Taumatatotara Windfarm Ltd.

LANDSCAPE AND VISUAL ASSESSMENT

PROPOSED VARIATION TO CONSENT

10 DECEMBER 2020

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LANDSCAPE AND VISUAL ASSESSMENT

PROPOSED VARIATION TO CONSENT

Taumatatotara Windfarm Ltd.

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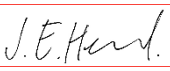
Prepared by:	Jeremy Head	10 December 2020	
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TABLE OF CONTENTS

1 INTRODUCTION 1

2 REFERENCE DOCUMENTS 3

3 LANDSCAPE CONTEXT 4

3.1 BROADER LANDSCAPE CHARACTER 4

3.2 SITE CONTEXT 4

4 METHODOLOGY 6

5 DESCRIPTION OF PROJECT 9

6 STATUTORY DISCUSSION 9

6.1 WAIKATO REGIONAL POLICY STATEMENT 10

6.2 WAITOMO DISTRICT PLAN 10

7 ASSESSMENT OF THE LANDSCAPE AND VISUAL EFFECTS 11

7.1 LANDSCAPE EFFECTS 11

7.2 VISUAL EFFECTS 12

7.3 EFFECTS OF DISTANCE ON RECEPTORS 12

7.4 VISUAL EFFECTS ARISING FROM THE SPECIFICS OF THE PROPOSAL 13

7.4.1 ZONE OF THEORETICAL VISIBILITY (ZTV) MAPS 13

7.4.2 HUB AND TOWER HEIGHT 13

7.4.3 BLADE TIP HEIGHT (OVERALL TURBINE HEIGHT) 14

7.4.4 CHANGES AT GROUND LEVEL 14

7.4.5 SHADOW FLICKER 14

7.4.6 VISUAL EFFECTS ON SPECIFIC IDENTIFIED THIRD-PARTY DWELLINGS IN THE RECEIVING ENVIRONMENT 15

7.4.7 SUMMARY – VISUAL EFFECTS ON PRIVATE THIRD-PARTY DWELLINGS 16

7.4.8 VISUAL EFFECTS FROM PUBLIC PLACES (ROADS) 16

7.5 CONCLUSION - VISUAL EFFECTS 17

8 AVOIDANCE, MITIGATION AND REMEDIATION OF EFFECTS 19

9 CONCLUSION 20

10 LIMITATIONS 21

TABLE 1: 23

COMPARISON 23

APPENDIX 1 24

NEAREST 3RD PARTY HOUSES 24

25

APPENDIX 2 26

CONSENTED TURBINE LOCATIONS PLAN 26

APPENDIX 3 28

SEVEN POINT SCALE OF EFFECTS 28

1 INTRODUCTION

WSP has been commissioned by Taumatatotara Windfarm Ltd (TWF) to prepare a Landscape and Visual Assessment (LVA) to assess the landscape and visual effects of a proposed variation to consent RM050019 regarding a twenty-two-turbine windfarm at Taumatatotara West Road, Te Anga (the 'T4' windfarm) (**Attachment 1**). Specifically, the LVA addresses the landscape and visual effects of a change in height of eleven of twenty-two wind turbines and a reduction in the number of turbines from twenty-two to eleven at the consented Taumatatotara Windfarm site.

As required under section 127 of the Resource Management Act ("RMA") this application is for a discretionary activity change of the existing consent conditions.

An assessment of effects is required to ascertain any potential adverse effects of the variation of the consent conditions on landscape character and visual amenity. This assessment responds to TWF's request to reduce the size of the windfarm from twenty-two to eleven wind turbines[1] and increase the tip height (overall height) of the remaining eleven turbines from the consented 110m to 172.5m. Twenty-two 110m tall[2] turbines are to date consented (but unbuilt) at the site[3].

This report will include a discussion on the:

- effects on landscape and visual amenity;
- proposal's distance from potentially affected parties where the effects will be 'low'[4] or less than 'low'; and,
- methodological approach used in rating the effects.

The site is located approximately 6.5km northwest of Te Anga, which is approximately 30km west of the Waitomo Caves area, within the Waitomo District. The Project is situated along a ridge line with turbines being in a northwest/southeast line, straddling the Taumatatotara West Road. In the Waikato Regional Landscape Assessment (WRLA), the site is located within the Western Hill Country landscape type. Within the WRLA the area where the site is located is not categorised as an Outstanding Natural Landscape/Feature (ONLF).

It is considered that the primary issue is whether a windfarm is appropriate in this setting or not. In this regard both landscape and visual effects are relevant. As twenty-two turbines have been consented to date, the decision regarding the appropriateness of such a proposed change to the setting has already been made based on the various assessments provided to date.

It is also noted that the originally consented twenty-two 110m tall turbines are very large structures. Given the relatively sparsely lived-in and visited receiving[5] environment, it is anticipated that an increase in height

[1] 'Turbines' refers to the mast, nacelle, hub and blades (the entire structure).

