established vegetation screening which may frame or conceal available views and ameliorate potential visual effects.
- 6.4.4 For private viewpoints within the Site, the residential amenity assessment identifies one dwelling (ID 15) which will have **very high** effects and three dwellings with **high**

effects (IDs 6,14 and 21) all of which are associated with the Project. Beyond the Site, a further 4 dwellings (IDs 2,13, 18 and 31) may potentially incur **high effects** where turbines appear prominent but not dominant, based on proximity, orientation and nature of intervening landform or vegetation. Such dwellings are typically orientated to obtain open primary views towards elements of the proposed wind farm within approximately 1.5km of the nearest turbine. Notwithstanding this, such views also encompass a wider working rural landscape which will also remain apparent, and which influences the overall nature of visual effects.

- 6.4.5 Three dwellings (IDs 25, 26, 27) lie within close proximity to the proposed substation and transmission line route. Views from these dwellings toward the turbine sites generally have some screening by landform or vegetation. Existing vegetation also contributes to screening views towards the transmission line. In addition, the proposed retention of the existing shelterbelt adjacent to the substation site will further screen views for these dwellings. Anticipated effects for these dwellings are **low**.
- 6.4.6 A further dwelling (ID 28) has more open views from the northern side of the dwelling towards turbine sites. Turbines will be visible as two groups – part of the six turbines (turbines 15- 20) on the lower lying landform to the north, with a group of ten turbines visible to the south strung out along the ridgeline. The lower parts of the turbines, including the blades of some turbines will be screened by landform in the view. This property will also have views to the north towards the transmission line which will be partially screened by intervening vegetation. Oblique views will be possible towards the substation, which will be partially screened by the retained shelterbelt. Anticipated effects from this dwelling are **low-moderate**.
- 6.4.7 For the remainder of the individual dwellings within 2km which have been assessed, effects range from **very low**, where views are entirely screened by surrounding vegetation or landform, to **moderate-high**, where a relatively near but partial view is available, typically with a smaller number of turbines visible or as part of a secondary view. Such views are typically limited by existing vegetation.
- 6.4.8 Beyond approximately 2km, visual effects become increasingly reduced with increasing viewing distance and intervening landform and vegetation contributing additional screening. Notwithstanding this, there is some limited potential for visual effects from rural dwellings within the wider landscape where open views of turbines remain available. For completeness, dwellings beyond approximately 2km have also been assessed as groups, as illustrated by the Viewing Audiences map on **Figure 7**. The potential effects from these broader viewing areas are summarised below.
- 6.4.9 Dwellings in a localised rural area and located approximately 2km to the east of the Site along Bowen Road are identified as **Viewing Area A**. Such dwellings are located within a lower lying valley which continues to the north of the Wairarapa Railway Line. In this area the intervening landform increasingly obscures views towards the turbine sites, or have their views screened by vegetation such that all but the tip of some turbine blades may be visible. Given the high level of containment in this local area, potential views of the proposed turbines from dwellings will remain well concealed and result in **low** effects.

- 6.4.10 The more rugged landform to the north of Mauriceville is identified as **Viewing Area B**, located to the southeast of the Site. Here the nature of the folded landform with dwellings typically contained within valleys limits the potential for views towards the Site. Where visible, it is likely only upper parts of the blade tips of turbines will be seen in long distance views. Visual effects for dwellings in this contained viewing area during operation would be **low**. Views towards the Site from the historic Mauriceville Church are obscured by landform.
- 6.4.11 **Viewing Area C** encompasses rural land to the south-west of the Site including dispersed dwellings along South Road No.2 and west of SH2 from which there are potential views of turbines along the main ridgeline of the Site. Representative views from this area are provided in **Viewpoints 6** and **7**. The undulating nature of the landform in this area, along with boundary shelterbelt vegetation, limits the potential for views. Any earthworks within the Site will appear localised and readily re-absorbed within the wider working rural character once re-established in pasture. For some people in rural dwellings which obtain primary open views towards the Site, there may be some **moderate** effects, however the majority of views remain well contained.
- 6.4.12 **Viewing Area D** covers a broad swathe of undulating rural landscape to the west of SH2 as well as dwellings accessed along SH2 north of Waiwaka beyond around 2km from the nearest turbines. The undulating nature of the landform in this area, along with boundary shelterbelt vegetation, generally limits any potential to obtain open views towards the Site with the exception of some open elevated private rural land holdings. In this context there may be some **moderate** visual effects during operation for the occupants of rural dwellings which obtain primary open views towards the Site. However, most views from dwellings remain visually well contained with no discernible views or consequent effects.
- 6.4.13 **Viewing Area E** represents dwellings and commercial areas within Eketahuna, which is also represented by **Viewpoint 8**. From here any views will occur beyond approximately 5km and are typically seen from the edge of the settlement. Most views remain obscured beyond dwellings and vegetation with no apparent effects. Where visible, visual effects for residents of Eketahuna during operation would remain very limited with no more than **low-moderate** and minor effects.
- 6.4.14 **Viewing Area F** covers very long-distance views to the west of Eketahuna and representative views **Viewpoints 9** and **10**. Dwellings in this area are frequently surrounded by shelterbelts and trees which limit views towards the Site. Any views which remain occur over very long distances and typically remain at least partially enclosed by intervening shelter belts. Where available, visual effects from rural dwellings in this area would be **low-moderate to low and no more than minor effects**.
- 6.4.15 Distant views for residents to the north of Eketahuna along SH2, are defined in **Viewing Area G**. Dwellings in this area are frequently surrounded by shelterbelt vegetation, limiting the potential for views towards the Site. Given the substantial viewing distance and nature of intervening vegetation characteristic of the surrounding rural landscape, visual effects for this area during operation are anticipated to be **very low**.

## Summary of Visual Effects

- 6.4.16 Views towards the Site are available from a range of near and more distant views. Generally, within around 2km of the Site turbines have potential to appear as more prominent elements in views. However, in many locations, views are also restricted by intervening landform and vegetation. As distance from the turbines increases, potential visual effects also generally dissipate. Beyond 2km, potential visual effects reduce with increasing viewing distance, with potential visual effects from dwellings likely to be **moderate** or less.
- 6.4.17 Over greater distances around 5km from the Site, including from within the vicinity of residential development within Eketahuna, no more than **low-moderate or minor** visual effects are anticipated. In such views, proposed earthworks, once completed and grassed, will remain largely indiscernible within the Site with turbines representing a relatively indistinct but dynamic element along part of the distant horizon, typically observed in association with intervening structures and vegetation which also punctuates the skyline in closer proximity to the viewpoint.
- 6.4.18 Views from roads which enable views of the Site, the change in view and level of effects are similar, albeit reduced, given the transient nature and associated lower sensitivity of this viewing audience. Some **moderate** effects would be experienced by road users from the rural roads nearest the Site – namely along Falkner Road, parts of Opaki Kaiparoro Road and Smiths Line. From SH2 to the west of the Site, some **moderate effects** may also occur albeit limited by the orientation of the road and speed of traffic. As distance increases the effects from roads similarly reduce, with users of more distant rural roads beyond approximately 3 kilometres such as Nireaha Road and the northern extent of South Road No.2 typically assessed as **low** effects.
- 6.4.19 Near fixed views from private dwellings, include views from one dwelling with **very high** effects and three dwellings with High effects within and associated with the Project. Beyond the Site, a further four dwellings are assessed as resulting in **high effects** where turbines form prominent but not dominant elements in primary open views from dwellings. Such effects also typically occur within the context of a broader working rural landscape which will also remain. Other private dwellings within 2km of the Site are assessed as having **moderate – high to very low** visual effects, dependent on the orientation and nature of available views. This range of effects also recognises that many private dwellings do not face directly towards the Site or otherwise have views screened by the surrounding landform and vegetation.
- 6.4.20 From local locations of interest, the level of effects also varies – there will be no visual effects at the site of the historic Mauriceville Church as the Site remains screened by landform from the church and its curtilage. Views towards the Site are available from the Anzac Bridge, another historic site. Intervening landform limits the view from here. However, the tops of turbine blades will appear as dynamic elements which sweep along the skyline with **low-moderate** visual effects during operation.

## 6.5 Cumulative Effects

- 6.5.1 Cumulative landscape effects may occur when the cumulative changes to landscape character as a result of multiple wind farm developments bring about a change in landscape character – i.e. rather than the character of the landscape being that of a landscape with a wind farm in it, the landscape becomes a ‘wind farm landscape’.



- 6.5.2 Cumulative visual effects can also occur in combination (when more than one wind farms are seen together in the same view), in succession (where the observer needs to turn their head) or sequentially (with a time lapse between instances where proposals are visible when moving through a landscape).

#### Cumulative Visual Effects

- 6.5.3 The locations of other wind farm sites which are either operational, consented or in planning which have been considered in this assessment of cumulative visual effects are located on **Figure 8**. The nearest wind farm site to the Mount Munro Site is the consented Castle Hill Wind farm site, the boundary of which is located around 13km east of the Mount Munro Site boundary. The other sites considered are as follows:
- Puketoi Wind Farm (Consented) 23.7km northeast
  - Turitea Wind Farm (Operational) 23.2km north
  - Te Rere Hau Wind Farm (Operational) 31.1km north
  - Tararua Wind Farm (Operational) 33.8km north
  - Te Apiti Wind Farm (Operational) 42km north
- 6.5.4 In terms of combined visual effects, these would occur where the proposed wind farm is visible in combination with one or more other wind farm sites in the same view. Given the distance between the Site and other wind farm sites, and the nature of the surrounding landscape, the potential for this is limited.
- 6.5.5 To the east and northeast respectively, the wind farms at Castle Hill and Puketoi are separated from the Site by the steeply rolling hill country to the east and north-east of Eketahuna. This landform consists of a number of complex hill and valley systems which limit the potential for views of the Site in combination or succession with the Castle Hill and Puketoi sites.
- 6.5.6 Where the proposed wind farm is visible in combination near to the other wind farms along the Tararua Ranges over distances beyond 30km, the proposed Mount Munro wind farm will form a very small distant element within a wider panoramic view. Likewise, any potential views of these sites will be very distant when combined with nearer views of the Mount Munro turbines. Such viewing opportunities will be very limited given the surrounding landform, vegetation and climatic conditions, ensuring the potential for combined views from publicly accessible locations is limited.
- 6.5.7 The cumulative visual effect of the existing and proposed wind farms in combination with the proposed wind farm at Mount Munro is therefore assessed as **very low**.
- 6.5.8 Vehicle travellers along State Highway 2 and other rural roads in the vicinity have the potential to experience sequential visual effects, of different wind farm developments, principally those developments on the Tararua Ranges, combined with the Mount Munro development. Typically, the sequential appearance of the wind farm would be experienced as a series of briefly glimpsed views, with turbines other than those at Mount Munro in the landscape context distant features in the view. The turbines would be viewed in the context of surrounding rural activities and movement of vehicles along roads.
- 6.5.9 Views from roads generally are minimised by the existing intervening landform, vegetation and settlement. In the area immediately surrounding the Site there are

shelterbelts frequently along the road corridor which obscure or limit views. Users of roads would experience a very low cumulative visual effect, as the appearance of the turbine developments would occur as a series of very briefly glimpsed distant views travelling along the road.

### Cumulative Landscape Effects

- 6.5.10 The rural character of the Site contributes to the landscape character of the wider area. The Site is currently in pastoral use, as is the land within the immediate area, typical of the rural landscape to the south of Eketahuna.
- 6.5.11 **Figure 8** illustrates the site of the Mount Munro Wind farm in relation to other consented and operational wind farms in the area. Given the nature of the surrounding landscape - the rolling hill country to the east of the Site, and the distance between the Site and surrounding wind farms, views of the Mount Munro Site in combination with other wind farms are infrequent, with most other turbines in the area being of such a distant scale as to be indistinguishable within the wider landscape. Therefore, the cumulative effect on the landscape character of the area is assessed as **very low**.

## 6.6 Shadow Flicker

- 6.6.1 Shadow flicker is caused by the rotation of turbine blades, which cast intermittent shadows that appear to 'flicker' as the sun passes behind the turbine blades. Typically, this is most apparent when the shadow passes across the window of a dwelling. The duration of this effect can be calculated using the geometry of the turbine and the relative locations of the turbine and the viewer (i.e. through windows or similar). The likelihood of the effect occurring, and the duration and intensity of such an effect depends upon several factors:
- the distance of the dwelling from the turbine.
  - the orientation of the dwelling relative to the turbine.
  - the height and rotor diameter of the turbine.
  - the time of day and time of year.
  - the prevailing wind direction.
  - the frequency of sunshine hours (i.e. cloud free days).
  - the nature of the intervening terrain between dwelling and turbine.
  - the impact of any intervening vegetation and/or structures.
- 6.6.2 International guidelines<sup>10</sup> state that acceptable levels of exposure to shadow flicker are deemed to be either:
- Acceptable Level = 30 hours per year (modelled)
  - Acceptable Level = 10 hours per year - actual (i.e. measured).

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<sup>10</sup> Environment Protection and Heritage Council, Australia (2010) *Draft National Wind Farm Development Guidelines*. Page 153.

- 6.6.3 To assist an understanding of shadow flicker, BML have undertaken an assessment of the extent of shadow flicker which results from the likely shadow flicker shown in Figure 9 and identified timing of shadow flicker for individual dwellings included in **Figure 11**. This identified a total of eight out-of-compliance dwellings which would potentially experience shadow flicker exposure (Dwellings, 1, 2, 6, 10, 11,12, 14, and 15 as identified in **Figure 9**). The identified hours of shadow flicker do not take account of the orientation or presence of sheds or windbreaks around the buildings which may restrict direct effects between wind turbines and affected dwellings.
- 6.6.4 Assuming no on-site mitigation is undertaken by the owners of affected residences (such as drawing curtains) there are two main mitigation strategies that Meridian Energy could implement to reduce the number of hours of shadow flicker at the dwellings surrounding the Site. The first is a curtailment strategy where certain turbines can be shut off during periods of the year. The second mitigation strategy for reducing shadow flicker is related to the construction of sheds or planting windbreaks in strategic locations.

## 6.7 Reversibility of Effects

- 6.7.1 Provisions of the National Policy Statement for Renewable Energy Generation relevant to landscape include having regard to reversibility of adverse effects. In this respect, any adverse landscape or visual effects associated with the proposed wind farm are largely reversible. The wind turbines could be removed in the future should the wind farm no longer be required. The residual wind turbine platforms would not be perceived from beyond the Site and the access roads would not look out of place as farm roads.

## 6.8 Landscape and Visual Effects in relation to Statutory Provisions

- 6.8.1 In terms of Section 6b of the Resource Management Act relating to the protection of outstanding natural features and landscapes from inappropriate subdivision, use and development, this assessment has identified only low-level effects for these areas. There will be negligible adverse effects on natural character (RMA, Section 6a) as earthworks boundaries occur in the context of an area of modified rural landscape and outside any identified waterbodies or their margins. Section 7c) and 7f) of the Act relating to the maintenance and enhancement of amenity values and quality of the environment are discussed in relation to the relevant Regional and District provisions relating to these matters below.
- 6.8.2 The Site is zoned Rural Management Area under the Tararua District Plan and Rural under the Wairarapa Combined District Plan.
- 6.8.3 Objectives in the Tararua District Plan for the Rural Zone aim to “ensure a high level of environmental quality and amenity throughout the rural areas of the District” and to protect natural features and landscapes, trees and areas of indigenous vegetation and habitats of indigenous fauna”. The Plan also recognises the potential of the Rural Management Area “for renewable energy generation and wind farms in particular”. Policy 5.3.7 of the Plan seeks to ensure resource consent applications for renewable

energy generation ensure that the actual and potential environmental effects of generation are managed, as proposed.

- 6.8.4 The Site forms part of a working rural zone which avoids any recognised outstanding or special amenity landscape values and is surrounded by a relatively limited number of dwellings from which proposed turbines appear prominent in existing primary views. Whilst turbines will be highly visible from some areas, proposed earthworks have been configured to largely internalise available views and facilitate a coherent turbine layout which responds well to the underlying topography and maintains the inherent working rural character. Given this context and response, the Site is considered to have capacity to successfully absorb the windfarm as proposed and manage the potential for significant adverse effects. It is also recognised the nature of any potential visual effects (including whether such effects are adverse) relies on an individual's perception which may change over time, particularly within the vicinity of the windfarm.
- 6.8.5 The Wairarapa Combined Plan notes that higher landforms in the district have "considerable potential for wind energy generation". It notes that there will be "some consequential effects" which can be "managed to maintain rural amenity values". Objectives within the plan for the Rural zone also aim to "maintain and enhance the amenity values of the Rural Zone, including natural character" (Objective 4.3.1), ensure that "primary production and other land uses function efficiently and effectively in the Rural Zone"(4.3.2), "identify and protect outstanding landscape and natural features from the adverse effects of inappropriate subdivision, use and development"(9.3.1) and "encourage energy efficiency and the generation of energy from renewable sources" (16.3.1).
- 6.8.6 In land use terms, primary production will continue outside the turbine footprints and access tracks, with sheep farming continuing as the primary land use. Thus, the Site and surrounds will largely retain their existing productive rural character following construction of the windfarm. Given the necessary scale of turbines introduced along the skyline it is recognised that there will be some inevitable changes to the landscape character, most particularly of the immediate environs of the Site, however this remains relatively localised and any adverse landscape effects increasingly dissipate beyond approximately 2km from the Site. The proposal is also consistent with the desire of both Plans to accommodate renewable energy developments in this appropriate location, while managing potential environmental effects.
- 6.8.7 Overall, it is considered that the proposal is consistent with the outcomes envisaged by the landscape, rural character and amenity provisions in the Tararua District Plan and Wairarapa Combined Plan as outlined above.