[2] It is understood that a recent consent variation was granted to increase the turbine heights from 110m to 121.5m tall for the eleven turbines. However, this assessment is based on the potential visual and landscape effects arising from the increase in height between what is proposed now and the first consent.

[3] The 'site' refers to the ridgeline where the twenty-two consented turbines are located.

[4] **Low**: A low level of effect on the character or key attributes of the receiving environment and/or the visual context within which it is seen; and/or have a low level of effect on the perceived amenity derived from it. (Oxford English Dictionary Definition: Low: adjective- below average in amount, extent, or intensity).

[5] The receiving environment is a 'study area' considered to be the area where any landscape or visual effects of the proposal will be potentially adverse. The proposal may be visible beyond the receiving environment; however, any effects from here will not be adverse.

(within reason) of a substantially reduced number of individual structures is not likely to trigger additional landscape character or visual effects that would be unacceptable given the existing consented setting.

2 REFERENCE DOCUMENTS

This report should be read in association with the Taumatatotara Windfarm Application to Change Conditions of Consent[6], which provides the background history to the original submission for the ultimately consented windfarm scheme.

In addition, wire-frame diagrams, visual simulations, and plans showing the Zone of Theoretical Visibility (ZTV) (**Attachments 2 - 10**) have been produced by Energy3 Services Ltd.[7], engaged by the Applicant and where relevant have been referenced within this report.

Regarding landscape, visual and amenity planning matters, the assessment component of this report is in accordance with relevant provisions of Part 2 and the Fourth Schedule of the Resource Management Act 1991 (RMA).

[6] by Shearer Consulting 5 July 2020.

[7] Energy3 Services Ltd. specialise in windfarm development and assessment / visualisations.

3 LANDSCAPE CONTEXT

3.1 BROADER LANDSCAPE CHARACTER

The broader context in which the proposal is located in is the Western Hill Country of the Waikato District. The landscape is characterised by steep pastoral hill country, inter-dispersed with exotic tree stands and areas of native vegetation. The proposal is located within the Western Hill Country landscape type as identified in the WRLA. This area encompasses the western hill country located along the west coast of Waikato and includes both volcanic and sedimentary rocks, which is often overlaid by a thick layer of volcanic ash. Landcover includes areas of pasture, exotic forestry and large tracts of indigenous forest especially to the south of Kawhia.

The WRLA describes the landscape as being *"…. pastoral farming is the predominant productive rural land use with the majority of farms consisting of hill country. In the Hills west of Otorohanga there is an extensive system of limestone outcrops featuring pinnacles, as well as caves. The limestone forms the karst topography – an amalgamation of caves, underground channels, outcrops, and a bumpy ground surface. The karst landscape and associated caves are a special feature of the Waitomo District."*

Overall the character of the area can be described as highly modified with isolated buildings scattered about associated with farming development. The area is not identified as an area of high amenity within the WRLA (**Attachments 1 – 1C**).

3.2 SITE CONTEXT

The topography of the area where the site is located is characterised by steep sided hills which have well defined ridgelines with narrow valley systems occurring to the north and south of the site. The area's topography defines views particularly from the valley areas where ridges or the steep sided hills screen or contain views. The highest local peak to the site (Maungaakohe) is 344m above sea level.

The landcover is predominantly pastoral with areas of remnant native vegetation associated with the hill slopes and valley systems that run off the ridgelines. Isolated areas of exotic trees occur across the hilly landscape with the stands generally being located on the hill side slopes particularly to the south of the site. Generally, the ridgelines are exposed with little vegetation occurring along the ridges.

Landuse within the 10km study area is predominantly pastoral with areas of exotic trees scattered across the landscape. Rural residential buildings and associated farm buildings within the area are generally sparsely located particularly to the north, west and east of the site, with several houses well dispersed along the Marokopa Valley. Within the hill country area, rural residential dwellings are sparsely located and are typically set within sheltered areas in lower lying areas away from the ridgeline and generally with associated vegetation.

To the north of the site the area is highly modified with hilly open pastoral land predominating with small areas of remnant bush or tree planting. To the south of the site the landscape has been highly modified, but the extent of remnant/regrowth native bush and forestry combined with the pastoral areas results in a relatively cohesive appearance with a moderate degree of 'natural' appearance. The amenity value varies in relation to each dwelling depending on the orientation of views, degree of screening vegetation and the effects of topography (**Attachments 1 – 1C**).

The landscape character has been assessed as having a moderate[8] amenity value, and will be assessed in relation to the consented, yet un-built twenty-two turbine windfarm.

[8] Average in amount, intensity, quality, or degree. (Oxford Dictionary definition).

4 METHODOLOGY

The methodology for assessing the change in height of the wind turbines utilises information obtained from both desk top study and site context investigation. The assessment will address the effects on landscape and amenity values for owners and occupiers within a 15km study area, and specifically deal with view locations identified within the visual catchment area, as identified within the Zone of Theoretical Visibility (ZTV maps) (**Attachments 2 - 5**).

The desktop study included the review of the earlier consented windfarm scheme documentation, the material prepared by Energy3 Services Ltd and the current consent application for the increased turbine height.

The desktop study information has been utilised to help describe the study area, landscape character and evaluate the landscape and visual effects in relation to the increased height of eleven turbines and the reduction in consented turbine numbers from twenty-two to eleven.

With regards to the desktop aspect, technical information has been provided by the Applicant[9]. This information includes:

- T4 Windfarm ZTV Analysis by Energy3 Services Ltd ('Energy3');
- Australasian standards for determining the potential effects of windfarms[10];
- 'wire frame' renderings of the topography, consented and proposed turbines (**Attachments 6-10**);
- visual simulations of the consented and proposed turbines (**Attachments 6-10**);
- zones of theoretical visibility (ZTV) mapping (**Attachments 2-5**);
- the locations and names of potentially affected parties (**Appendix 1**); and,
- the Taumatatotara Windfarm Site Plan (**Attachment 1 and Appendix 2**).

As part of the desktop exercise, the ZTV maps[11] were studied and compared with each other. The purpose of the ZTV mapping was to illustrate the area over which the consented and proposed windfarm can theoretically be seen. The maps are useful to illustrate the potential for views and the extent of the viewer catchment of the windfarm.

When examining the ZTV maps, it is important to understand that:

- ZTV maps do not show how a project will appear or the magnitude of visual effects as they only show an indicative area and extent of potential view;
- They do not take into consideration the potential screening effect of localised vegetation or structures within the area on individual properties;
- The accuracy is limited to the contour information/intervals; and
- ZTV's are an assessment tool which produces a baseline of the potential maximum visibility of the windfarm, however it does not consider the effects of distance of viewer and the atmospheric conditions in terms of visibility of the turbines.

[9] 'T4 Windfarm ZVI Analysis', prepared by Energy3 Services Ltd, 2020.

[10] National Wind Farm Development Guidelines Draft, July 2010.

[11] **Figures 10-13**; Energy3 Services Ltd report and **Attachments 2-5**.

The potential visual effects have been validated through onsite assessment of the ZTV's with examination of specific viewpoints to assist with further defining and refining the extent of potential visual effects. The purpose of this was to establish whether any views from dwellings or public viewpoints within the receiving environment would potentially see more turbines or more of any one turbine than what was consented (for example, a turbine previously out of sight behind screening topography may have its upper extent visible when taller). **Attachments 4 and 5** illustrate the nett change in visibility between the consented and proposed windfarms. In these maps, it is demonstrated that there will be no increase in visibility from dwellings and unlikely from public spaces (in this case roads) generated by the proposal compared to what has been consented.

It is further acknowledged that of the eleven turbines that were visible from within the identified dwellings and public places in the ZTV analysis in the consented scheme, the visibility of these eleven turbines will increase as the proposal increases their height. **Attachment 5** includes the area where there will be a nett reduction in the visibility of the windfarm due to the southern eleven turbines being surrendered.

From the ZTV analysis and mapping, occupants in dwelling 'No. 21' (**Attachment 1**, and Figure 13, Energy3 report) will no longer be able to see any turbines as the southern eleven turbines have been surrendered. Occupants' views from all the remaining dwellings in the receiving environment will experience an increase in the visibility of the eleven remaining northern turbines, however they will also see eleven less turbines than what was consented. It is also acknowledged that the surrendered southern eleven turbines were closer to most dwellings in the area than the retained taller eleven turbines which are further to the north away from the more relatively 'settled' area.

A site visit was undertaken on 8 August 2019 to examine the landscape character and amenity value of the area and consider the potential visual receptors (viewers). Receptor groups include single residential dwellings within a 15km study area (**Attachments 2-5**) and travellers passing through the area (i.e. motorists, cyclists and pedestrians). Other than a single new house approximately 0.6kms northwards along Taharoa Road from the intersection of Taharoa Road and Te Waitere Road (house no. 22, **Attachment 1**), it was confirmed that the appearance of the setting for the proposal has not altered discernibly since the first consent was granted.

The site visit investigated and assessed potential view points from public roads and areas adjacent to residential properties - particularly along Marokopa Road and Coutts Road where occupants of dwellings have a direct view of most of the site. Several stops were carried out and a photographic record was taken. The primary purpose of the site visit was to determine the extent of the receiving environment and the locations of any potentially affected parties (**Attachment 1**). While it was not possible to observe the site from the privately-owned dwellings or properties themselves, the site was observed from close by these dwellings on public roads from where the proposal will appear similar.

The 3D visual simulations produced by Energy3 utilise a 3D ground model that is photo matched to replicate the change in view. It is considered that the methodology used, photographic viewpoints selected, and turbines as depicted are sufficiently accurate to illustrate the effects of the change in turbine height and are photographically realistic to portray the proposed activity. To this extent, the information provided by Energy3 has been relied upon in the conclusions reached in this LVA. The Energy3 methodology is included in the Planner's report[12] at appendix 11 of that report and is consistent with best practice[13].

[12] by Shearer Consulting 5 July 2020.

[13] NZILA Best Practice Guide Visual Simulations BPG 10.2.