## 7.0 Recommendations

- 7.1.1 Measures to avoid, remedy and mitigate effects have been considered during the planning and design of the Project and incorporated in several ways. This has included the following:
- The Site's location is distant from urban areas and forms part of a working rural landscape which can continue to operate. However, there are rural dwellings in

reasonably close proximity to the Site from which the envelope approach means that turbines can be located to reduce effects from the nearest dwellings.

- The Earthworks envelope allows for flexibility to minimise the earthworks required for the turbine platforms and access tracks. Earthworks within the Turbine Envelope and Turbine Exclusion Zones are designed to avoid the removal of vegetation as far as is practicable with resultant batters re-established in pasture.
- The towers and rotors will be coloured in a uniform light grey matt finish to reduce reflectivity. This will result in a consistent and unified appearance of turbines; in addition, the turbines will not include any branding or logos.
- Where shadow flicker is identified and raises concerns, cease the rotation of individual identified turbines to ensure overall effects remain within acceptable limits.
- The substation location close to the southwest Site boundary means only a short section of new transmission line is required for the project. Existing shelterbelt planting provides effective containment of this Site to the west of SH2 which should be retained.

7.1.2 Given the necessary size of turbines associated with wind energy generation, tree planting on the Site itself is neither feasible nor desirable. Tree planting close to the viewpoint can provide effective screening in specific locations. However, proposing such tree planting as a mitigation measure may not be acceptable without careful consideration of how this intervention may impact on other available views. It may also not be appropriate, depending upon the subjective response of viewers of the proposal.

7.1.3 For several of the viewpoints from private properties, dwellings are surrounded by tall shelterbelts, hedges and/or amenity planting and thus screening or reducing views to the surrounding countryside, including towards the turbines. For those properties where existing screen planting is limited or does not exist and the visual effects are high, landowners could be offered tree planting. Such planting would be subject to the wishes and agreement of affected property owners and would typically involve planting of shelterbelts or stands of amenity trees between the dwelling and the wind turbines.

## 8.0 Conclusions

8.1.1 In terms of overall landscape effects, the wind farm would have the greatest effects within 2km of the Site, where it may introduce prominent wind turbines along the skyline in some public and private views. The wind farm is most typically viewed in conjunction with roads, electricity power pylons and agricultural activities forming part of an established working rural landscape. The siting of the proposed wind farm on a series of rolling ridgelines provides a coherent response to the underlying landform and is typical of New Zealand's wind farms which are generally situated on elevated locations along ridges and hilltops where the wind speeds are generally high.

- 8.1.2 The Site lies outside any identified Outstanding Natural Features or Landscapes as identified at either a District or Regional scale with any potential indirect effects on such areas assessed as **low**. The layout of the turbines within the Turbine Envelope Zone are spaced along the ridgeline to help achieve a visually balanced layout which responds well to the underlying topography. The simple forms of the turbines and light grey colour also assists with minimising landscape effects with access and earthworks relatively well integrated within this folded working farming context. Whilst turbines may appear prominent in some local views, the open rural character of this broader rolling hill country landscape will essentially remain. Landscape effects are therefore anticipated to be **moderate-high** within approximately 2km of the Site and reduce incrementally with distance to **low** beyond 5km.
- 8.1.3 Physical effects will result from the earthworks necessary to create the access roads, turbine platforms and construction and laydown areas. Although there are some locally substantial areas of earthworks, visual effects of this beyond the Site are limited due to screening by landform. Roads and turbine platforms have been designed to generally follow the main and secondary ridgelines of the Site to minimise the need for cut and benching works and will result in overall **moderate** adverse effects. Vegetation removal, will be minimal, relating to small areas within the access envelope required for access track earthworks. Physical effects of constructing the proposed wind farm are also largely reversible given the ability for wind turbines to be removed in the future should the wind farm no longer be required. Any residual effects of wind turbine platforms would not be perceived from beyond the Site, and the access roads would not look out of place as farm roads.
- 8.1.4 The Site falls outside the coastal environment and contains no rivers or lakes where effects on natural character might need to be considered under s6(a) of the RMA. The potential for natural character effects therefore occurs in the context of established farmland which is extensively modified by grazed pasture with little or no indigenous riparian planting which is of low or negligible ecological value. Impacts on such areas will therefore have **very low** natural character effects and are readily addressed by recommendations set out in the ecological assessment.
- 8.1.5 Views towards the Site are available from a range of near and more distant views. Generally, in near views (i.e. closer than 2km of the Site), the scale of turbines means they may form prominent dynamic elements viewed along the skyline, however in many locations, views are typically restricted by intervening landform and vegetation. Near views are available from private dwellings to the south, east and west of the wind farm, including four dwellings within the Site. Depending upon the subjective response of the viewer, visual effects from these private viewpoints are **very high** for one dwelling which is associated with the project and **high** for a further seven dwellings (three of which are associated with the project and within the Site).
- 8.1.6 For those closer dwellings orientated towards the Site with limited or absent screen planting enabling open primary views and consequent higher visual effects and where the landowner has an aversion to viewing the windfarm, landowners could be offered tree planting to establish or reinforce existing gardens and ameliorate the impacts of visible turbines within prominent views. Such planting would necessarily be subject to the wishes and agreement of affected property owners and would typically involve planting of specimen trees between the dwelling and specific areas of skyline to foreshorten and punctuate views in areas where turbines are proposed. In all instances where turbines are prominent in views, pastoral land use will also remain a

dominant aspect of available views and support the landscape's broader established working rural character.

- 8.1.7 Other private dwellings within approximately 2km of the Site experience between **moderate–high** to **very low** visual effects, dependent on the orientation and nature of the view and relationship to the Site. This range in visual effects is found as many private dwellings have primary views focussed away from the Site or at least partially screened by surrounding amenity planting or rural shelter belts which provides a sense of enclosure which foreshortens longer distance views.
- 8.1.8 As distance from the turbines increases, so too does a reduction in visual effects, with residents within and in rural areas surrounding the more distant settlement of Eketahuna around 5km from the Site experiencing no more than **low-moderate** and minor visual effects. Beyond approximately 6 kilometres, some very long distances may occur from SH2 when approaching Eketahuna from the north, however viewing distance, landform and roadside vegetation ensure any visual effects will be **very low**.
- 8.1.9 In relation to cumulative effects, combined visual effects have the potential to occur where the proposed wind farm is visible in combination with one or more other wind farm sites in the same view. Given the distance between the Site and other wind farm sites, and the nature of the surrounding landscape, the potential for this is very limited. The cumulative visual effect of the existing and proposed wind farms in combination with the proposed wind farm at Mount Munro is therefore assessed as **very low**.
- 8.1.10 From publicly accessible locations, the change in view and level of effects are similar, albeit transient views from road users. Some **moderate** adverse effects would be experienced in transient views from users along adjoining rural roads nearest the Site, namely Falkner Road, Hall Road, Smiths Line and Opaki Kaiparoro Road. Transient middle and distance views also occur from SH2 to the west of the Site which would result in some **moderate** adverse effects, limited by the orientation of the road and speed of traffic. As distance increases, the effects reduce with users of more distant rural roads such as Nireaha Road and the northern extent of South Road No.2 experiencing **low adverse effects**.
- 8.1.11 From local locations of interest, the level of effects also varies – there will be no visual effects at the site of the historic Mauriceville Church and the Site is screened by landform from the church and its curtilage. Views towards the Site are available from the Anzac Bridge, another historic site. Intervening landform limits the view from here, with visual effects during operation being **low-moderate adverse**.
- 8.1.12 Overall, the proposed Site is considered appropriate for a windfarm and enables such development to remain well integrated within this underlying rural setting. The proposed layout of turbines will appear responsive to the undulating topography with limited views of earthworks from beyond the Site. Whilst turbines may be prominent elements from some areas, including a relatively small number of private views in close proximity to the Site, such views remain relatively localised and embedded within the context of this broader working rural landscape which will also essentially remain. Such outcomes are consistent with the statutory landscape provisions in the Tararua District Plan and Wairarapa Combined Plans and therefore enable the windfarm to be effectively absorbed within this area of landscape.

## 9.0 References

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# Appendix 1: Landscape Effects Assessment Method

## Introduction

The Landscape and Visual Effects Assessment (LEA) process provides a framework for assessing and identifying the nature and level of likely effects that may result from a proposed development. Such effects can occur in relation to changes to physical elements, the existing character of the landscape and the experience of it. In addition, the landscape assessment method may include an iterative design development processes, which includes stakeholder involvement. The outcome of any assessment approach should seek to avoid, remedy or mitigate adverse effects (see **Figure 1**). A separate assessment is required to assess changes in natural character in coastal areas and other waterbodies.

This outline of the landscape and visual effects assessment methodology has been undertaken with reference to Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines<sup>11</sup> and its signposts to examples of best practice, which include the Quality Planning Landscape Guidance Note<sup>12</sup> and the UK guidelines for landscape and visual impact assessment<sup>13</sup>. Te Tangi a te Manu recognises the term 'landscape effects' as all-encompassing, and that visual effects and natural character effects are a subset of landscape effects. This methodology provides separate sections to discuss landscape, visual and natural character effects.

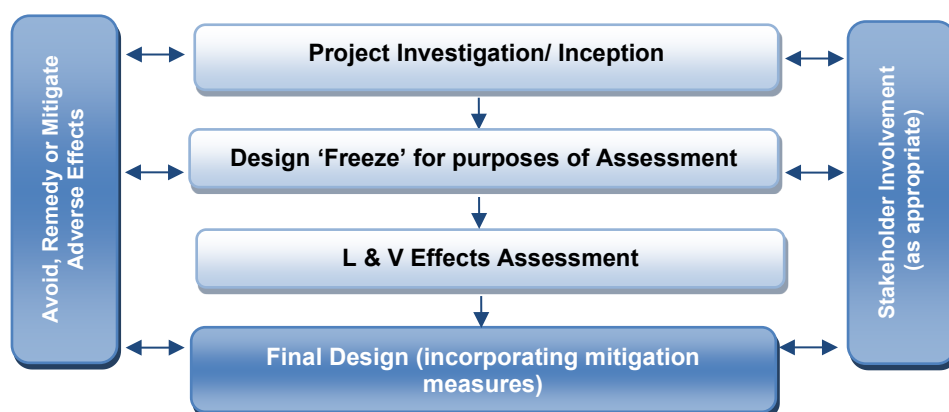


Figure 1: Design feedback loop

When undertaking a LEA, it is important that a **structured and consistent approach** is used to ensure that **findings are clear and objective**. Judgement should be based on skills and experience and be supported by explicit evidence and reasoned argument.

While landscape and visual effects assessments are closely related, they form separate procedures. The assessment of the potential effect on the landscape forms the first step in this process and is carried out as an effect on landscape elements, features and on landscape character. The assessment of visual effects considers how changes to the physical landscape affect the viewing audience. The types of effects can be summarised as follows:

**Landscape effects:** *Change in the physical landscape, which may affect its characteristics or qualities.*

**Visual effects:** *Change to views which may affect the visual amenity experienced by people.*

<sup>11</sup> NZILA (2022) Te Tangi a te Manu Aotearoa New Zealand Landscape Assessment Guidelines

<sup>12</sup> <https://www.qualityplanning.org.nz/node/802>

<sup>13</sup> Landscape Institute and Institute of Environmental Management and Assessment (2013) Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA3)

The policy context, existing landscape resource and locations from which a development or change is visible, all inform the 'baseline' for landscape and visual effects assessments. To assess effects, the landscape must first be **described**, including an understanding of the **key landscape characteristics and qualities**. This process, known as landscape characterisation, is the basic tool for understanding landscape character and may involve subdividing the landscape into character areas or types. The condition of the landscape (i.e. the state of an individual area of landscape or landscape feature) should also be described together with, a judgement made on the value or importance of the potentially affected landscape.

## **Landscape Effects**

Assessing landscape effects requires an understanding of the landscape resource and the magnitude of change which results from a proposed activity to determine the overall level of landscape effects.

### **Landscape Resource**

Assessing the sensitivity of the landscape resource considers the key characteristics and qualities. This involves an understanding of both the ability of an area of landscape to absorb change and the value of the landscape.

#### ***Ability of an area to absorb change***

This will vary upon the following factors:

- Physical elements such as topography / hydrology / soils / vegetation;
- Existing land use;
- The pattern and scale of the landscape;
- Visual enclosure / openness of views and distribution of the viewing audience;
- The zoning of the land and its associated anticipated level of development;
- The scope for mitigation, appropriate to the existing landscape.

The ability of an area of landscape to absorb change takes account of both the attributes of the receiving environment and the characteristics of the proposed development. It considers the ability of a specific type of change occurring without generating adverse effects and/or achievement of landscape planning policies and strategies.

#### ***The value of the Landscape***

Landscape value derives from the importance that people and communities, including tangata whenua, attach to particular landscapes and landscape attributes. This may include the classification of Outstanding Natural Feature or Landscape (ONFL) (RMA s.6(b)) based on important biophysical, sensory/ aesthetic and associative landscape attributes, which have potential to be affected by a proposed development. A landscape can have value even if it is not recognised as being an ONFL.

### **Magnitude of Landscape Change**

The magnitude of landscape change judges the amount of change that is likely to occur to areas of landscape, landscape features, or key landscape attributes. In undertaking this assessment, it is important that the size or scale of the change is considered within the geographical extent of the area influenced and the duration of change, including whether the change is reversible. In some situations, the loss /change or enhancement to existing landscape elements such as vegetation or earthworks should also be quantified.

When assessing the level of landscape effects, it is important to be clear about what factors have been considered when making professional judgements. This can include consideration of any benefits which result from a proposed development. **Table 1** below helps to explain this process. The tabulating of effects is only intended to inform overall judgements.

Contributing Factors		Higher	Lower
Landscape (sensitivity)	<b>Ability to absorb change</b>	The landscape context has limited existing landscape detractors which make it highly vulnerable to the type of change resulting from the proposed development.	The landscape context has many detractors and can easily accommodate the proposed development without undue consequences to landscape character.
	<b>The value of the landscape</b>	The landscape includes important biophysical, sensory and shared and recognised attributes. The landscape requires protection as a matter of national importance (ONF/L).	The landscape lacks any important biophysical, sensory or shared and recognised attributes. The landscape is of low or local importance.
Magnitude of Change	<b>Size or scale</b>	Total loss or addition of key features or elements. Major changes in the key characteristics of the landscape, including significant aesthetic or perceptual elements.	The majority of key features or elements are retained. Key characteristics of the landscape remain intact with limited aesthetic or perceptual change apparent.
	<b>Geographical extent</b>	Wider landscape scale.	Site scale, immediate setting.
	<b>Duration and reversibility</b>	Permanent. Long term (over 10 years).	Reversible. Short Term (0-5 years).

Table 9-1: Determining the level of landscape effects

## Visual Effects

To assess the visual effects of a proposed development on a landscape, a visual baseline must first be defined. The visual 'baseline' forms a technical exercise which identifies the area where the development may be visible, the potential viewing audience, and the key representative public viewpoints from which visual effects are assessed.

The viewing audience comprises the individuals or groups of people occupying or using the properties, roads, footpaths and public open spaces that lie within the visual envelope or 'zone of theoretical visibility (ZTV)' of the site and proposal. Where possible, computer modelling can assist to determine the theoretical extent of visibility together with field work to confirm this. Where appropriate, key representative viewpoints should be agreed with the relevant local authority.

### **Zone of Theoretical Visibility**

As an initial step in the visual analysis, a Zone of Theoretical Visibility (ZTV) mapping exercise was undertaken of the site in its context to determine the likely extent of visibility in the wider landscape. ZTV mapping represents the area that a development may theoretically be seen – that is, it may not actually be visible in reality due to localised screening from intervening vegetation, buildings or other structures. In addition, TV mapping does not convey the nature or magnitude of visual impacts, for example whether visibility will result in positive or negative effects and whether these will be significant

'Zone of Theoretical Visibility' (ZTV) is based on a Digital Terrain Model (DTM) overlaid on a map base. It is also known as a Zone of Visual Influence (ZVI), Visual Envelope Map (VEM) or Viewshed Map. The term ZTV is preferred for its emphasis of two key factors that are often misunderstood:

- Visibility maps represent where a development may be seen theoretically – that is, it may not actually be visible in reality, for example due to localised screening from intervening vegetation, buildings or other structures which is not represented by the DTM; and
- the maps indicate potential visibility only – that is, the areas within which there may be a line of sight. They do not convey the nature or magnitude of visual impacts, for example whether visibility will result in positive or negative effects and whether these will be significant or not.

ZTVs are calculated by computer, using any one of a number of available software packages and based upon a DTM that represents topography. The resulting ZTV is usually produced as an overlay upon a base map, representing theoretical visibility within a defined study area.

As the ZTV mapping is based entirely on 'bare ground' topographic data, it does not take into account the screening, unless LIDAR based vegetation data is used to generate the DTM. In addition, the level of reliability of the contour information will influence the accuracy of the mapping. ZTV mapping does however take into account factors relating to the curvature of the earth and light refraction. ZTV is helpful where to focus field work but it should be remembered that while ZTV is a useful assessment tool, it is important to recognise its limitations.

For this project, the following parameters were used:

Location of target points: Tip height of proposed turbines at 160m above ground level

Observer Eye Height: 2.0m

Coefficient of Earth Curvature and Refraction: 0.07

Base Spheroid used for computation: WGS 84

Following the ZTV analysis, field work is used to determine the actual extent of visibility of the site, including the selection of representative viewpoints from public areas. This stage is also used to identify the potential 'viewing audience' e.g. residential, visitors, recreation users, and other groups of viewers who can see the site. During fieldwork, photographs are taken to represent views from available viewing audiences.