The seven-point scale of effects[14] has been used in this LVA when assessing the potential adverse landscape and visual effects arising from the change in turbine height. This effects scale ranges between: 'very low' to 'low' to 'moderate to low' to 'moderate' to 'moderate to high' to 'high' to 'very high'. It is generally understood that 'less than minor' effects are equivalent to the 'very low' and 'low' effects ratings (**Appendix 3**).

[14] Defined and agreed at NZILA assessment methodology workshop (Christchurch), Dec 4, 2017 (part of a national roadshow facilitated by retired Environment Court Judge Gordon Whiting). Results currently being compiled.

5 DESCRIPTION OF PROJECT

Refer to the current Resource Consent[15] application for project description and information pertaining to the proposed rotor types, dimensions and ancillary components.

In summary, consent has been given for the construction of access roads, the placement of transmission lines and installation of twenty-two 110m high turbines, which to date have not been constructed. The site has well defined but level ridges with steep slopes on the flanks. The local peak to the northern end of the site has an elevation of 340m with the remainder of the site at around 320m above sea level.

The proposal is to increase the maximum height[16] of the northern eleven turbines numbered 1 to eleven on the site plan (**Attachment 1**) from 110m to 172.5m. The proposal also halves the turbine numbers compared to what has been consented. The eleven turbines retained, propose a nominal turbine with a 95m hub height and 155m diameter rotor that will have a 17.5m clearance between blade tip and ground (i.e. 172.5m overall height).

In addition, the fundamental design of the turbines and the individual locations of the retained northern eleven[17] turbines are largely unchanged. The increased heights of the turbines will be considered in the context of the consented scheme.

Other aspects, such as the construction methodology and specifics of the access road and transmission lines of the consented project will not fundamentally change and will be constructed in accordance with the current consent conditions. It is also acknowledged that the extent of the earthworks and formed roading will be greatly reduced compared to what has been consented.

In addition to the overall height increase of the eleven retained turbines, other changes are involved at a design engineering level which have negligible changes in terms of landscape and visual effects over what has been consented. Some changes represent net improvements. These changes are included in **Table 1**.

All eleven turbines will use a 'narrow blade' type, which reduces the extent of any shadow flicker effects to what is consented. In addition, the proposed turbine blades have a lower rotation frequency. Both of these changes represent positive visual effects over what is currently consented turbines which is discussed shortly.

The effects considered in this assessment concern only the physical parts of the proposal that exceed what has been consented. It is understood that the reason for the change of conditions sought (turbine number and size) is to respond to recent changes in windfarm technology that have occurred over the last twelve years since the original proposal was consented in 2008. These technical matters are addressed in the overall Assessment of Environmental Effects and are not discussed here.

6 STATUTORY DISCUSSION

The proposed activity is in the Rural Zone within the Waitomo District Plan. It is understood that the change of consent conditions application is to be assessed as a discretionary activity under section 127 of the Resource Management Act.

[15] Taumatatotara Windfarm Application to Change Conditions of Consent, 5 July 2020.

[16] From the ground to the tip of the blade when in a vertical position.

[17] The locations of the eleven turbines have altered from between 2-86m of their consented locations. See Figure 1 in Energy3 Services Ltd report.

The landscape-based Objectives and Policies below are considered relevant to the proposal.

6.1 WAIKATO REGIONAL POLICY STATEMENT

Objective 3.20

The values of outstanding natural features and landscapes are identified and protected

from inappropriate subdivision, use and development.

The site is not included as an Outstanding Natural Feature or Landscape and as such this objective does not apply to the proposal.

Objective 3.21

The qualities and characteristics of areas and features, valued for their contribution to amenity, are maintained or enhanced.

Policy 12.3 gives effect to this objective and identifies different landscape types where their amenity values are to be maintained or enhanced. '*Other landscapes or seascapes or natural features'* (area 'd') is the closest fit to the site. As such, the proposal meets the intent of this objective through a halving in turbine numbers from what has been consented. In this regard any effects on the landscape will be enhanced through a lesser level of development which has been permitted to occur. The proposal now includes less roading, vegetation removal, and loss of land for traditional rural landuse practices. In other regards this objective and policy would have been addressed when the windfarm was first proposed in 2005 where any adverse effects on amenity values were found to be acceptable. The additional height of the eleven turbines is not considered to affect levels of amenity to more than a 'low' degree.

Objective 3.22

The natural character of the coastal environment, wetlands, and lakes and rivers and their margins are protected from the adverse effects of inappropriate subdivision, use and development.

The site is not part of a coastal environment, includes no wetlands, lakes or rivers and as such this objective does not apply to the proposal.

6.2 WAITOMO DISTRICT PLAN

Objective eleven .3.8

To promote use of rural land in a manner which encourages maintenance and enhancement of amenity values of the rural environment, protects outstanding natural features and landscapes from inappropriate use and development, and preserves the natural character of the coastal environment, wetlands, lakes and rivers, and their margins.

Objective eleven .3.9

To encourage maintenance and enhancement of rural visual character.

As mentioned above the site is not part of an ONLF, coastal environment, wetlands, lakes and rivers and their margins. However, 'moderate' levels of rural amenity exist at and in the context of the site which needs consideration. The additional turbine height will have 'low' adverse effects on rural amenity for the reasons discussed in Section 8 below. It is also acknowledged that for a part of the site; rural amenity values will be unchanged as the number of turbines is halved compared to what is currently permitted to occur. On balance, it is conservatively determined that there will be 'low' adverse visual effects arising from the proposal when compared with the consented environment. It is also considered that due to the areas isolation, low population numbers, low visitor numbers and modified rural landscape character the proposal would not be inappropriate here.

7 ASSESSMENT OF THE LANDSCAPE AND VISUAL EFFECTS

7.1 LANDSCAPE EFFECTS

Landscape effects concern physical changes to the setting which may or may not be seen but are otherwise understood to exist. Landscape effects are also synonymous with effects on character and levels of amenity derived from landscape character or in other words - whether a change to the setting is appropriate or not. Landscape character is comprised from a combination of landform, land cover and land use (or cultural patterns). As such, physical changes to the landscape from the construction of the windfarm beyond what has been consented will include:

- While overall vegetation removal will be greatly less than what is consented as the windfarm is halved in extent, there will be discrete areas where more vegetation removal will be required to allow for the construction of the access road which will need to be wider in places on corners than what has been consented (below);
- While there is less roading proposed than what has been consented, there will be an increase in the roading width on corners from 10m wide (consented) to 14m wide.
- While the numbers of proposed turbines have been halved compared to what has been consented, the taller turbines require larger footings at 18 x 18m (consented footing widths are 14 x 14m).

The extent of change and the effects on landscape character in relation to the above, have already been largely considered through the consenting process that was carried out in November 2005 and by 'consent' are within acceptable limits.

The increased height of eleven of the retained turbines as illustrated in the photographic montages (**Attachments 6-10**) provides a comparison of the consented scheme with the increase in height of a lesser number of turbines now proposed. The visual simulations demonstrate that on balance the change in height in conjunction with the reduction in turbine numbers will have a positive effect on landscape character compared with the consented scheme.

Additional potentially adverse landscape effects arising from the proposal are confined to close to the construction footprint and will be generated from the larger turbine footing size, wider road bench widths and the formation of theoretically[18] taller cut and fill batters on either side of the road (where required) on corners. These earthworks are proposed to be rehabilitated to natural grades and revegetated as per the original consent conditions. Most of the site roading occurs along a ridgeline at a high point in the landscape above public and private viewpoints limiting the road's visibility from these places. It is also understood that the final location of the roading will avoid highly visible slope faces where roading would generate scarring and visually adverse effects (for example at 'switch backs'). The eleven individual turbine footings will be largely below ground level and not visible from land-based public viewpoints. For these reasons, any landscape effects relative to what has been consented will be less given the halving in the

[18] Detailed roading design will be carried out following granting of resource consent for this proposal as is normal practice for a windfarm development.

number of turbines proposed and the subsequent reduction in the quantum of physical interventions in the landscape to build and provide access to each turbine.

To summarise, in terms of a comparison of effects with the existing consented environment, the reduction in the number of turbines now proposed from twenty-two to eleven will lead to significantly less landscape effects. The roading required for the eleven-turbine option will be approximately 40% less in overall length than the twenty-two-turbine consented option. The number of turbine platforms are also halved, albeit they will be larger. The consented twenty-two turbines platforms at 14 x 14m equate to 4,312m² of platform area, whereas the eleven 18 x 18m platforms equate to 3,564m² - a nett overall 17% decrease in excavation requirements.

With the location of the roading and turbine platforms obscured from public viewing areas and from off-site landholdings, the earthworks effects are assessed as being noticeably less than what has been consented.

7.2 VISUAL EFFECTS

Levels of visual amenity are generally associated with how 'natural' a place is. The more natural or unmodified the place is, the higher the level of visual amenity will be, typically. The project area and the contextual setting beyond it has been modified over time through vegetation clearance and land drainage practices to provide for pastoral farming activities (**Attachments 1 – 1C and Cover**). This has led to widespread erosion and unsightly scarring of the landscape - particularly on steeper slopes. As such, the landscape surrounding, and including the site cannot be considered as being a high-value landscape and is assessed as having a low to medium degree of 'naturalness'.

Given the extent of change that has occurred within the landscape discussed above, the area's relative remoteness and low population, it is considered that the area including the site has a high level of capacity to absorb change, including windfarms.

In general, from public and most, if not all private viewpoints there will be a positive change in the landscape and the visual amenity derived from it when comparing the proposal with the consented twenty-two-turbine windfarm (**Attachments 6-10**). The visual effects generated by the increased height of the northern retained eleven turbines is offset, or at worst, evenly balanced by the halving in turbine numbers.