### **The Sensitivity of the viewing audience**

The sensitivity of the viewing audience is assessed in terms of assessing the likely response of the viewing audience to change and understanding the value attached to views.

#### ***Likely response of the viewing audience to change***

Appraising the likely response of the viewing audience to change is determined by assessing the occupation or activity of people experiencing the view at particular locations and the extent to which their interest or activity may be focussed on views of the surrounding landscape. This relies on a landscape architect's judgement in respect of visual amenity and the reaction of people who may be affected by a proposal. This should also recognise that people more susceptible to change generally include: residents at home, people engaged in outdoor recreation whose attention or interest is likely to be focussed on the landscape and on particular views; visitors to heritage assets or other important visitor attractions; and communities where views contribute to the wider landscape setting.

#### ***Value attached to views***

The value or importance attached to particular views may be determined with respect to its popularity or numbers of people affected or reference to planning instruments such as viewshafts or view corridors. Important viewpoints are also likely to appear in guidebooks or tourist maps and may include facilities provided for its enjoyment. There may also be references to this in literature or art, which also acknowledge a level of recognition and importance.

### **Magnitude of Visual Change**

The assessment of visual effects also considers the potential magnitude of change which will result from views of a proposed development. This takes account of the size or scale of the effect, the geographical extent of views and the duration of visual change, which may distinguish between temporary (often associated with construction) and permanent effects

where relevant. Preparation of any simulations of visual change to assist this process should be guided by best practice as identified by the NZILA<sup>14</sup>.

**Visual Simulations**

As part of the assessment process, visual simulations have been prepared in accordance with NZILA Best Practice Guide: Visual Simulations BPG 10.2<sup>15</sup>. This has entailed taking digital photographs from each of the identified viewpoints and recording their GPS locations. Preparation of visual simulations required the preparation of a 3D model of the proposed turbine locations and associated earthworks supplied by Meridian. The GPS coordinates for each viewpoint were also added to the model and using the same focal length parameters as that of the camera, an image of the 3D wire frame of the proposed landform was then generated for each viewpoint. This was then registered over the actual photograph, using known reference points to bring the two together. The surface of the proposed landform was then rendered to approximate the likely appearance of the Site.

When determining the overall level of visual effect, the nature of the viewing audience is considered together with the magnitude of change resulting from the proposed development. **Table 2** has been prepared to help guide this process:

Contributing Factors		Higher	Lower	Examples
The Viewing Audience (sensitivity)	<b>Ability to absorb change</b>	Views from dwellings and recreation areas where attention is typically focussed on the landscape.	Views from places of employment and other places where the focus is typically incidental to its landscape context. Views from transport corridors.	Dwellings, places of work, transport corridors, public tracks
	<b>Value attached to views</b>	Viewpoint is recognised by the community such as an important view shaft, identification on tourist maps or in art and literature. High visitor numbers.	Viewpoint is not typically recognised or valued by the community. Infrequent visitor numbers.	Acknowledged viewshafts, Lookouts
Magnitude of Change	<b>Size or scale</b>	Loss or addition of key features in the view. High degree of contrast with existing landscape elements (i.e. in terms of form scale, mass, line, height, colour and texture). Full view of the proposed development.	Most key features of views retained. Low degree of contrast with existing landscape elements (i.e. in terms of form scale, mass, line, height, colour and texture). Glimpse / no view of the proposed development.	- Higher contrast/ Lower contrast. - Open views, Partial views, Glimpse views (or filtered); No views (or obscured)
	<b>Geographical extent</b>	Front on views. Near distance views; Change visible across a wide area.	Oblique views. Long distance views. Small portion of change visible.	- Front or Oblique views. - Near distant, Middle distant and Long distant views
	<b>Duration and reversibility</b>	Permanent. Long term (over 15 years).	Transient / temporary. Short Term (0-5 years).	- Permanent (fixed), Transitory (moving)

Table 9-2: Determining the level of visual effects

## Nature of Effects

In combination with assessing the level of effects, the landscape and visual effects assessment also considers the nature of effects in terms of whether this will be positive (beneficial) or negative (adverse) in the context within which it occurs. Neutral effects can also occur where landscape or visual change is benign.

<sup>14</sup> Best Practice Guide: Visual Simulations BPG 10.2, NZILA

<sup>15</sup> Best Practice Guide: Visual Simulations BPG 10.2, NZILA

It should also be noted that a change in a landscape does not, of itself, necessarily constitute an adverse landscape or visual effect. Landscape is dynamic and is constantly changing over time in both subtle and more dramatic transformational ways; these changes are both natural and human induced. What is important in managing landscape change is that adverse effects are avoided or sufficiently mitigated to ameliorate the effects of the change in land use. The aim is to provide a high amenity environment through appropriate design outcomes.

This assessment of the nature effects can be further guided by **Table 3** set out below:

Nature of effect	Use and Definition
<b>Adverse (negative):</b>	The activity would be out of scale with the landscape or at odds with the local pattern and landform which results in a reduction in landscape and / or visual amenity values
<b>Neutral (benign):</b>	The activity would be consistent with (or blend in with) the scale, landform and pattern of the landscape maintaining existing landscape and / or visual amenity values
<b>Beneficial (positive):</b>	The activity would enhance the landscape and / or visual amenity through removal or restoration of existing degraded landscape activities and / or addition of positive elements or features

Table 9-3: Determining the Nature of Effects

## Cumulative Effects

During the scoping of an assessment, where appropriate, agreement should be reached with the relevant local authority as to the nature of cumulative effects to be assessed. This can include effects of the same type of development (e.g. wind farms) or the combined effect of all past, present and approved future development<sup>16</sup> of varying types, taking account of both the permitted baseline and receiving environment. Cumulative effects can also be positive, negative or benign.

### Cumulative Landscape Effects

Cumulative landscape effects can include additional or combined changes in components of the landscape and changes in the overall landscape character. The extent within which cumulative landscape effects are assessed can cover the entire landscape character area within which the proposal is located, or alternatively, the zone of visual influence from which the proposal can be observed.

### Cumulative Visual Effects

Cumulative visual effects can occur in combination (seen together in the same view), in succession (where the observer needs to turn their head) or sequentially (with a time lapse between instances where proposals are visible when moving through a landscape). Further visualisations may be required to indicate the change in view compared with the appearance of the project on its own.

Determining the nature and level of cumulative landscape and visual effects should adopt the same approach as the project assessment in describing both the nature of the viewing audience and magnitude of change leading to a final judgement. Mitigation may require broader consideration which may extend beyond the geographical extent of the project being assessed.

## Determining the Overall Level of Effects

The landscape and visual effects assessment concludes with an overall assessment of the likely level of landscape and visual effects. This step also takes account of the nature of effects and the effectiveness of any proposed mitigation. The process can be illustrated in Figure 2:

<sup>16</sup> The life of the statutory planning document or unimplemented resource consents.



Figure 2: Assessment process

This step informs an overall judgement identifying what level of effects are likely to be generated as indicated in **Table 4** below. This table which can be used to guide the level of landscape and visual effects uses an adapted seven-point scale derived from NZILA's Best Practice Note.

Effect Rating	Use and Definition
<b>Very High:</b>	Total loss of key elements / features / characteristics, i.e. amounts to a complete change of landscape character and in views. Turbines would appear dominant and overbearing in primary views.
<b>High:</b>	Major modification or loss of most key elements / features / characteristics, i.e. little of the pre-development landscape character remains and/or result in a major change in primary views. Turbines would appear prominent, but not necessarily dominant. <i>Concise Oxford English Dictionary Definition</i> <i>High: adjective- Great in amount, value, size, or intensity.</i>
<b>Moderate- High:</b>	Modifications of several key elements / features / characteristics of the baseline, i.e. the pre-development landscape character remains evident but materially changed and may appear prominent in views
<b>Moderate:</b>	Partial loss of or modification to key elements / features / characteristics of the baseline, i.e. new elements may be prominent in secondary views but not necessarily uncharacteristic within the receiving landscape. <i>Concise Oxford English Dictionary Definition</i> <i>Moderate: adjective- average in amount, intensity, quality or degree</i>
<b>Low - Moderate:</b>	Minor loss of or modification to one or more key elements / features / characteristics, i.e. new elements are not prominent within views or uncharacteristic within the receiving landscape.
<b>Low:</b>	Little material loss of or modification to key elements / features / characteristics. i.e. modification or change is not uncharacteristic or prominent in views and absorbed within the receiving landscape. <i>Concise Oxford English Dictionary Definition</i> <i>Low: adjective- 1. Below average in amount, extent, or intensity.</i>
<b>Very Low:</b>	Negligible loss of or modification to key elements/ features/ characteristics of the baseline, i.e. approximating a 'no change' situation and a negligible change in views.

Table 9-4: Determining the overall level of landscape and visual effects



# Appendix 2: Statutory Provisions

## Horizons One Plan

### **Chapter 3 Infrastructure, Energy, Waste, Hazardous Substances and Contaminated Land**

#### **Section 3.4.2** relates to **Energy**

#### **Policy 3-6 Renewable Energy**

The Regional Council and Territorial Authorities must have particular regard to the benefits of the use and development of renewable energy resources including:

- a) contributing to reduction in greenhouse gases,
- b) reduced dependency on imported energy sources,
- c) reduced exposure to fossil fuel price volatility, and
- d) security of supply for current and future generations,

the Region's potential for the use and development of renewable energy<sup>^</sup> resources, and

the need for renewable energy activities to locate where the renewable energy<sup>^</sup> resource is located, and

the benefits of enabling the increased generation capacity and efficiency of existing renewable electricity generation facilities, and

the logistical or technical practicalities associated with developing, upgrading, operating or maintaining an established renewable electricity generation activity.

The Regional Council and Territorial Authorities must generally not restrict the use of small domestic-scale renewable energy<sup>^</sup> production for individual domestic use.

#### **Anticipated Environmental Results:**

Increased efficiency of the end use of energy and increased generation of energy from renewable resources in the Region.

Efficient end use of energy in the Region

Amount of energy generated from renewable energy resources in the Region

### **Chapter 6 - Indigenous biological diversity, landscape and historic heritage**

#### **Section 6.42** relates to **Landscape and Natural Character**

The natural features and landscapes listed in Schedule G Table G.1 must be recognised as regionally outstanding and must be spatially defined in the review and development of district plans. All subdivision, use and development directly affecting these areas must be managed in a manner which:

- (a) avoids significant adverse cumulative effects on the characteristics and values of those outstanding natural features and landscapes, and

(b) except as required under (a), avoids adverse effects as far as reasonably practicable and, where avoidance is not reasonably practicable, remedies or mitigates adverse effects on the characteristics and values of those outstanding natural features and landscapes.

#### **Anticipated Environmental Results:**

Except for change because of natural processes, or change authorised by a resource consent, at 2017 the characteristics and values of all outstanding landscapes and natural features identified in the Region ([Schedule G](#) Table G.1) will be in the same or a better state as assessed prior to this Plan becoming operative. Indicators for success include:

Level of protection afforded to Schedule G (outstanding landscapes and ONF) is included in Territorial Authority and District Plans AND the number of those where identified characteristics and values have been damaged.

#### **Policy 6.7 Assessing outstanding natural features and landscapes**

- To be identified and include in any district plan'

Table 6.1 lists the assessment factors for Natural Features and Landscape scope (includes Natural Science, Aesthetic, Expressive, transient, shared and recognised, cultural/spiritual and heritage values)

**Policy 6.8 Natural Character** – to be preserved and protected from inappropriate subdivision, use and development and;

restored and rehabilitated where this is appropriate and practicable

#### **Policy 6.9 Managing natural character**

In relation to the natural character of:

(a) the component of the coastal environment which is not coastal marine area<sup>a</sup> (CMA), and

(b) wetlands, rivers and lakes and their margins

Subdivision, use or development must generally (but without limitation) be considered appropriate if it:

(c) is compatible with the existing level of modification to the environment,

(d) has a functional necessity to be located in or near the component of the coastal environment which is not coastal marine area (CMA), wetland, river or lake and no reasonably practicable alternative locations exist, Indigenous biological diversity, landscape and historic heritage One Plan - 2014 6-11

(e) is of an appropriate form, scale and design to be compatible with the existing landforms, geological features and vegetation,

(f) will not, by itself or in combination with effects of other activities, significantly disrupt natural processes or existing ecosystems, and

(g) will provide for the restoration and rehabilitation of natural character where that is appropriate and practicable.

## Greater Wellington Natural Resources Plan

**Policy P12** requires that when considering proposals that relate to the provision of regionally significant infrastructure, or renewable energy generation activities, particular regard will be given to the benefits of those activities.

**Policy P13:** Providing for regionally significant infrastructure and renewable electricity generation activities. The use, development, operation, maintenance, and upgrade of regionally significant infrastructure and renewable energy generation activities are provided for, in appropriate places and ways. This includes by having particular regard to: (a) the strategic integration of infrastructure and land use, and (b) the location of existing infrastructure and structures, and (c) the need for renewable energy generation activities to locate where the renewable energy resources exist, and (d) the functional need and operational requirements associated with developing, operating, maintaining and upgrading regionally significant infrastructure and renewable energy generation activities.

**Policy P20:** Exercise of kaitiakitanga. Kaitiakitanga shall be recognised and provided for by involving mana whenua in the assessment and decision-making processes associated with use and development of natural and physical resources including; (a) managing activities in sites with significant mana whenua values listed in Schedule C (mana whenua) in accordance with tikanga and kaupapa Māori as exercised by mana whenua, and (b) the identification and inclusion of mana whenua attributes and values in the kaitiaki information and monitoring strategy in accordance with Method M2, and (c) identification of mana whenua values and attributes and their application through tikanga and kaupapa Māori in the maintenance and enhancement of mana whenua relationships with Ngā Taonga Nui a Kiwa.

**Policy P44:** Protection and restoration of sites with significant mana whenua values. Sites with significant mana whenua values identified in Schedule C (mana whenua) shall be protected and restored by a mix of the following regulatory and non-regulatory methods: (a) managing use and development through rules in the plan, and (b) working in partnership with key stakeholders through: (i) increasing landowner and community understanding of significant values within Schedule C sites, and (ii) working with mana whenua, landowners, and other interested parties as appropriate, to develop and implement restoration programmes for Schedule C sites, and (iii) the Wellington Regional Council and iwi authorities implementing kaupapa Māori monitoring of Schedule C sites. Te Awa o Kopuranga (Kopuranga River) is identified in Schedule B as a Ngā Taonga Nui a Kiwa, for mana whenua Rangitāne o Wairarapa; and Ngāti Kahungunu ki Wairarapa.

**Policy P48:** Protection of outstanding natural features and landscapes. The natural features and landscapes (including seascapes) of the coastal marine area, rivers, lakes and their margins and natural wetlands shall be protected from inappropriate use and development by: (a) identifying outstanding natural features and landscapes within the region, and (b) avoiding adverse effects of activities on outstanding natural features and landscapes, and (c) avoiding significant adverse effects and avoiding, remedying or mitigating other adverse effects of activities on all other natural features and landscapes.

## Tararua District Plan

### 2.3.2 SUSTAINABLE AND EFFICIENT RURAL LAND USE

The following objective, policies and methods are derived from issue 2.3.1.1 above.

#### 2.3.2.1 Objective

To achieve sustainable rural land use and efficient use of resources

#### **2.3.2.2 Policies**

(a) To promote sustainable land management community programmes in order to achieve sustainable land use practices which:

- are compatible with the inherent productive capabilities of the land;
- do not result in any on or off-site adverse environmental effects in areas vulnerable to erosion, subsidence or landslip;
- retain existing vegetation where steep slopes or erosion prone soils indicate a risk of accelerated erosion;
- protect water quality (this may include riparian management practices);
- do not result in any on and off-site adverse environmental effects from the discharge of contaminants to land;
- protect soil structure

(b) To avoid, remedy or mitigate significant irreversible losses of the productive capability of the District's Class I and II soils.

### **ENVIRONMENTAL QUALITY AND AMENITY**

The following objective, policies and methods are derived from issue 2.3.1.3 above.

#### **2.3.4.1 Objective**

To ensure a high level of environmental quality and amenity throughout the rural areas of the District.

#### **2.3.4.2 Policies**

(a) To ensure that any actual or potential adverse environmental effects of activities are avoided, remedied or mitigated.

(b) To maintain and/or enhance the character, level of amenity and environmental quality of the District's rural areas.

(c) To reduce the potential for conflict between incompatible activities in rural areas, particularly in the rural-urban fringe, and between existing, lawfully established activities and new subdivision and development.

### **MAINTENANCE AND ENHANCEMENT OF ENVIRONMENTAL QUALITY AND AMENITY**

The following objective, policy and methods are derived from issue 2.6.1.1 above.

#### **2.6.2.1 Objective**

To maintain and/or enhance amenity values and environmental quality in the District, for present and future generations.

### **2.6.2.2 Policy**

(a) To manage the adverse effects of activities on amenity values by specifying minimum environmental standards for the development and maintenance of such activities.

### **LANDSCAPES, SIGNIFICANT TREES AND SIGNIFICANT INDIGENOUS VEGETATION AND SIGNIFICANT HABITATS OF INDIGENOUS FAUNA**

The following objective, policies and methods are derived from issue 2.6.1.3 above.

#### **2.6.4.1 Objective**

To protect natural features and landscapes, trees and areas of indigenous vegetation and habitats of indigenous fauna that are of district, regional or national significance from inappropriate subdivision, use and development.