7.3 EFFECTS OF DISTANCE ON RECEPTORS

The project's Visual Catchment or Zone of Theoretical Visibility (**Attachments 2-5** – ZTV Plans) illustrates the potential visibility of the proposed windfarm within the surrounding landscape. The ZTV plans provide a comparison between the consented scheme (**Attachment 2**) and the proposal (**Attachment 3**). Effectively there is a small nett increase in the visibility of the turbines (**Attachment 4**). However, this is small, with the effects of the increases falling on farm and forestry land which would be sparsely occupied. For these reasons, the increased height of the eleven turbines illustrates that any potential adverse visual effects will be 'low[19]' to 'very low[20]'

[19] **Low**: A low level of effect on the character or key attributes of the receiving environment and/or the visual context within which it is seen; and/or have a low level of effect on the perceived amenity derived from it. (Oxford English Dictionary Definition: Low: adjective- below average in amount, extent, or intensity).

[20] **Very Low**: Very low or no modification to key elements/features/characteristics of the baseline or available views, i.e. approximating a 'no-change' situation.

During the site visit, the assessment process determined that the topography, existing vegetation cover, distance between turbines and the alignment along a north-south axis meant that an additional 62.5m turbine height will be difficult to discern for occupants and the public located to the south of the site who will be very distant from the turbines.

The Applicant has prepared 'wireframe' images (**Attachments 6 – 10**) from selected public points in the landscape to help determine the visual effects of the additional turbine height.

As the physical distance from the windfarm increases, any adverse visual effects will correspondingly and gradually lessen. The surrendering of the eleven turbines at the south 'end' of the site near where most residents in the area are located provides an immediate reduction in potentially adverse effects compared to what is consented.

Partial views of the consented windfarm will potentially be obtainable from Te Anga Road, parts of Taharoa village[21] and Whakapirau Road. However, the location of dwellings and viewers within these areas is sufficiently distant from the windfarm, that the change in turbine height will not be apparent. Given the halving in turbine numbers any visual effects of the windfarm will be reduced overall compared with what has been consented.

From dwellings located along the Taumatatotara West Road, Taharoa Road and Taharoa village itself, residents will not recognise the increased height of the turbine as distance, intervening topography and vegetation patterns will effectively screen most views to the windfarm. Therefore, there will be no discernible additional adverse visual effects on these parties.

7.4 VISUAL EFFECTS ARISING FROM THE SPECIFICS OF THE PROPOSAL

7.4.1 ZONE OF THEORETICAL VISIBILITY (ZTV) MAPS

The ZTV maps (**Attachments 2-5**) map the theoretical visibility of the turbines from all points in the landscape within an 15km radius. When the existing consent ZTV and the proposed ZTV were digitally compared by Energy3 (**Attachments 4 and 5**), the nett difference in turbine number visibility between the two can be summarised. The conclusion reached from assessing **Attachment 4** is that the increased height of the 11 turbines does not bring into view the upper parts of turbines that would otherwise have been concealed behind ridgelines when the turbines were lower in height as consented. This also appears to be the case from public (road) views. **Attachment 5** identifies an area of the receiving environment (red shade) where there will be a nett reduction in the visibility of the proposal due to the southern eleven turbines being surrendered. It is acknowledged that this mapping assumes that no intervening structures and vegetation occurs within the topographical study environment. This would reduce the visibility of the proposal – potentially greatly.

7.4.2 HUB AND TOWER HEIGHT

The hub height (measured from the base of the mast) will increase by 58% (60m to 95m) (**Table 1**). It is concluded that a 58% increase in height over what is consented will have low adverse visual effects. This conclusion is largely based on the visualisations provided by the Applicant (**Attachments 7, 9 and 10**), which are considered to be accurate and representative.

[21] The ZTV mapping suggests that most, if not all views towards the proposal from Taharoa are screened by intervening topography. Taharoa is also over 6 kms from the site which also reduces any potential visual effects.

Increases in the proposed tower diameters (top and bottom), blade stem chord width, hub and nacelle dimensions above what has been consented are between 22% and 40% (**Table 1**). Additional visual effects of these increases will be acceptable given what has been consented, as the scale (and change in scale) of these items is relatively small compared with the overall turbine height increase. From the viewing distances involved, it will be unlikely that these increases are discernible. **Table 1** identifies several changes in the size of the turbine components. The following section assesses the potential visual effects of each of these in turn:

7.4.3 BLADE TIP HEIGHT (OVERALL TURBINE HEIGHT)

The blade tip height will increase by 58% over what is consented. However, while this appears large – particularly in the case of the change from a 110m tall turbine to a 172.5m tall one, there are two mitigating factors relative to the already consented windfarm. The first is due to the 'narrow' type blade now proposed, with a maximum blade chord width of 4m[22] which despite the longer blade length and turbine height reduces the extent of the shadow flicker zone compared to what has been consented.

Secondly, the larger turbines generate a slower maximum blade rotation speed of 12.5 revolutions per minute (rpm). The consented turbines rotate at a typical 18 rpm. The slower rpm of the proposal will result in a more languid rotation which will appear 'calmer' and for that reason, less visually intrusive and distracting - particularly in the field of peripheral vision. This goes some way towards compensating for the increased visual effects of overall height.

7.4.4 CHANGES AT GROUND LEVEL

Changes at ground level include the footings and roading. The footings diameter increases by 28%. It is expected that any increase in footing size will have nil visual effects as these changes will be largely below ground level and out of public view.

Similarly, there are some increases to roading width compared with what has been consented. These increases enable longer components to be trucked around complex topographical change points. It is considered that an increase in road width above what is consented on corners of up to 4m will have acceptable visual effects. This is due to the limited permanent viewing audience, cuts are all on the top of ridgelines (not across side-slopes) and that any theoretical increased heights of cuttings and fill batters will be required to be revegetated as part of consent conditions, should the proposed variation to the consent be granted. It is also acknowledged that overall there will be significantly less changes at ground level included in the proposal compared to what has been consented due to the halving in turbine numbers.

7.4.5 SHADOW FLICKER

The extent of the shadow flicker zone is reduced by approximately 100m compared with the consented turbines as the proposed turbines include 'narrow width' blades. Shadow flicker effects are determined by multiplying the maximum blade chord[23] width by a factor of 265[24]. The maximum blade chord width is 4m (or a radius of 1,060m centred on each turbine). It is understood that no additional (recently constructed) dwellings are located within the potential shadow flicker zone compared with the consented windfarm. Shadow flicker effects are therefore not addressed further in this LVA.

[22] 4.4m blade width consented.

[23] Point where the blade width is at its maximum.

[24] Table E-2 Summary Modelling Assumptions, EPHC National Windfarm Development Guidelines – Draft July 2010 (Australia).

7.4.6 VISUAL EFFECTS ON SPECIFIC IDENTIFIED THIRD-PARTY DWELLINGS IN THE RECEIVING ENVIRONMENT

The dwellings referred to below are identified in **Appendix 1, 2 and Attachment 1 and 1A** where their views towards the windfarm are assessed from field-based observations and supported with the ZTV analysis mapping (**Attachments 2-5**)[25]. The actual views from within each dwelling were not assessed. However, during the site visit, observations were made, and photographs were taken from public roads near these dwellings looking towards the site. In this regard an understanding of the likely views was able to be made. It is also acknowledged that intervening vegetation and structures - which may partially or fully obscure views to the proposal from the various dwellings is not included in the ZTV mapping. For this reason, the below findings will be conservative.

Dwelling '22' (Taharoa Road):

The dwelling at this location was not in place when the site visit was undertaken. The location of this dwelling is shown in the inset on **Attachment 1**. From this dwelling possibly all of the turbines will be visible (**Attachments 3, 5**). In the consented scheme 4-6 turbines would be visible (**Attachment 2**). It is acknowledged that from a Google 'drive-by' this dwelling may be partly screened from the proposal by rising topography to its south. It is also likely that this dwelling faces north, orienting away from the proposal. Notwithstanding this, for these reasons any potentially adverse visual effects from the proposal from this dwelling will be greater than what the effects would be from the consented scheme.

Dwellings '18' and '21' (Marokopa Road):

From dwelling 18 there will be 4-6 turbines visible. From dwelling 21 there will be 1-3 turbines visible (**Attachments 3, 5**). In the consented scheme 7-9 turbines would be visible from dwelling 18 and 4-6 turbines would be visible from dwelling 21 (**Attachment 2**). For these reasons any potentially adverse visual effects from the proposal on these two dwellings will be less than what the effects would be from the consented scheme. The turbines that are visible will be taller, but the overall number of turbines will be essentially halved in the proposal and substantially further away from these dwellings compared with what was consented.

Dwellings '19' and '20' (off Marokopa Road):

From these dwellings, 1-3 turbines will be visible (**Attachments 3, 5**). In the consented scheme 4-6 turbines would be visible (**Attachment 2**). The fewer turbines visible from these two dwellings will be taller, but will also be at least 4,325m away (closest turbine no.11) where the increase in height over the consented 110m tall turbine will be unlikely to be appreciated. For these reasons any potentially adverse visual effects from the proposal on these two dwellings will be less than what the effects would be from the consented scheme.

Dwellings '14', '15', '16' and '17' (Coutts Road):

From occupants' views from these dwellings, 10-12 turbines will be visible (**Attachments 3 and 5**). In the consented scheme 19-22 turbines would be visible (**Attachment 2**). The turbines visible from these four dwellings will be taller, but will also be at least 3,850m away (closest turbine no.11). From these dwellings the increase in height over the consented 110m tall turbines will be unlikely to be appreciated. It is also acknowledged that occupants from these dwellings would have a 'broadside' view to at least 7 more turbines in the consented scheme located at closest 2,864 m (surrendered turbine no. 20 to dwelling 14

[25] The ZTV mapping has a level of 'coarseness' that prevents a highly accurate assessment of the visibility to be made where dwellings are located on or near the edges of several colour 'shades'. Where this occurs, a conservative assumption on the potential visibility of the proposal is made.

Appendix 2). For these reasons any potentially adverse visual effects from the proposal on these dwellings will be less compared to what was consented.