#### **Policies**

(a) To identify particular natural features and landscapes that contribute in a significant way to the amenity and environmental quality of the District and to classify them, in a Schedule in this Plan, according to their significance and relative value to the community. In determining the significance of natural features and landscapes, whether for the purpose of making additions to, or deletions from, the Schedule of Natural Features and Landscapes, or for assessing the effects of an activity on an item included in the Schedule, the following factors shall be taken into account:

1. Natural science factors which relate to the geological, ecological, topographical and dynamic components of the natural feature or landscape:
2. Aesthetic values which relate to scenic perceptions of the feature or landscape:
3. Expressiveness (legibility): The feature or landscape clearly shows the formative natural processes or historic influences that led to its existing character.
4. Transient values: The consistent and noticeable occurrence of transient natural events, such as daily or seasonal changes in weather, vegetation or wildlife movement, contributes to the character of the feature or landscape.
5. Shared and recognised values: The feature or landscape is widely known and is highly valued for its contribution to local identity within its immediate and wider community.
6. Cultural and spiritual values for tangata whenua: Māori values inherent in the feature or landscape add to the feature or landscape being recognised as a special place.
7. Historical associations: Knowledge of historic events that occurred in and around the feature or landscape is widely held and substantially influences and adds to the value the community attaches to the natural feature or landscape.

(b) To identify trees, indigenous vegetation and habitats of indigenous fauna in the District that contribute in a significant way to the amenity and environmental quality of the District and to classify them according to their significance and relative value to the community.

To encourage the protection of significant trees, significant indigenous vegetation, significant habitats of indigenous fauna, and identified natural features and landscapes from inappropriate subdivision, development or use, and to promote public access where this will not adversely affect conservation or private property values.

(d) To consider rates relief and/or rebates, as well as other financial instruments or measures, where an area of significant indigenous biodiversity is being voluntarily protected by landowners in conjunction with other agencies (e.g. QEII Trust, MWRC, Department of Conservation, Tararua District Council).

(e) To assist landowners, wherever possible and practicable, in obtaining information concerning the management of indigenous biodiversity on private land.

## **ELECTRICITY GENERATION FROM RENEWABLE SOURCES INCLUDING WIND FARMS**

The following objective, policies and methods are derived from issue 2.8.1.3.

### **2.8.4.1 Objective**

To recognise the potential of the District's Rural Management Area for renewable electricity generation and wind farms in particular.

### **2.8.4.2 Policies**

(a) To recognise the local, regional and national benefits to be derived from the development of renewable energy resources, and wind farms, in particular.

(b) To remedy, mitigate, or avoid, where possible, the actual and potential adverse effects on the environment of wind farms and other renewable electricity generation facilities, by recognising that they have the potential to cause significant adverse effects on the environment, particularly in respect of amenity values, landscape ecology, noise and traffic, and may therefore be inappropriate in some locations.

### **Renewable Electricity Generation Criteria for assessment**

(a) The contribution that the proposed renewable electricity generation facility will make to the achievement of energy policy objectives and/or renewable energy generation targets of the New Zealand government;

(b) The local, regional and national benefits to be derived from renewable electricity generation and use;

(c) The extent to which the facility will adversely affect the amenity values of the locality, having particular regard to the impact of the development on existing residential dwellings, and including (but not limited to) the following effects:

Electromagnetic interference to broadcast or other signals

(ii) Glint resulting from the reflection of the sun off of turbine blades

(iii) Shadow flicker resulting from shadows generated by moving turbine blades.

(d) The visual and amenity effects of the facility with regard to the existing character of the area to which the proposal relates, the desired characteristics for the relevant Management Area as

set out in Section 3.2 of this Plan, any significant landscapes or natural features identified in this Plan and/or any Regional Policy Statement and/or Regional Plan that applies to the area in which the site of the proposal is located;

(e) The ecological effects of the facility, including any effect on significant natural areas including areas and habitats of indigenous flora and fauna, as identified in this Plan or any Regional Policy Statement or Plan that applies to the area in which the site of the proposal is located;

(f) The effects of the facility on recognised archaeological and/or historic heritage features identified in this Plan or in other heritage registers;

(g) The expected noise effects arising from the construction, maintenance and operation of the facility, with particular regard to the impact of noise on existing dwellings and the ability of the proposal to meet any relevant standards such as NZS6808:2010 Acoustics – Wind Farm Noise and the NZS6803:1999 Construction Noise or any subsequent versions of these standards.

(h) The effects of the facility on aviation, navigation and existing network facilities.

(i) The ability of the land to accommodate the earthworks, roads, building platforms or other infrastructure necessary to construct, maintain and operate the facility.

## Wairarapa Combined Plan

**Rur1 Policies** (a) Identify areas within the Rural Zone where the predominant land use is primary production, which needs to operate and develop effectively – Rural (Primary Production) Zone. (b) Identify areas within the Rural Zone where the predominant land use is conservation management, and which are primarily managed by public agencies – Rural (Conservation) Zone. (c) Identify areas within the Rural Zone in which there are particular land use issues that require specific management approaches, including urban growth, flood hazards, and the operational requirements of key infrastructural facilities and intensive primary production activities – Rural (Special) Zone. (d) Maintain and enhance the amenity values, including natural character, of the differing Rural character areas through appropriate controls over subdivision and the bulk, location and nature of activities and buildings, to ensure activities and buildings are consistent with the rural character, including an appropriate scale, density and

**4.3.5 Rur2 Policies** (a) Provide for primary production activities as permitted activities in the Rural (Primary Production) Zone and Rural (Special) Zone, subject to such environmental standards as necessary to avoid, remedy or mitigate any adverse effects of primary production activities without unreasonably affecting landowners' ability to use their land productively. (b) Provide for other land uses as permitted activities in the Rural (Primary Production) Zone and Rural (Special) Zone, subject to such environmental standards as necessary to avoid, remedy or mitigate any adverse effects. (c) Manage the establishment and operation of a range of other activities in the Rural Zone, such that their adverse effects on the environment are appropriately avoided, remedied or mitigated. (d) Ensure activities that are potentially sensitive to the adverse external effects of primary production and any other lawfully established activities, particularly those activities with significant external effects, are either appropriately sited, managed or restricted to avoid or mitigate these effects. (e) Ensure that new primary production and other activities that may have significant external adverse effects are appropriately sited from sensitive land uses or are otherwise controlled to avoid or mitigate such effects. (f) Provide interface controls on primary production and other activities that may have adverse effects on adjoining activities level of environmental effects. (e) Manage subdivision, use and development

in a manner which recognises the attributes that contribute to rural character, including: (i) Openness and predominance of vegetation (ii) Productive working landscape (iii) Varying forms, scale and separation of structures associated with primary production activities (iv) Ancillary living environment, with an overall low population density (v) Self-serviced allotments.

**9.3.2 Lan1 Policies** (a) Comprehensively and consistently identify and assess the outstanding landscapes and natural features within the Wairarapa. (b) Manage the effects of activities with the potential to adversely affect the attributes and values of outstanding landscapes and natural features. (c) Protect the particular attributes and values of outstanding landscapes and natural features from inappropriate development, with any adverse effects on those attributes and values being avoided, remedied or mitigated. (d) Encourage new development to be located and designed in a way that protects the attributes and values of the Wairarapa's outstanding landscapes and natural features. (e) Increase public awareness of landscape values and their importance, and encourage the community and landowners to support protection of the Wairarapa's outstanding landscapes and natural features. (f) Provide support and incentives as appropriate to landowners in the protection of outstanding landscapes and natural features. (g) Ensure subdivision and development is managed by having regard to the adverse effects on the landscape values of the site and locality.

**16.3.5 NUE2 Policies** (a) Encourage energy efficiency through conservation and efficient energy use. (b) Recognise the local, regional and national benefits to be derived from renewable energy generation. (c) Recognise and manage appropriate development of the Wairarapa's significant potential renewable energy resource. (d) Provide for renewable energy generation while, as far as practicable, avoiding, remedying or mitigating the adverse effects, particularly of large scale and/or prominent facilities. (e) Recognise and promote the use of environmental management codes of practice and best practice methods in energy generation, distribution and use. (f) Recognise the technical and operational requirements of energy generation and distribution and its benefits to the wellbeing of the Wairarapa when setting and implementing appropriate environmental standards to avoid, remedy or mitigate the adverse effects on the environment and when assessing applications for resource consent. (g) Manage subdivision and land use activities to avoid adverse effects on the efficient operation of established energy generation facilities.



## Appendix 3: Residential Visual Amenity Assessment: Visual Effects from Dwellings within 2km of Nearest Turbine

ID	Address	Distance to nearest turbine	Sensitivity	Magnitude of Visual Change	Shadow Flicker Analysis <sup>17</sup>	Potential Visual Effect
1*	72 Smiths Line, Eketahuna	1.1km	<p>Dwelling located on an elevated knoll to north-east of Mount Munro from with primary views face southeast and away from the Site. Mature trees and shelterbelt vegetation extend from the north to the southwest to the rear of the dwelling and limits available views towards the wind farm. Landowner anticipates some intervening mature vegetation will need to be removed given its age.</p> <p>The wind farm Site is also visible from more open areas of the larger working farm which continues along a ridge to the north.</p>	<p>From curtilage areas, views towards the proposed wind farm will remain filtered and largely obscured by mature trees and shelterbelts established to the rear of the dwelling. Individual turbines may appear visible along the treeline and further changes in view may occur in the event mature vegetation is removed. Existing screening would be gradually replaced as shelter belts are re-established.</p> <p>Earthworks to construct the ridgeline access track will remain concealed except for a localised cut to access turbines 13 and 14. This section of access is to be accommodated in box cutting within the Site to limit external views.</p>	<p>Total of 62.4 hours per year. (Turbines 8,9 and 10)</p> <p>Occurs on 172 days per year around 4pm between May and September. Mean of 22 minutes per day.</p>	Moderate
2*	48 Smiths Line, Eketahuna	1.3km	<p>Dwelling located along north-eastern toe of Mount Munro. Primary views from living areas face north and west and incorporate open views towards the Site.</p> <p>Established vegetation within this property has predominantly been maintained to enable views towards the rural backdrop of Mount Munro. A single individual deciduous tree and overhead</p>	<p>Views looking west from the living areas will observe turbines 1-12, the nearest of which will form prominent dynamic elements along the skyline. Turbines 13-14 are located relatively lower along the ridgeline to the north and will largely remain screened beyond intervening vegetation.</p>	<p>Total of up to 49.8 hours per year (Turbines 8, 9 and 10).</p> <p>Occurs on 132 days per year around 4pm between April and</p>	High

<sup>17</sup> Based on MTMR\_v10-01\_20\_WTG. Zone of influence for Shadow Flicker based on 10 x rotor diameter (1,360m).

\* Indicates location of dwelling has been visited as part of confirming this assessment

ID	Address	Distance to nearest turbine	Sensitivity	Magnitude of Visual Change	Shadow Flicker Analysis <sup>17</sup>	Potential Visual Effect
			transmission line punctuates the skyline to the west of the dwelling.	The majority of proposed earthworks will remain concealed beyond the ridgetop. A localised area of proposed cut will be visible to form access below the base of turbine 12, however this will remain below the main ridge and remain prominently screened beyond established vegetation. The existing visible landform will remain in pasture and support ongoing rural land use.	August. Mean of 23 minutes per day.	
3	12 Smiths Line, Eketahuna	1.6km	<p>Dwelling located within broader rural land holding to the east of Mount Munro with primary views appearing to face north and west but enclosed within established garden vegetation that conceals longer distance views including towards the wind farm Site.</p> <p>There may be some partially screened or filtered views from the vicinity of outbuildings and other areas of this working farm.</p>	<p>Views of the proposed wind farm from the dwelling and its associated curtilage areas appear to remain concealed by existing intervening vegetation and would result in no apparent visual change. In the event existing vegetation is removed, turbines 1-14 may appear visible along the main ridgeline not currently observed. Turbines 15-20 along the lower western ridgeline would remain concealed.</p> <p>No views of proposed earthworks would occur with tracks and turbine foundations remaining concealed within the existing landform within the Site. Any views of the larger Site would continue to support ongoing pastoral land use.</p>	No shadow flicker effects identified	Low - Moderate
4	2219 Opaki Kaiparoro Road, Eketahuna	2km	<p>Dwelling located to the east of Mount Munro with primary views facing north-east away from the proposed wind farm and partially enclosed within established garden vegetation.</p> <p>Potential long-distance views appear to occur from the north-west side of the dwelling and the adjoining driveway.</p>	<p>Secondary views of turbines 1 -14 would likely be visible as an ordered array of dynamic structures along the skyline in long distance views. From this location, parts of the tips of turbines 19 and 20 are also visible above the top of the intervening ridgeline.</p> <p>Earthworks within the Site would remain obscured by the intervening landform with the</p>	No shadow flicker effects identified	Moderate

ID	Address	Distance to nearest turbine	Sensitivity	Magnitude of Visual Change	Shadow Flicker Analysis <sup>17</sup>	Potential Visual Effect
				exception of part of the access track beneath turbine 12. The larger landholding surrounding the proposed turbines will continue to support ongoing pastoral land use.		
5	2310 Opaki Kaiparoro Road	1.7km	Dwelling located to the south- east of Mount Munro with primary views appearing to face east away from the wind farm. Rear views to the north-west appear to encompass a backdrop which encompass part of the broader Mount Munro backdrop which will include the wind farm Site. Potential views are punctuated by intervening vegetation and outbuildings to the north-west. Access was not provided to this dwelling to confirm views.	<p>Partial and open long-distance views of turbines 1 – 7 would likely be visible in long distance views and form an ordered array of dynamic structures along the skyline to the rear of the dwelling. Views of turbines 8-14 to the north-west appear to be partially screened by intervening vegetation which reduces the extent to which the larger wind farm will remain apparent.</p> <p>Proposed earthworks would remain concealed within the existing landform with the Site. The larger landholding surrounding the proposed turbines would continue to support ongoing pastoral land use.</p>	No shadow flicker effects identified	Moderate - High
6*	73 Hall Road, Eketahuna	950m	Dwelling located along the eastern toe of Mount Munro. Primary view face northeast away from the Site with rear views primarily contained within established planting which encloses the garden. Views towards the Site remain available from curtilage areas including the driveway and from larger working areas of the farm.	<p>Views from much of the curtilage area will remain screened by intervening garden planting and shelterbelt trees. Some rear views between intervening vegetation from curtilage areas will enable prominent views of individual turbines above the ridgeline to the west. Open views will also be available from other areas of the farm.</p> <p>Proposed earthworks will remain concealed within the existing landform with the Site. The larger landholding surrounding the proposed turbines will continue to support ongoing pastoral land use.</p>	<p>Total of up to 100.5 hours per year (Turbines 2,3,4,5 and 6).</p> <p>Occurs during 212 days per year around 4pm between February and October for a mean of 29 minutes per day.</p>	High (Within Project Site)

ID	Address	Distance to nearest turbine	Sensitivity	Magnitude of Visual Change	Shadow Flicker Analysis <sup>17</sup>	Potential Visual Effect
7	2420 Opaki Kaiparoro Road, Eketahuna	1.5km	Dwelling located to the south-east of Mount Munro with primary views appearing to face east within an established garden. Vegetation in the rear garden to the north of the dwelling combined with intervening shelter belts to the west appear to limit other available views from the dwelling and associated curtilage areas.	<p>Views of the proposed wind farm from the dwelling and its associated curtilage areas appear to remain largely concealed by existing intervening vegetation. Individual turbines may appear visible in rear views through gaps between vegetation, or the event existing vegetation is removed. Turbines 15-20 along the lower western ridgeline will remain concealed.</p> <p>No potential earthworks will be visible. Any views of the larger landholding supporting the turbines will continue to support ongoing pastoral land use.</p>	No shadow flicker effects identified	Moderate
8*	2472 Opaki Kaiparoro Road, Eketahuna	1.2km	Dwelling to the south-east of Mount Munro with primary views facing northeast through gaps in established vegetation. The east facing slopes of Mount Munro are not generally visible on account of mature vegetation established to the rear of the Site and which encloses curtilage areas.	<p>Possible views of the tops turbines 1-4 may occur from parts of the curtilage area. Such views would remain largely filtered by intervening vegetation and limits the extent to which changes are observed.</p> <p>No potential earthworks will be visible being contained within the landform of the Site.</p>	<p>Total of up to 11.3 hours per year (Turbine1).</p> <p>Occurs during 37 days per year around 3pm in the middle of winter. Mean of 18 minutes per day.</p>	Low - Moderate
9	310 Opaki Kaiparoro Road, Eketahuna	970m	Dwelling located to the south-east of Mount Munro from which primary views appear to face southwest and away from the wind farm. Views towards the Site are primarily obscured by intervening roadside vegetation and mature shelter belts on the opposite side of the road.	<p>Oblique potential views towards turbines 1 – 8 will remain obscured by intervening roadside shelterbelts.</p> <p>No earthworks will be visible within the Site.</p>	No shadow flicker effects identified	Low - Moderate
10	174 Opaki Kaiparoro	680m	Dwelling recently upgraded with new living areas constructed to the south-west of Mount Munro. Primary views to the north and west remain	Dwelling set back from the roadside and property boundary established with existing shelterbelt vegetation which largely restricts	Total of up to 105.3 hours per	Moderate - High

ID	Address	Distance to nearest turbine	Sensitivity	Magnitude of Visual Change	Shadow Flicker Analysis <sup>17</sup>	Potential Visual Effect
	Road, Eketahuna		relatively well contained within established pine trees. The dwelling is arranged in separate pods which require occupiers to regularly move between buildings across the curtilage area of the Site.	existing external views. Possible partial views of turbines 1, 2 and 3 and the upper part of turbine 4 where there are gaps through existing intervening vegetation and in the event existing vegetation is removed. Potential longer distance views towards turbines 15 – 20 remain relatively low along the more distant skyline and predominantly screened by intervening vegetation.	year (Turbines 1,2,3 and 4).  Occurs during 193 days per year before 8am between September and March. Mean of 33 minutes a day.	
11*	152 Opaki Kaiparoro Road, Eketahuna	670m	Dwelling to south-west of Mount Munro with primary views facing north-west away from the Site and towards part of the Tararua Ranges observed along the alignment of Opaki Kaiparoro Road. Open rear views of southern part of Mount Munro from driveway approaching dwelling with rear views from dwelling remaining partially obscured by intervening vegetation.	Primary views from dwelling are in opposite direction of wind farm and therefore remain largely unchanged. When approaching the dwelling along the driveway and through gaps in vegetation, turbines 1 and 2 will appear as prominent structures along the skyline of the adjoining rural backdrop. The remaining turbines within the wind farm will remain concealed by established boundary vegetation.  No earthworks will be visible within the Site.	Total of up to 79 hours per year (Turbines 1,2,3 and 4).  Occurs during 79 hours per year before 8 am between September and March.  Mean of 28 minutes per day.	Moderate - High
12*	124 Opaki Kaiparoro Road, Eketahuna	1.1km	Small dwelling 'The Cottage' with primary views looking north-west and overlooking an upper tributary along the Makakahi River. Oblique open views are available from a side window looking north-east towards the wind farm.	Primary views from dwelling overlooking the Makakahi River will remain unchanged. Oblique open views to the northeast will observe turbines 1-11 along the skyline of the main ridge alongside partial views of turbines 15-20 forming an overlapping cluster to the right over greater distances. The larger array of turbines may appear prominent as part of this secondary rural outlook.	Total of up to 38.4 34 hours per year (Turbines 1 and 2).  Occurs during 100 days per year before 7 am between November and January.	Moderate - High

ID	Address	Distance to nearest turbine	Sensitivity	Magnitude of Visual Change	Shadow Flicker Analysis <sup>17</sup>	Potential Visual Effect
				No earthworks will be visible within the Site.		
13*	117 Opaki Kaiparoro Road, Eketahuna	1.2km	<p>Dwelling located to the west of Mount Munro within enclosed rural valley which extends along Falkner Road. Primary views from dwelling look northeast towards the wind farm Site and southwest along the alignment of Opaki Kaiparoro Road towards the Tararua Ranges.</p> <p>Farm sheds and mature vegetation punctuates parts of the Mount Munro ridgelines</p>	<p>Primary views from the dwelling will observe the majority of the proposed wind farm which will appear as prominent dynamic structures along the skyline. Parts of turbines 13,14 and 20 will be obscured beyond the intervening landform.</p> <p>No earthworks will be visible within the Site.</p>	No shadow flicker effects identified	High
14*	171 Opaki Kaiparoro Road, Eketahuna	775m	Dwelling located on an elevated knoll within the confines of the wind farm with primary views to the west and north. Views typically enclosed within an established garden setting with open views from the side of the dwelling also available including from the north facing washing line.	<p>Primary views to the west will remain contained within established garden areas. Open side views will observe turbines 6-14 extending along the main ridgeline. To the left of this turbine 15 will appear prominent on the western ridgeline to the left of partial views of turbines 16-20 which appear to overlap as they continue to the north.</p> <p>Oblique rear views towards the nearest turbines 1-5 will remain partially obscured beyond established vegetation.</p>	<p>Total of up to 77.8 hours per year (Turbines 1,5,6 and 15).</p> <p>Occurs on 197 days per year between October and February around 7am and in the middle of winter around 9am. Mean of 24 minutes per day.</p>	High (Within Site)
15*	85 Old Coach Road South, Eketahuna	625m	Dwelling located on an elevated spur which extends between the ridgeline areas where turbines are proposed. Living areas associated with this dwelling face west towards the Tararua Range in the distance and north overlooking the Site.	Long distance views to the west will remain unchanged. Secondary views from north facing living areas will observe open near distance views of turbines which continuing along the main ridgeline to the east. The nearest turbines (turbines 15 and 5-7) will from dominant elements in the view within a larger surrounding wind farm.	<p>Total of up to 36.6 hours per year (Turbines 6,7 and 8).</p> <p>Occurs on 93 days per year between September and November and January and</p>	Very High (Within Site)

ID	Address	Distance to nearest turbine	Sensitivity	Magnitude of Visual Change	Shadow Flicker Analysis <sup>17</sup>	Potential Visual Effect
				<p>During construction, areas of earthworks will extend along and below the ridgetop visible from this elevated location. Where visible, the larger wind farm will form a dominant characteristic in middle distance views for much of this northern aspect.</p>	<p>March around 7am. Mean of 24 minutes per day.</p>	
<b>16*</b>	136 Falkner Road, Eketahuna	915m	<p>Dwelling located to the west of Mount Munro within a working dairy farm. Views from dwelling are largely enclosed within established garden planting which extends to the east with secondary more open views looking to the north and from south facing bedrooms.</p> <p>Some open views are also available the larger working rural land holding.</p>	<p>Views east towards proposed turbines will remain contained by established intervening vegetation. Oblique views from the southern side of the dwelling and parts of the curtilage area will observe prominent views of turbines 15-17 along the western ridgeline and in the foreground of the larger array of turbines 1-12 along the main ridgeline.</p> <p>Proposed earthworks associated with access to the Site extend below turbines 18-20 observed from this dwelling and remain concealed.</p>	<p>Total of up to 25.6 hours per year (Turbines 16 and 17).</p> <p>Occurs on 76 days per year between November and January prior to 7am. Mean of 20 minutes per day.</p>	Moderate - High
<b>17*</b>	114 Falkner Road, Eketahuna	985m	<p>Dwelling is located to the west of Mount Munro with primary views facing north and east, including filtered views towards the wind farm through vegetation established along the road frontage.</p> <p>Some open views are also available the larger working rural land holding.</p>	<p>Existing garden and roadside vegetation typically punctuate and break up the skyline of the larger Mount Munro ridge from the dwelling along which the wind farm and limits the extent to which the Site forms a primary focus of the view.</p> <p>Where visible, individual turbines may appear prominent, however established planting also contributes to foreshortening and breaking up larger views of the wind farm and limits the overall observed magnitude of change.</p> <p>Proposed earthworks associated with access to the Site extend below turbines 15-19 and</p>	<p>No shadow flicker effects identified</p>	Moderate - High

ID	Address	Distance to nearest turbine	Sensitivity	Magnitude of Visual Change	Shadow Flicker Analysis <sup>17</sup>	Potential Visual Effect
				may be observed in partial views through gaps between established plantings.		
18*	51 Falkner Road, Eketahuna	1.1km	<p>This dwelling is located to the west of Mount Munro with primary views facing south-west and framed by mature vegetation.</p> <p>Rear open views to the south-east of the dwelling also face towards the Site and overlook low level hedging, including views from the vicinity of the washing line.</p>	<p>Oblique partial views and open rear views of turbines 15-20 will appear prominent along the skyline of Mount Munro. Beyond this, the larger array of turbines 1-10 will appear along the main ridgeline. Possible views of blade tips of turbines 11 and 13 wiping beyond landform will also appear in this view.</p> <p>Earthworks associated with the Site access and turbines 16-19 along the skyline will also reveal an initial raw worked appearance before being re-established in pasture and assimilated in the working rural nature which remains evident in this view.</p>	<p>Total of up to 18.6 days per year (Turbine 20).</p> <p>Occurs on 54 days per year during January and November before 7am. Mean of 20 minutes a day.</p>	High
19*	32 Falkner Road, Eketahuna	1.2km	<p>Dwelling located to the north-west of Mount Munro. Primary views from the dwelling face east and north of the wind farm with oblique views remaining enclosed by mature garden vegetation which will continue to partially obscure long-distance views towards the Site.</p>	<p>Primary views from dwelling will remain largely enclosed within an established garden setting beyond which partial long- distance oblique views of turbines will appear visible along the skyline. Where visible turbines 15-20 will appear relatively larger along the lower western ridge with turbines 1-12 visible beyond these along the main ridgeline. Partial views with a wiping action of turbine blades for turbines 12-14 may also be visible beyond the intervening landform.</p> <p>Areas of earthworks associated with the access and turbines 16-19 may also be visible, however these are typically obscured by garden vegetation which encloses the dwelling.</p>	<p>No shadow flicker effects identified</p>	Low - Moderate



ID	Address	Distance to nearest turbine	Sensitivity	Magnitude of Visual Change	Shadow Flicker Analysis <sup>17</sup>	Potential Visual Effect
20	84743 State Highway 2, Eketahuna	1.5km	Dwelling established along an elevated terrace to the west of the Makakahi River and north-west of Mount Munro. Primary views from dwelling appear to face northwest in the opposite direction of the Site, with rear views appearing to remain largely enclosed within mature garden vegetation and other planting which continues along the margins of the Makakahi River.	<p>Primary views from dwelling appear to remain largely enclosed by intervening vegetation established in the rear garden and continuing along the margins of the Makakahi River. In this context, potential long distance rear views towards proposed wind turbines appear to remain filtered through gaps in established planting and reduce the overall extent of visual change.</p> <p>Earthworks associated with access into the Site would similarly remain obscured by intervening vegetation with proposed earthworks necessary to access the Site otherwise visible from this area.</p>	No shadow flicker effects identified	Moderate
21*	168 Old Coach Road, Eketahuna	660m	Dwelling located along the western toe of Mount Munro. Primary views from dwelling face northwest and away from the Site. There are potential rear east facing views from curtilage areas.	<p>Primary views look in the opposite direction of the Site and will not therefore change. Possible oblique prominent views towards turbines 18 – 20 above the adjoining ridgeline and north of turbines 15-17. Beyond these, turbines 5 and 6 may be visible along the head of a local gully with parts of turbines, 4-12 forming wiping along the summit of the ridgetop visible from this area.</p>	No shadow flicker effects identified	High (Within Site)
22	103 Old Coach Road, Eketahuna	1.1km	Dwelling located to the north-west of Mount Munro. Primary views appear to face north and west away from the Site. Existing views to the south and south-east appear to be obscured by a mature shelterbelt which encloses the dwelling.	<p>Existing primary views are not expected to change. Potential rear views appear to remain concealed beyond established vegetation which will continue to screen turbines along the skyline. Areas of earthworks along the secondary access track and associated with turbines 18 and 19 along the lower western ridgetop which may otherwise appear visible remain similarly concealed.</p>	No shadow flicker effects identified	Low - Moderate

ID	Address	Distance to nearest turbine	Sensitivity	Magnitude of Visual Change	Shadow Flicker Analysis <sup>17</sup>	Potential Visual Effect
23	56 Old Coach Road, Eketahuna	1.5km	Dwelling located to north-west of Mount Munro along terracing above the Makakahi River. Primary views appear to face south-east towards the northern extent of the larger wind farm. A semi-mature shelter belt extends to the south of the dwelling and limits potential south facing views. Established vegetation along the roadside boundary and opposite side of the road provides some further established screening to the east.	<p>Potential oblique partial views from eastern windows of the dwelling may observe part of the larger array of turbines along the skyline to the south of a sequence of low elevated hills. Turbines 15- 20 would appear relatively larger along the lower western ridge against a broader backdrop of turbines 1-20 along the main ridgeline in long distance views.</p> <p>Some earthworks may also be visible in association with the secondary access and turbines 18 and 19 near the ridgetop.</p>	No shadow flicker effects identified	Moderate
24	47 Old Coach Road, Eketahuna	1.5km	Dwelling located to the north-west of Mount Munro. Primary views from dwelling appear to face southwest, towards the Site, however these appear to remain predominantly screened by existing shelterbelt vegetation.	<p>The dwelling's enclosure within mature vegetation appears to limit any potential long-distance views towards the Site and thereby minimise the potential for any visual change. From other areas of this working farm and in the event existing intervening vegetation is removed, views of turbines 1 – 14 may be visible along the skyline in long distance views.</p> <p>Some potential earthworks may also be visible in associated with the main access into the Site and in the vicinity of Turbines 12 and 19 along the ridgetop.</p>	No shadow flicker effects identified	Low - Moderate
25	85151 State Highway 2, Eketahuna	2.4km from turbines, 300m from transmission line corridor	Dwelling located to the south-west of Mount Munro and accessed SH2. Primary views from this dwelling appear to face northwest and remain largely enclosed within a mature framework of vegetation.	Potential views of the proposed wind farm remain obscured by landform. However, this dwelling has potential views from the southern side towards the proposed transmission line however vegetation along the southern boundary of the property likely screens these views.	No shadow flicker effects identified	Low

ID	Address	Distance to nearest turbine	Sensitivity	Magnitude of Visual Change	Shadow Flicker Analysis <sup>17</sup>	Potential Visual Effect
26	85237 State Highway 2, Eketahuna	3km from turbines, 200m from transmission line corridor and 300m from substation	Dwelling located to the south-west of Mount Munro and east of the substation proposed on the opposite side of SH2. Primary views from this dwelling appear to face northeast and remain largely enclosed within established vegetation which buffers views along SH2.	Potential views from the dwelling toward the turbine sites occur in very long distances and appear to be largely screened by intervening vegetation. This dwelling is approximately 200m south-west of the proposed transmission line corridor and 300m from the proposed substation location on the opposite side of the road. Views of the substation have an ability to remain concealed by existing vegetation. Existing vegetation and local landform north of the dwelling screens views towards the transmission line.	No shadow flicker effects identified	Low
27	85274A State Highway 2, Eketahuna	3.5km from turbines, 300m south of substation, 850m south of transmission line corridor.	Dwelling located to the south-west of Mount Munro and west of SH2. Primary views from dwelling appear to face southeast and remain well enclosed within mature garden vegetation.	Views from the dwelling toward the proposed wind farm appear to remain screened by existing garden and shelterbelt vegetation. This vegetation will also screen views from the dwelling towards the proposed substation and transmission line.	No shadow flicker effects identified	Low
28	85289 State Highway 2, Eketahuna	3.4km from turbines, 450m to substation, 830m from transmission line corridor.	Dwelling located to the south-west of Mount Munro and east of SH2 with primary views facing northeast towards the proposed wind farm in very long-distance views. Transmission lines and the substation are also visible in closer proximity straddling SH2.	Very long-distance views of turbines remain partially obscured beyond the intervening landform to the south of Opaki Kaipararo Road. This property will also have views to the north towards the transmission line which will be partially screened by intervening vegetation. Oblique views will be possible towards the substation, which will be partially screened by an existing shelterbelt to the east.	No shadow flicker effects identified	Low - Moderate

ID	Address	Distance to nearest turbine	Sensitivity	Magnitude of Visual Change	Shadow Flicker Analysis <sup>17</sup>	Potential Visual Effect
29	Land owned by Glen Opal	1.5 km closest turbine to boundary distance	Consented subdivision, however lots are unbuilt. Where there are existing or anticipated dwellings within this area, these have been separately assessed below.	A series of open and partial views towards the main ridgeline may be available from within these lots. As a result, there may be a range of potential visual effects, the scale of which is dependent on the location and orientation of viewer and intervening planting to be established in associated curtilage areas. Given the absence of such development from which effects can be understood assessed, the level of effect is unable to be determined.	No shadow flicker effects identified	N/A
30	No address (Hall Road)	165 km	Land to the east of Mount Munro with no permanent dwelling yet. Temporary dwelling located within existing shed within the Site, Views assessed from the road only.	<p>The orientation and establishment of curtilage areas of a future permanent dwelling will affect the potential magnitude of visual change.</p> <p>Existing views towards the Site are punctuated by mature shelter belts beyond which views of turbines 5-14 would be visible along the main ridgeline. Turbines 15-20 will remain concealed beyond the main ridgeline.</p> <p>Proposed earthworks will remain concealed within the existing landform with the Site. The larger landholding supporting the turbines will continue to support ongoing pastoral land use.</p>	No shadow flicker effects identified.	Moderate - High
31*	No address Hall Road	1.4km	New house recently delivered with living areas facing north-east, North facing bedroom window with open view of ridgeline. Mature shelter belts surround this rural property with no established curtilage areas or planting surrounding the dwelling.	<p>Proposed turbines 1-14 would appear prominent as an ordered array or dynamic structures visible along the adjoining skyline. The lower parts of turbines 11-14 will appear partially obscured by intervening trees which punctuate the skyline. Turbines 15-20 along the lower western ridgeline will remain entirely concealed.</p> <p>Proposed earthworks will remain concealed within the existing landform with the Site. The</p>	No shadow flicker effects identified.	High

ID	Address	Distance to nearest turbine	Sensitivity	Magnitude of Visual Change	Shadow Flicker Analysis <sup>17</sup>	Potential Visual Effect
				larger landholding supporting the turbines will continue to support ongoing pastoral land use.		
32	No address Hall Road	1.6 km	Caravan and temporary accommodation adjoining site of future dwelling, the location and orientation of which is yet to be confirmed.  Recent planting established along parts of the boundary of the Site with no established curtilage areas or planting surrounding a future site of the dwelling.	The orientation and establishment of curtilage areas of the permanent dwelling will affect the potential magnitude of visual change.  From the existing curtilage of the temporary dwelling there are open views towards the main ridgeline along which turbines 1 - 14 will be visible as an ordered pattern along the skyline. The lower parts of turbines 1-3 will likely be partially obscured by intervening trees which punctuate the skyline with. Turbines 15-20 obscured beyond the main ridgeline.  Proposed earthworks will remain concealed within the existing landform with the Site. The larger landholding supporting the turbines will continue to support ongoing pastoral land use.	No shadow flicker effects identified.	Moderate - High
33	No address Hall Road	1.6 km	No dwelling yet (but containers visible on site).	The orientation and establishment of curtilage areas of a future permanent dwelling will affect the potential magnitude of views.  Views from open areas of Site observe the ordered array of turbines 1-14 along the skyline.  Beyond this, turbines 15-20 will remain obscured beyond the main ridgeline.  Proposed earthworks will remain concealed within the existing landform with the Site continuing to support ongoing rural land use.	No shadow flicker effects identified.	Moderate - High

ID	Address	Distance to nearest turbine	Sensitivity	Magnitude of Visual Change	Shadow Flicker Analysis <sup>17</sup>	Potential Visual Effect
34*	(No address) Old Coach Road	1.1km	Dwelling under construction facing primary views to the north-west along the Makakai River.  Rear views towards the Site are partially obscured by intervening roadside vegetation beyond which parts of the Site are visible.	The primary views from the dwelling to the north-west along the Makakai River will remain unchanged.  Rear views of turbines 18-19 and 15-17 will be visible along the hill backdrop beyond roadside vegetation which punctuates the skyline. Beyond this, partial views of turbine blades 1-14 may also be visible through intervening roadside vegetation. The larger landholding surrounding the proposed turbines will continue to support ongoing pastoral land use.	No shadow flicker effects identified	Moderate-High
35*	Old Coach Road	930m	No dwelling yet, however building platform orientated to face northwest along the Makakai River.  Some established and more recent planting is established along the toe of the adjoining hillside in rear views.	The primary views from the building platform are focused to the north-west along the Makakai River and will remain unchanged. Rear views of turbines 18-20 will appear prominent along the skyline with partial views of turbines 1-14 visible beyond this. will be visible along the hill backdrop.  Earthworks associated with the secondary access and turbines 18 and 19 along the ridgetop may also be visible. The larger landholding surrounding the proposed turbines will continue to support ongoing pastoral land use.	No shadow flicker effects identified	Moderate - High
36	22 Bowen Road	2.2km	Dwelling to east of Mount Munro. Primary views face south-west with the proposed wind farm visible in long distance oblique views. Views to the north-west towards the Site are predominantly screened by intervening garden and roadside vegetation.	From curtilage areas, the proposed wind farm will remain largely concealed beyond intervening vegetation. Proposed turbines at the southern end of Mount Munro (Turbines 1-5) may be visible in long distance oblique views with the majority of turbines to the north of the main ridge remaining obscured beyond intervening vegetation.	No shadow flicker effects identified	Moderate

ID	Address	Distance to nearest turbine	Sensitivity	Magnitude of Visual Change	Shadow Flicker Analysis <sup>17</sup>	Potential Visual Effect
			The Site is also visible from more open areas of the working farm.	Earthworks are not generally visible. A localised area of earthworks below turbine 12 will be concealed beyond intervening vegetation from this dwelling. The larger landholding surrounding the proposed turbines will continue to support ongoing pastoral land use.		

### **About Boffa Miskell**

Boffa Miskell is a leading New Zealand professional services consultancy with offices in Auckland, Hamilton, Tauranga, Wellington, Christchurch, Dunedin and Queenstown. We work with a wide range of local and international private and public sector clients in the areas of planning, urban design, landscape architecture, landscape planning, ecology, biosecurity, cultural heritage, graphics and mapping. Over the past four decades we have built a reputation for professionalism, innovation and excellence. During this time we have been associated with a significant number of projects that have shaped New Zealand's environment.

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# MOUNT MUNRO WINDFARM Landscape and Visual Effects Assessment

Graphic Supplement

Prepared for Meridian Energy by Boffa Miskell Ltd  
May 2023



Boffa Miskell



# MOUNT MUNRO WINDFARM



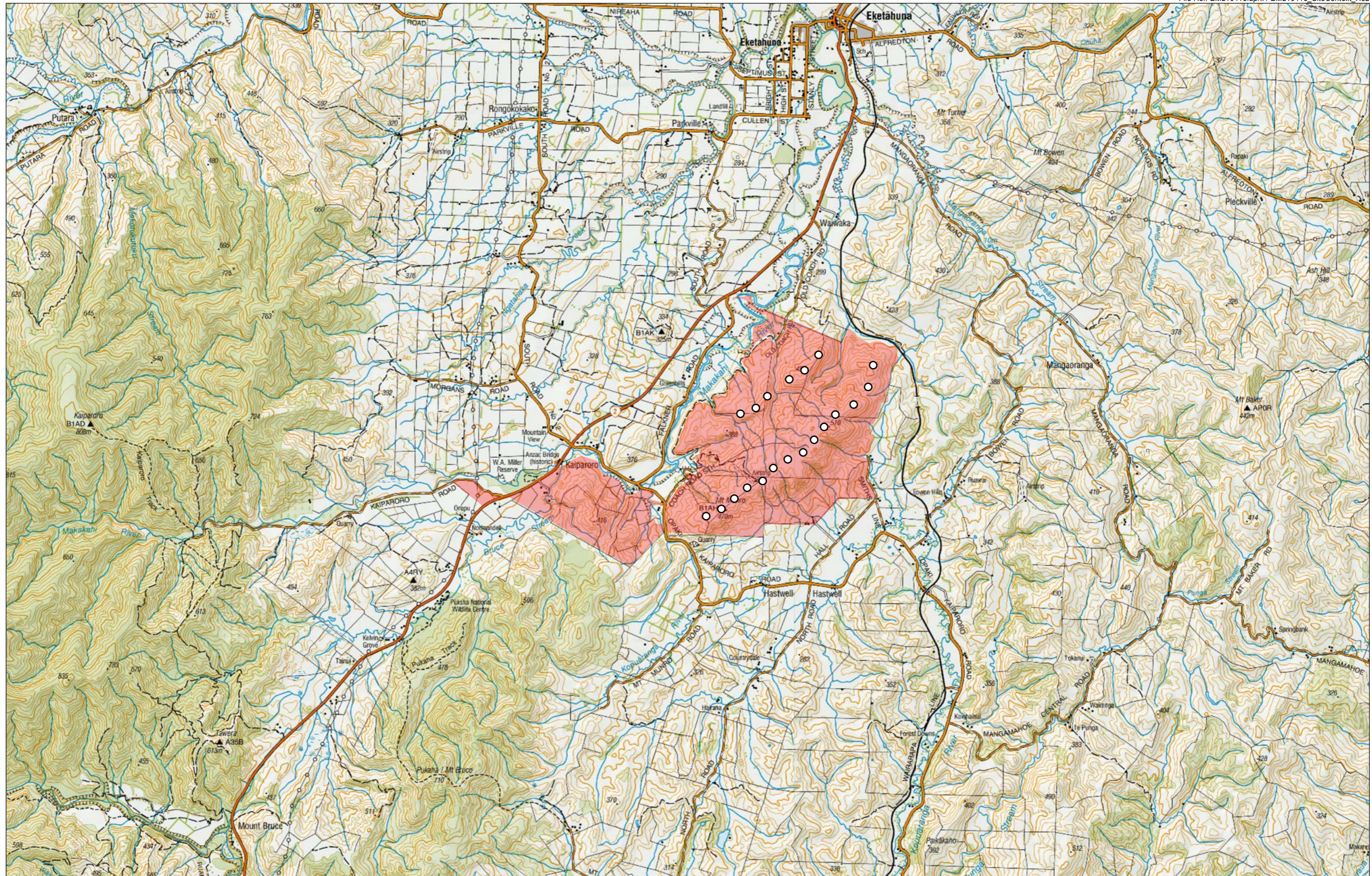
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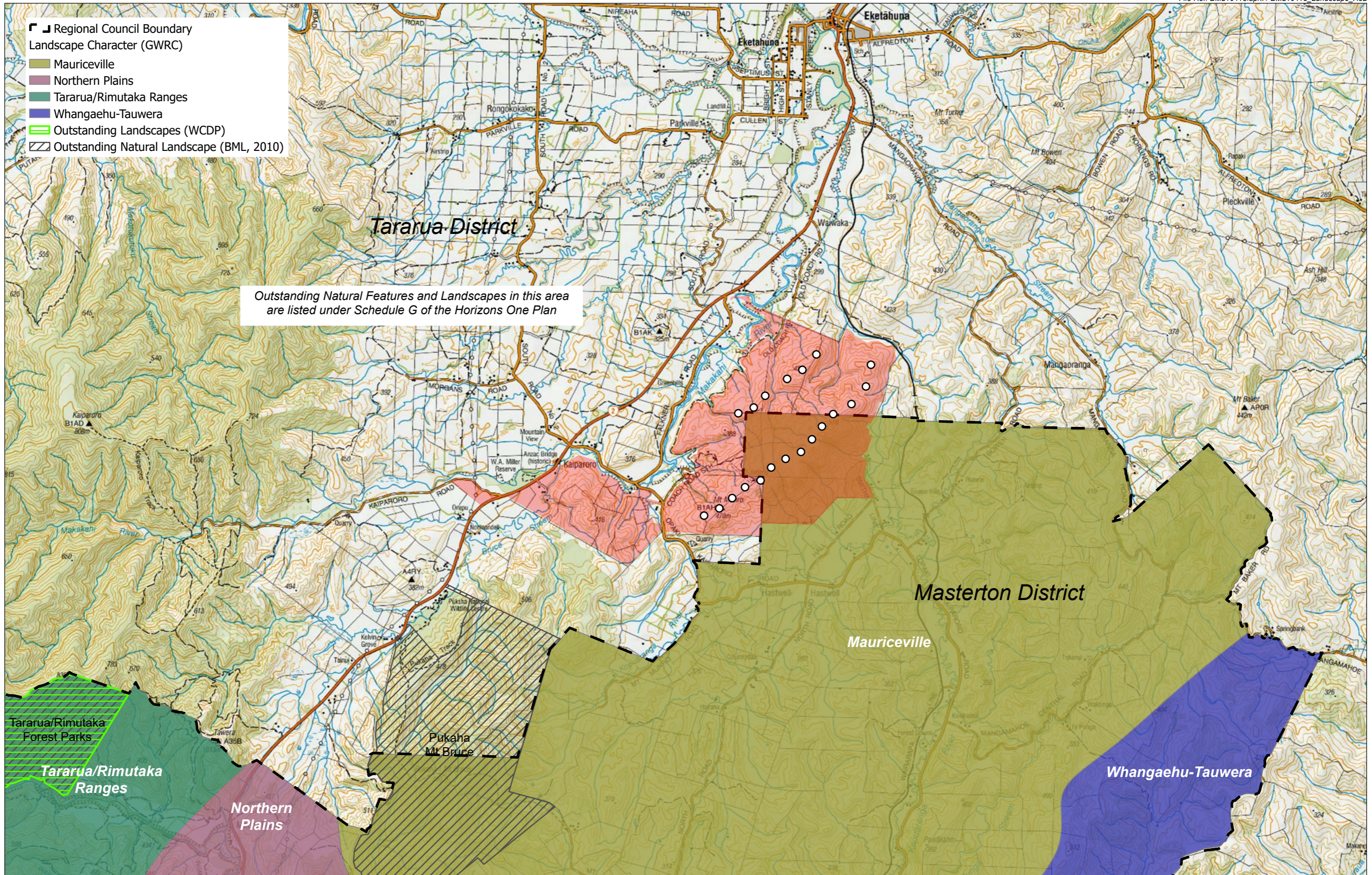
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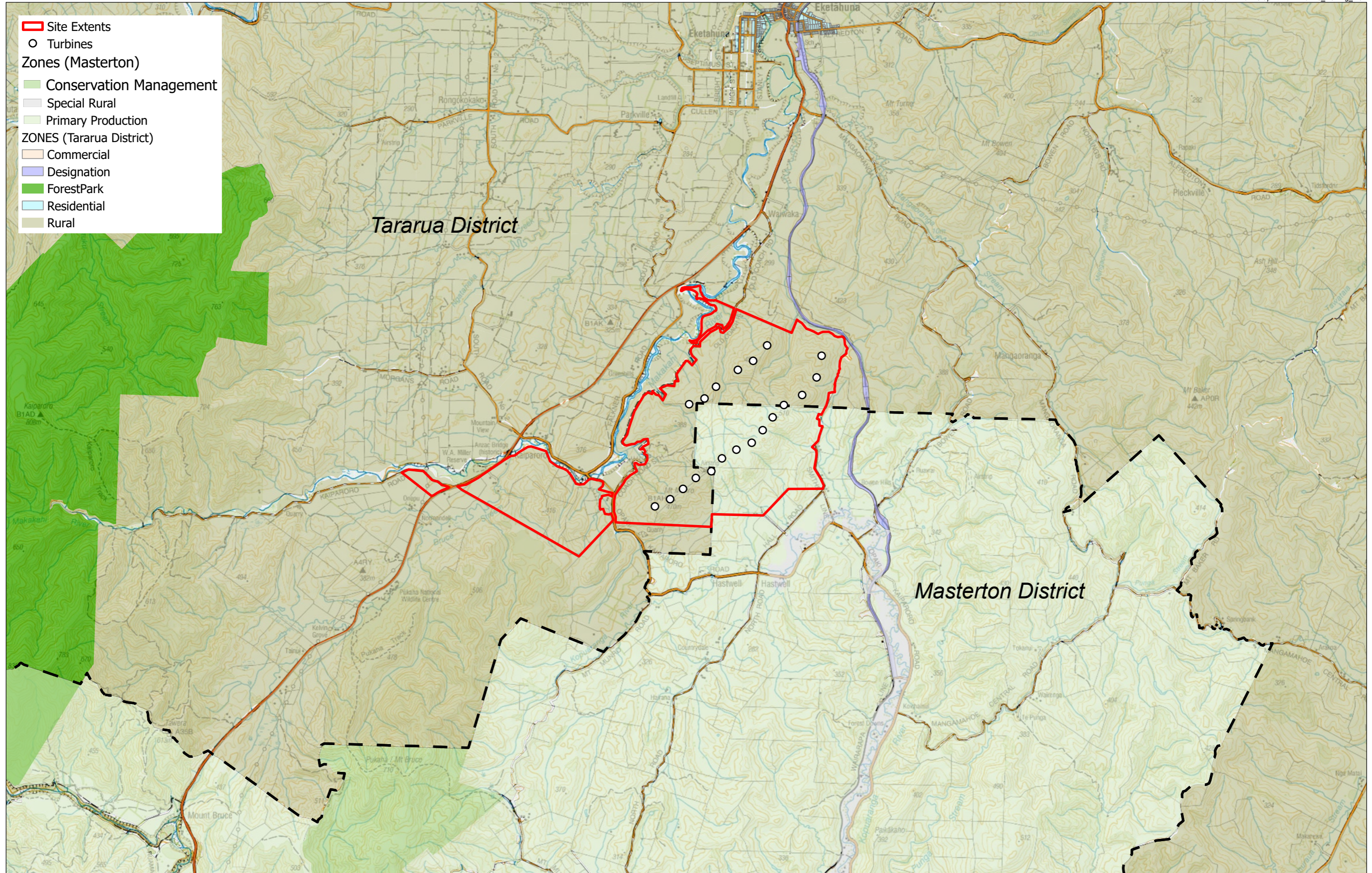




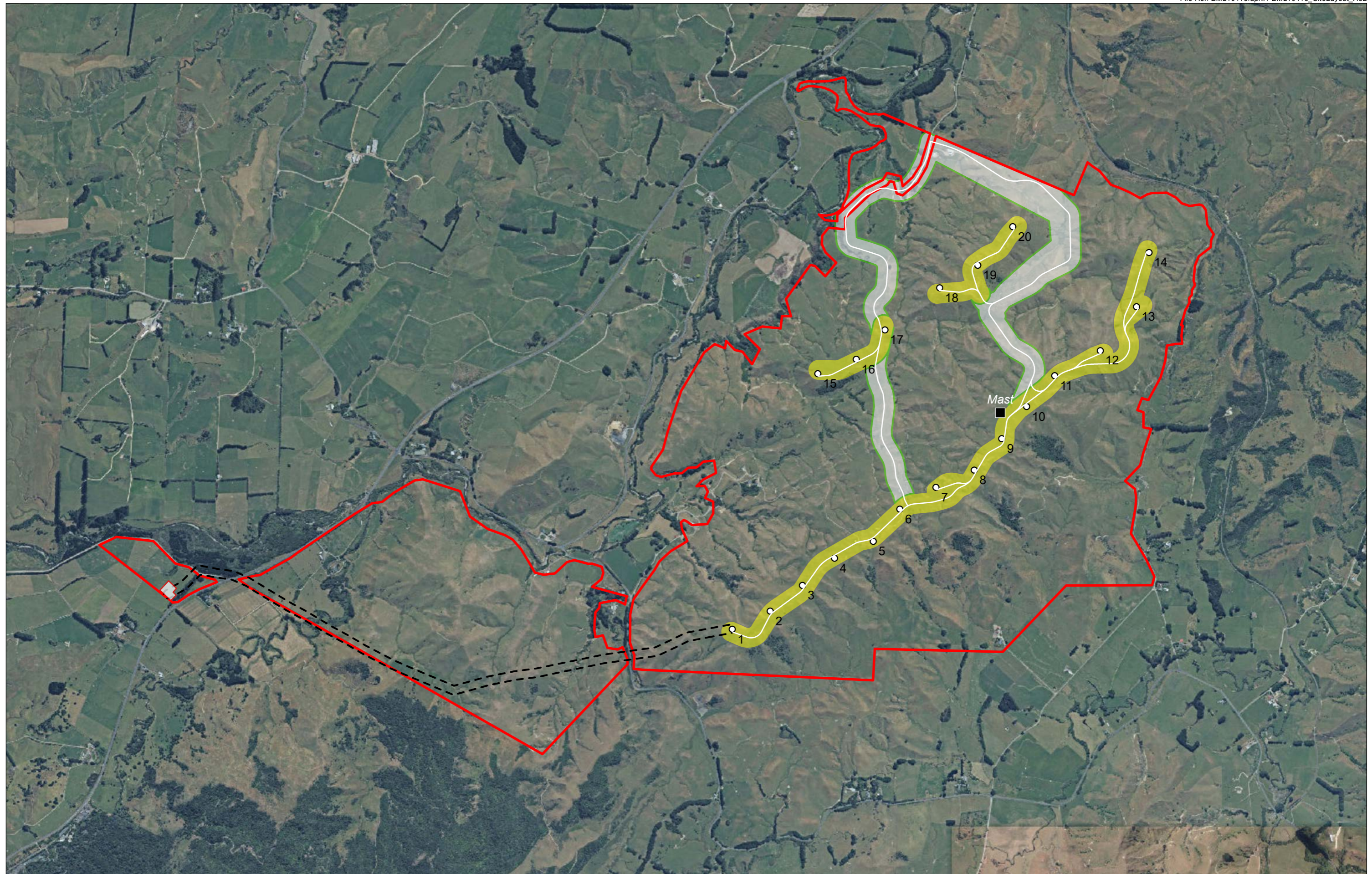


Outstanding Natural Features and Landscapes in this area are listed under Schedule G of the Horizons One Plan

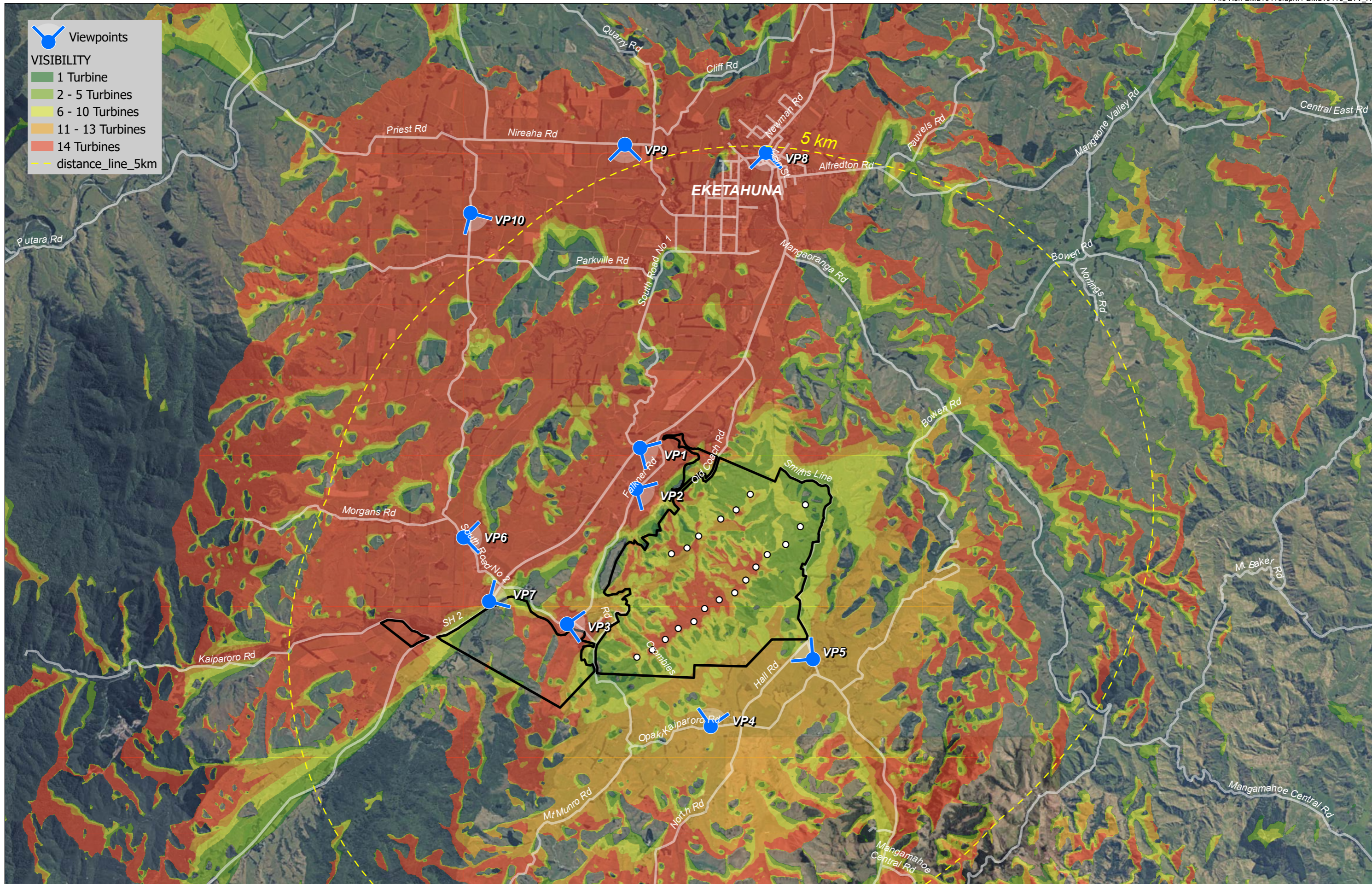










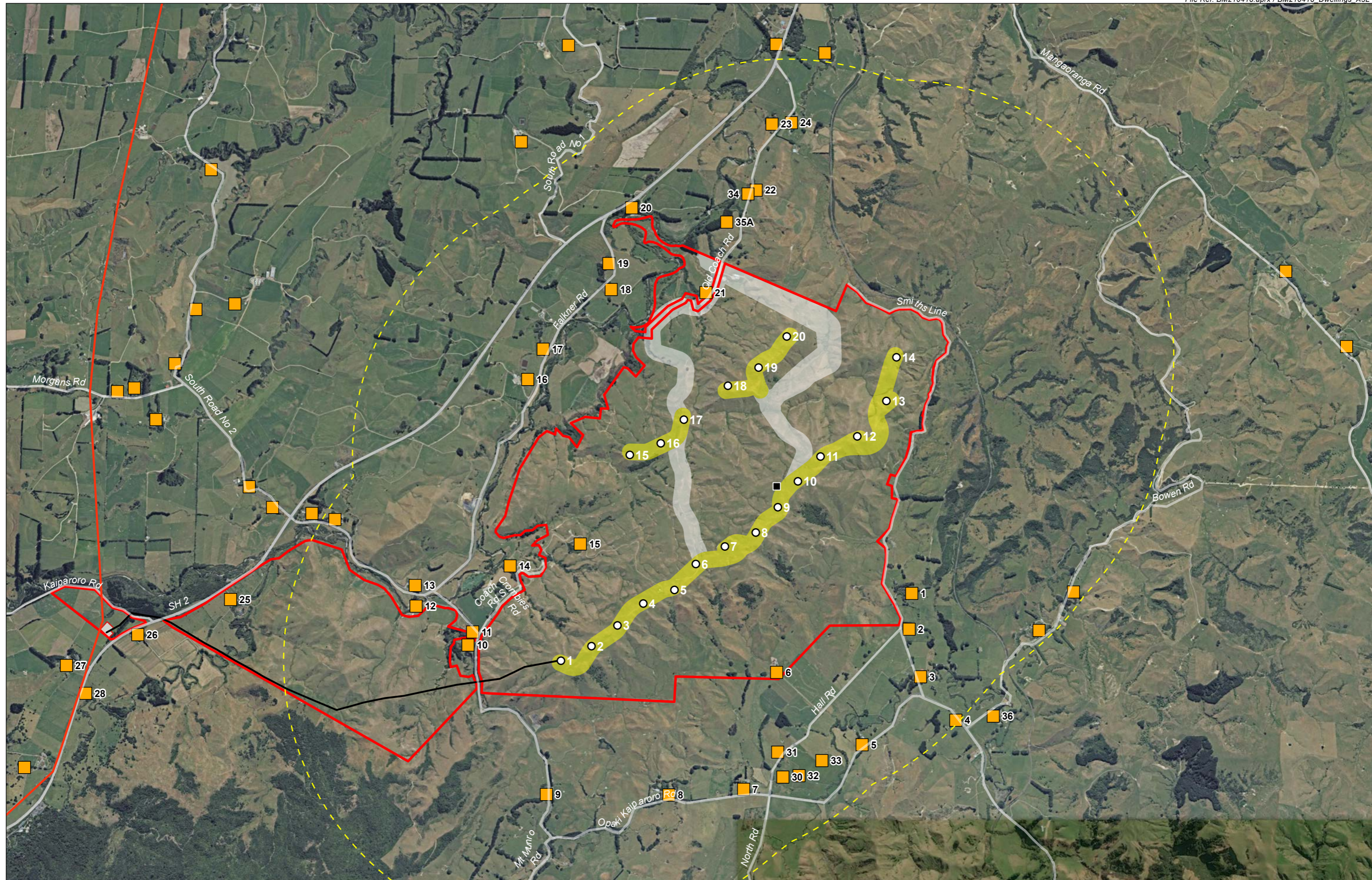


Viewpoints

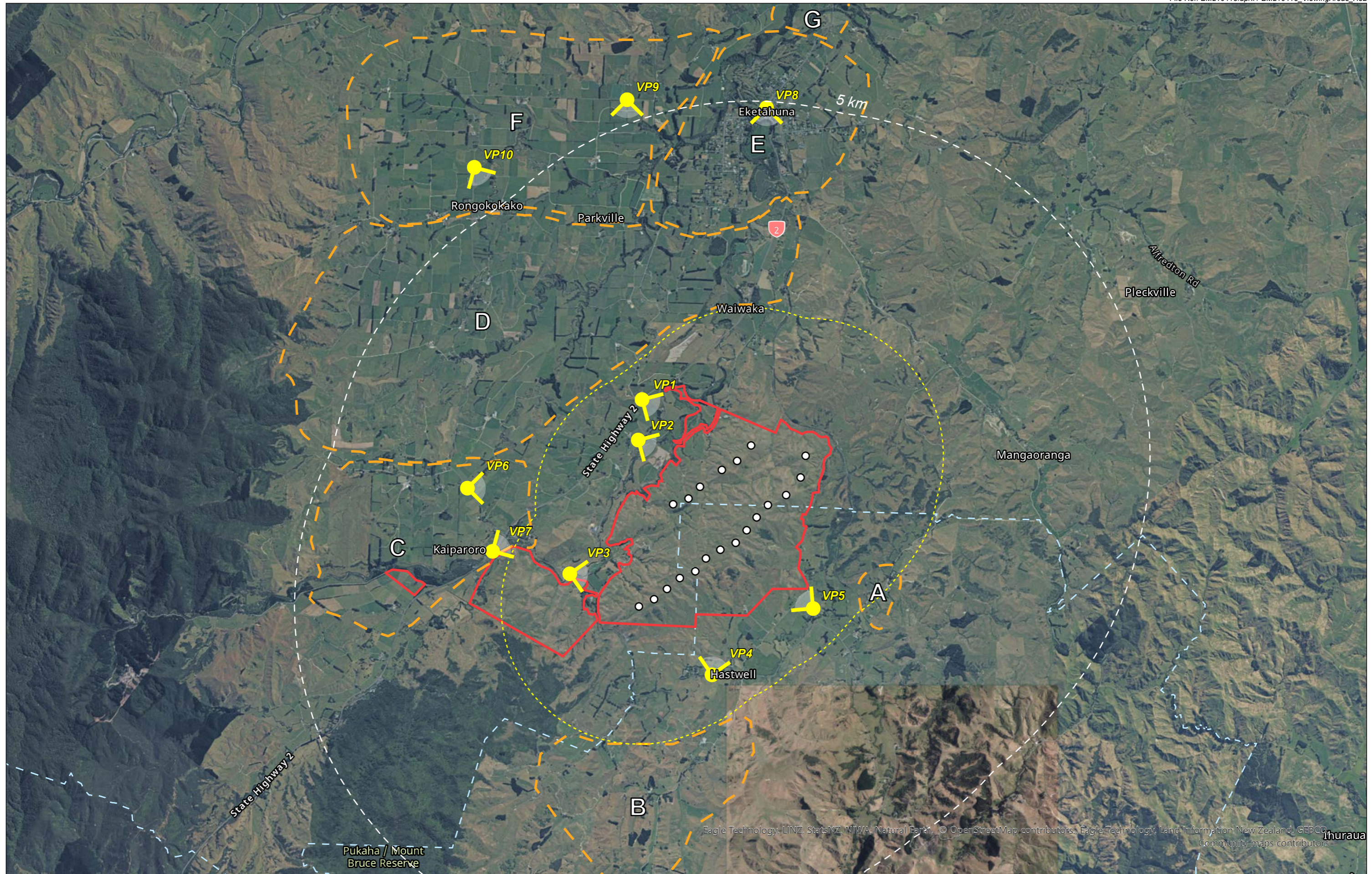
**VISIBILITY**

- 1 Turbine
- 2 - 5 Turbines
- 6 - 10 Turbines
- 11 - 13 Turbines
- 14 Turbines
- distance\_line\_5km

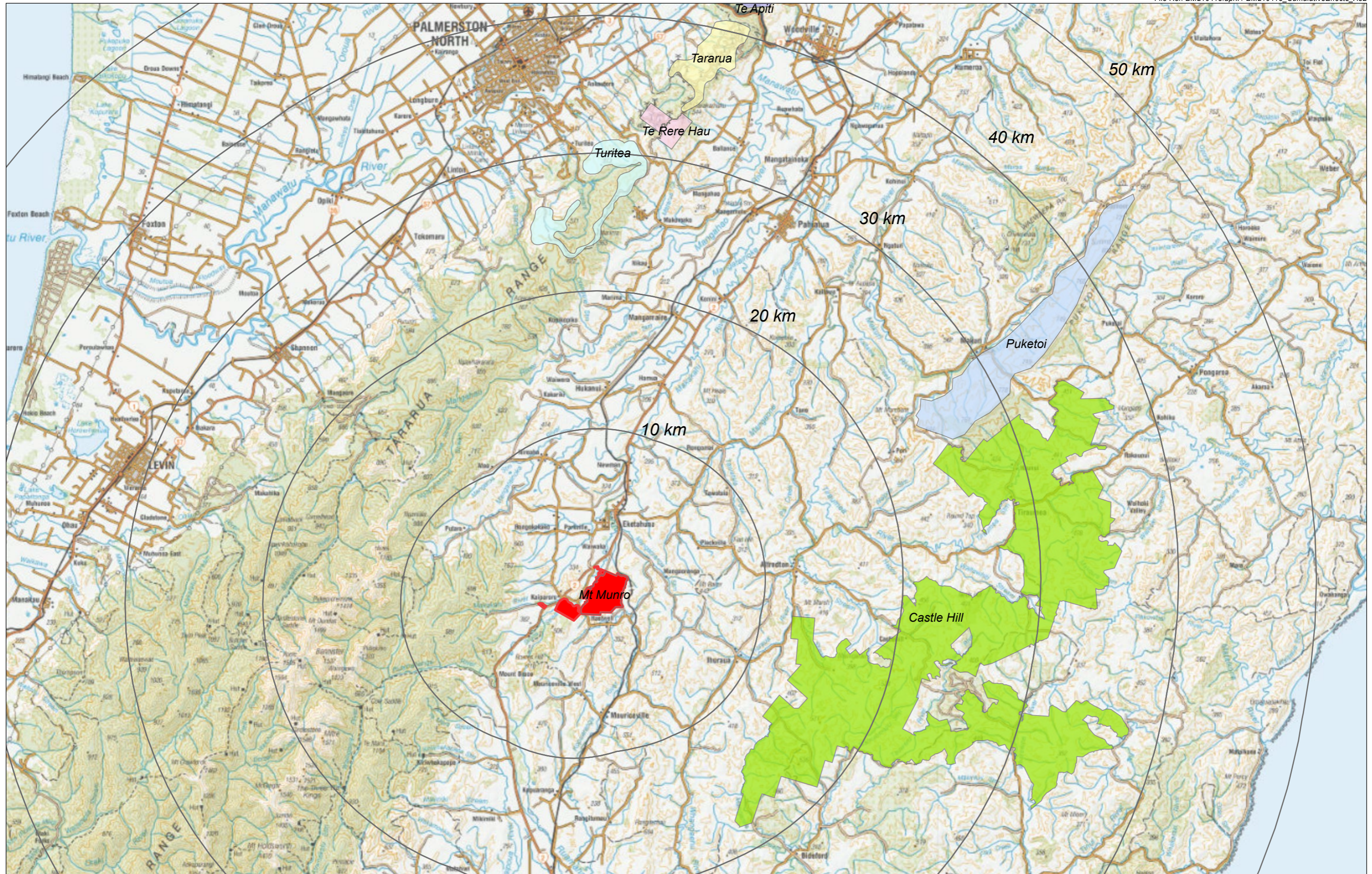




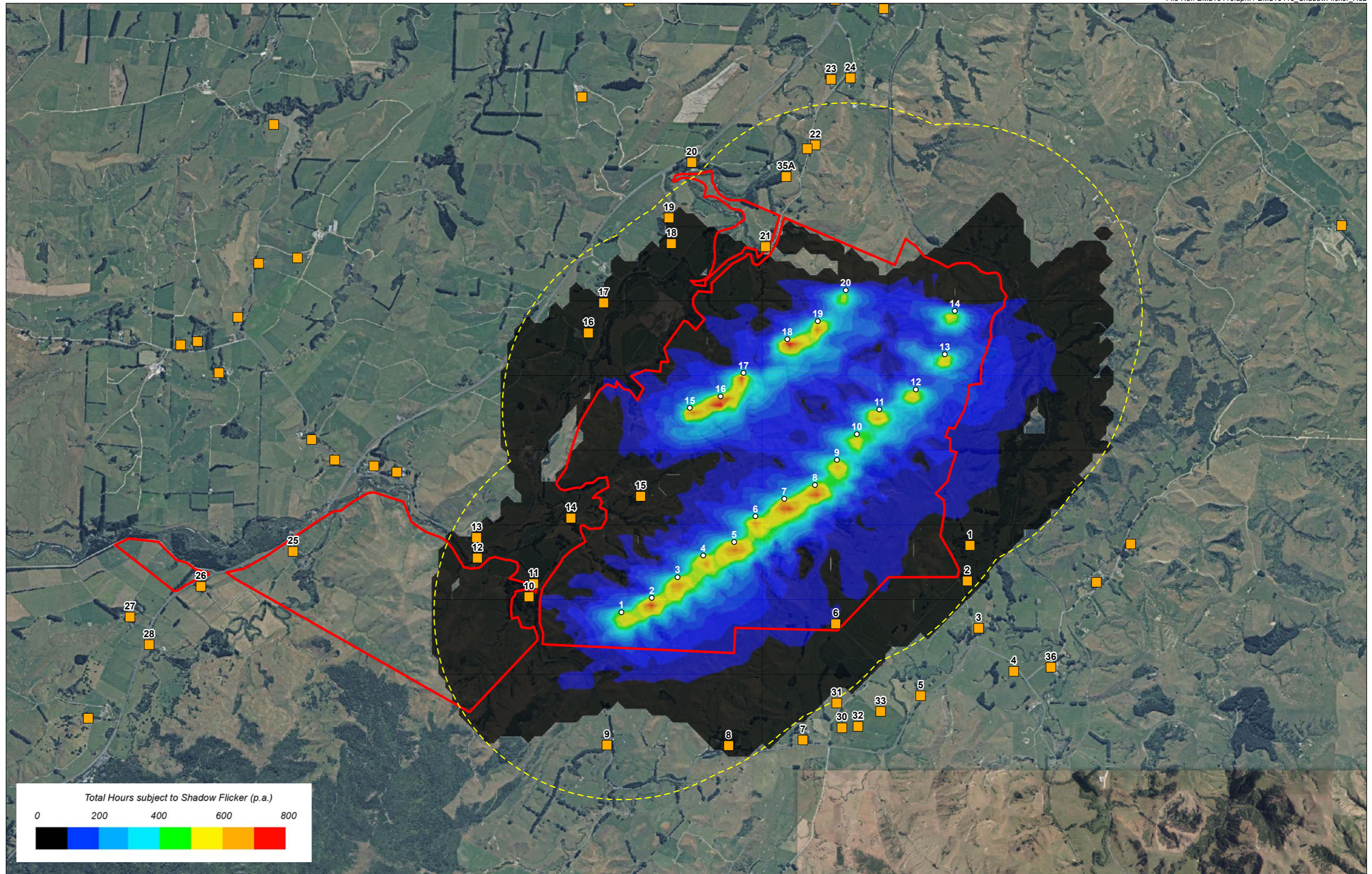














# VISUAL SIMULATIONS - METHODOLOGY

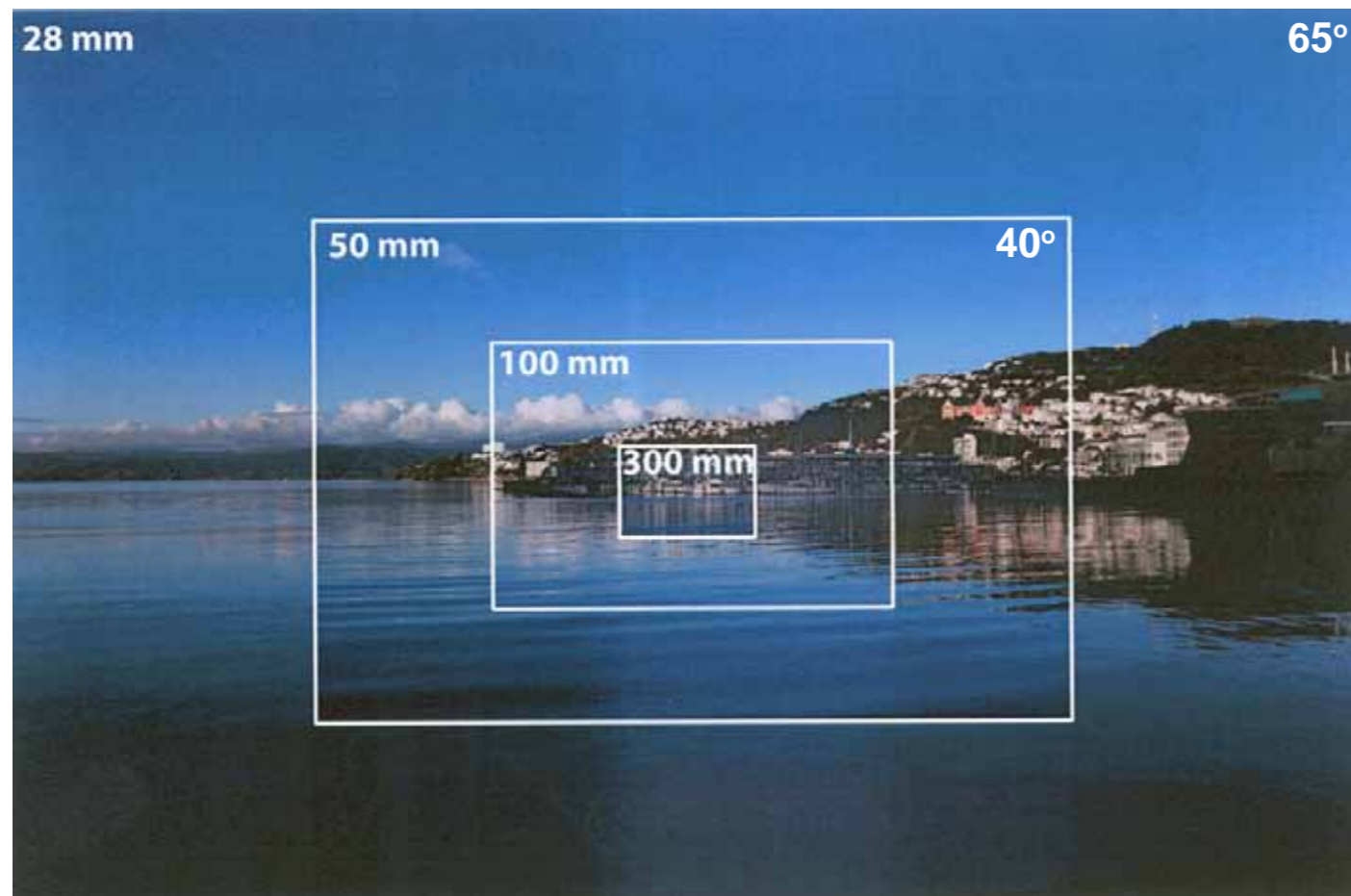
## SITE VISIT & PHOTOGRAPHY

Site photographs were taken with a Canon digital SLR camera fitted with a 50mm focal length lens, mounted on a tripod and panoramic head. A series of photos were taken at predetermined viewpoints. The location of each viewpoint was fixed by GPS unit, built in to the camera.

## NZILA GUIDELINES & PANORAMA PREPARATION

The visualisations have been produced in accordance with the NZILA Best Practice Guidelines for Visual Simulations (BPG 10.2) and also adhere to Boffa Miskell's internal Visualisation Guidelines.

Camera lenses with different focal lengths capture images with differing fields of view. As can be seen below (derived from Fig 9 of the NZILA BPG), a photo taken with a 28mm lens will provide a horizontal field of view of 65°. Using a 50mm lens will provide a cropped (40°) version of the same view. So panoramas can be created by taking multiple 28mm or 50mm photos (in "portrait" mode), and using digital stitching software to merge and crop to create a single 90° panorama.

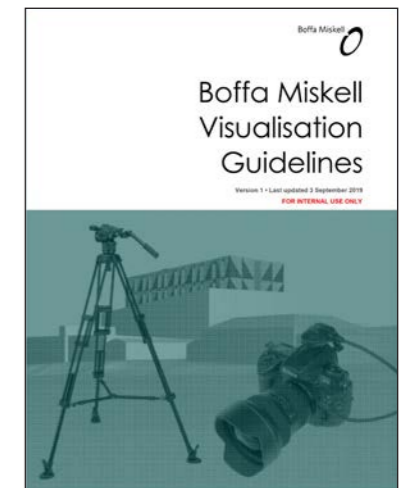
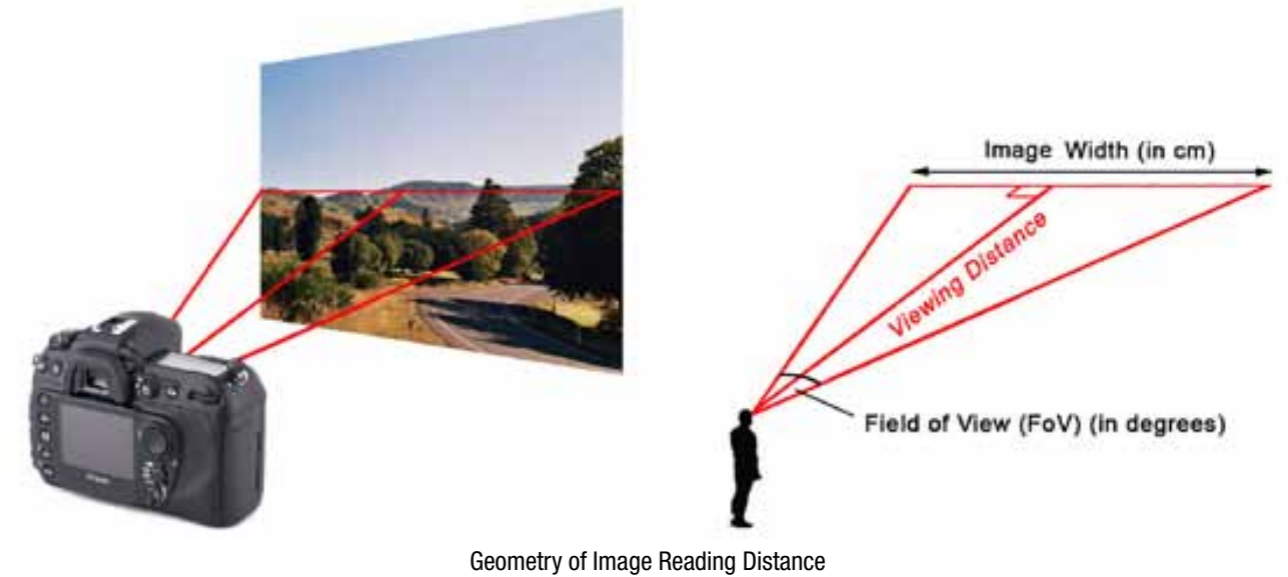


## 3D MODELLING

Virtual camera views were then created in 3D windfarm modelling software, drawing on 3D contour data and turbine locations. These were then matched to the corresponding photographic panorama, using identifiable features in the landscape and the characteristics of the camera to match the two together. The visualisations were then assembled using graphic design software.

## IMAGE READING DISTANCES

These visualisations have a field of view of 90° and so should be viewed from a distance of 20 cm when printed at A3. This will ensure that each simulation is viewed as if standing on-site at the actual camera location, and is in accordance with Section 7.11 of the NZILA BPG. Users are encouraged to print these pages on A3 transparency, go to the viewpoint and hold at the specified reading distance in order to verify the methodology.



# SHADOW FLICKER - METHODOLOGY

## SOFTWARE AND ASSUMPTIONS

Windfarm 5 software by ReSoft was used in the calculation of shadow flicker. The turbine layout version used was: *MTMR\_V10-01\_20WTG* (Hub Height=92m / Rotor Diameter=136m) and the terrain model was bucreated from 1m contour data.

The shadow flicker module requires specification of a window against which the passage of the sun and the shadow of the rotor can be measured. Each dwelling was therefore assigned a theoretical 1m x 1m window, oriented towards the turbines. In reality, dwellings may have more than one room facing in this direction, have all windows facing away from the turbines, or may be screened by vegetation.

The results for any given window are either in the form of tabulated data (see below), or as a set of diagrams for each individual dwelling. The sunrise/sunset data used in the diagrams is based on data for Palmerston North, and was obtained from [www.gaisma.com](http://www.gaisma.com).

The results of the shadow flicker calculations are mathematically derived and are therefore theoretical worst case scenarios. Calculations also use the following assumptions:

- i) weather conditions are such that shadows are always cast (ie. sunny at all times of day and throughout the year);
- ii) the rotors are facing directly towards the receptor at all times (ie. at their maximum size and sweep).

In practice the shadow flicker effects would occur on considerably less days than this.

## INTERNATIONAL GUIDANCE

International guidance states that the extent to which shadow flicker should be assessed is to a distance of 10x the rotor diameter (RD), and that the minimum altitude of the sun to be considered is 3° above the horizon. The reasons for this are:

- at over 10x RD, the rotors do not completely block the sun, weakening the effects of the shadow
- when the sun is below 3° it is more diffuse and accordingly the shadow is less intense
- at greater distances the sun passes behind the rotor more quickly, thus minimising the duration of the effect.

International guidelines confirm that acceptable levels of exposure are deemed to be either:

- i) Acceptable Level = 30 hours per year (modelled)
- ii) Acceptable Level = 30 minutes per day - actual (ie. measured)

The 30 hour/year limit is originally based on a German court ruling which subsequent studies have supported as a reasonable guideline. (Some other guidelines use 30 hour/year as the actual limit, as opposed to the modelled limit.) The 30 minutes/day limit is also based on research done in Germany, and may consist of more than one single occurrence within a 24 hour period.

The guidelines quoted above have been sourced from the following report:

*Environment Protection and Heritage Council, Australia (2010) Draft National Wind Farm Development Guidelines*

## SUMMARY OF MERGED SHADOW TIMES ON EACH WINDOW FOR ALL TURBINES

House/ Window	Easting	Northing	Width (m)	Depth (m)	Height (m)	Degrees from North	Tilt angle	Days per year	Max hours per day	Mean hours per day	Total hours
1/ 1	1829250	5490440	1.0	1.0	2.0	315.0	0.0	172	0.51	0.36	62.4
2/ 1	1829240	5490190	1.0	1.0	2.0	315.0	0.0	132	0.46	0.38	49.8
6/ 1	1828280	5489870	1.0	1.0	2.0	315.0	0.0	212	0.74	0.47	100.5
8/ 1	1827500	5488990	1.0	1.0	2.0	315.0	0.0	37	0.38	0.30	11.3
10/ 1	1826056	5490066	1.0	1.0	2.0	90.0	0.0	194	0.74	0.55	106.4
10/ 1	1826039	5490040	1.0	1.0	2.0	90.0	0.0	197	0.75	0.52	101.6
11/ 1	1826070	5490150	1.0	1.0	2.0	90.0	0.0	171	0.64	0.46	79.0
12/ 1	1825680	5490340	1.0	1.0	2.0	90.0	0.0	100	0.50	0.38	38.4
14/ 1	1826360	5490620	1.0	1.0	2.0	90.0	0.0	197	0.57	0.39	77.8
15/ 1	1826870	5490790	1.0	1.0	2.0	90.0	0.0	93	0.66	0.39	36.6
16/ 1	1826490	5491970	1.0	1.0	2.0	135.0	0.0	76	0.50	0.34	25.6
18/ 1	1827090	5492620	1.0	1.0	2.0	135.0	0.0	54	0.45	0.34	18.6







Existing View



Distance to nearest turbine: 1.5 km

Rotors facing dominant wind direction





Earthworks Highlighted



Rotors facing dominant wind direction (earthworks included)





Existing View



Distance to nearest turbine: 1.1 km

Rotors facing dominant wind direction





Earthworks Highlighted



Rotors facing dominant wind direction (earthworks included)





Existing View



Distance to nearest turbine: 1.1 km

Rotors facing dominant wind direction





Earthworks Highlighted



Rotors facing dominant wind direction (earthworks included)





Existing View



Distance to nearest turbine: 1.4 km

Rotors facing dominant wind direction





Earthworks Highlighted



Rotors facing dominant wind direction (earthworks included)





Existing View



Distance to nearest turbine: 1.3 km

Rotors facing dominant wind direction





Earthworks Highlighted



Rotors facing dominant wind direction (earthworks included)





Existing View



Distance to nearest turbine: 3.0 km

Rotors facing dominant wind direction





*Earthworks Highlighted*



*Rotors facing dominant wind direction (earthworks included)*





Existing View



Distance to nearest turbine: 2.2 km

Rotors facing dominant wind direction





*Earthworks Highlighted*



*Rotors facing dominant wind direction (earthworks included)*





Existing View



Distance to nearest turbine: 4.9 km

Rotors facing dominant wind direction









Existing View



Distance to nearest turbine: 5.3 km

Rotors facing dominant wind direction





Earthworks Highlighted



Rotors facing dominant wind direction (earthworks included)





Existing View



Distance to nearest turbine: 5.7 km

Rotors facing dominant wind direction





*Earthworks Highlighted*



*Rotors facing dominant wind direction (earthworks included)*