Dwelling '13' (Coutts Road):

From the occupants' views from this dwelling, 1-6[26] turbines will be 'visible'[27] (**Attachments 3, 5**). In the consented scheme 13-15 turbines would be visible[28] (**Attachment 2**). The turbines visible from this dwelling will be taller, but will also be at least 3,724m away (closest turbine no.11). From this distance the increase in height over the consented 110m tall turbine will be unlikely to be appreciated - if the turbines can indeed be seen. It is also acknowledged that with the consented scheme, occupants from this dwelling would possibly have an east / south-eastwards 'broadside' view to 5-6 turbines located approximately 3 km from the dwelling. For these reasons any potentially adverse visual effects from the proposal from this dwelling will be less compared to what was consented.

Dwellings '11' and '12' (Coutts Road)[29]:

From the occupants' views from these dwellings, 10-12 turbines will be 'visible'[30] (**Attachments 3, 5**). In the consented scheme 19-22 turbines would be visible[31] (**Attachment 2**). The turbines visible from these dwellings will be taller, but will also be at least 3,250m away (closest turbine no.10). From this distance the increase in height over the consented 110m tall turbines will be unlikely to be appreciated - if the turbines can indeed be seen. For these reasons any potentially adverse visual effects from the proposal on this dwelling will be reduced compared to what was consented.

7.4.7 SUMMARY – VISUAL EFFECTS ON PRIVATE THIRD-PARTY DWELLINGS

In summary, any adverse visual effects of the variation to increase the turbine heights by 62.5m is balanced by the surrendering of eleven turbines which were closer to the twelve potentially affected dwellings at that time. Any potentially adverse visual effects of the proposal to increase the turbine height is balanced out by the proposed halving of overall turbine numbers where the resultant visual effects will be between 'very low' and 'positive'.

7.4.8 VISUAL EFFECTS FROM PUBLIC PLACES (ROADS)

From the public perspective, only road users will be able to see the windfarm via glimpsed views. Such views are typically only available from winding roads and the visibility of up to eleven turbines depends on the degree of screening from intervening patterns of vegetation including roadside planting and changes in topography within the vicinity. Where the eleven turbines are visible from roads, any potential adverse visual effects arising from the 62.5m increase in turbine height will be 'low'[32], due to the typically transient nature of the views and the reduction in turbine numbers visible (up to eleven) compared with what has been consented (up to twenty-two).

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[26] The ZTV mapping is too fine to determine the difference between 1-3 or 4-6 turbines visible.

[27] There is plantation forestry located between this dwelling and the proposal which will likely preclude views of the turbines (**Appendix 2**).

[28] Ibid.

[29] It is understood that these houses are owned by one of the landowners who will have turbines on their property.

[30] There is plantation forestry located between these dwellings and the proposal which will likely preclude partial or all views of the turbines (**Appendix 2**).

[31] Ibid.

[32] **Low**: A low level of effect on the character or key attributes of the receiving environment and/or the visual context within which it is seen; and/or have a low level of effect on the perceived amenity derived from it. (Oxford English Dictionary Definition: Low: adjective- below average in amount, extent, or intensity).

As mentioned in the introduction - the primary issue is whether a windfarm can be appropriately located in this setting or not. This is partly informed by the quality of the setting, the visibility of the turbines and the sensitivity of the viewing audience. The consented 110m tall turbines are very large structures and so these questions have already been considered and answered. In other words, the primary visual effect is generated by the presence of a windfarm. Wind turbines are striking, unusual elements in the landscape and as such their actual size becomes less important.

Given the relatively sparsely lived-in and visited receiving environment – particularly proximate to the northern eleven turbines now proposed and the area's remoteness overall, it is concluded that the 62.5m increase in height sought will not trigger additional visual effects above 'low'. This is for the following reasons:

- The number of turbines now proposed is half what has been consented.
- The area's remoteness and modified character contributes considerably towards its capacity to absorb further change - additional to what has been consented.
- The windfarm's north-south orientation and setback from the majority of viewers located on the relatively 'busier' Coutts Road and Marokopa Road.
- The incorporation of a narrow blade which reduces the extent of shadow flicker effects compared with the wider blade consented.
- The winding nature of surrounding roads, often passing through cuttings and passing by roadside vegetation which precludes some views.
- Intervening vegetation patterns in the landscape including forestry which precludes some views.
- The slower rotational speed of the turbine blades when compared with the consented wind turbines.

On balance, any potentially adverse visual effects generated by the proposal when compared with the consented environment will be 'low' (which is generally understood to be equivalent with 'less than minor' in RMA terms).

7.5 CONCLUSION - VISUAL EFFECTS

To summarise, aesthetic coherence of the landscape is derived from all of the senses, although the visual sense is typically pre-eminent[33] for most people where one's appreciation of the landscape is largely obtained. The visual comes under 'amenity values' as defined in the RMA, the other attributes being pleasantness, cultural and recreational values.

It is acknowledged and has been discussed throughout section 8.4 that the additions in turbine height compared to what has been consented is the key generator of the magnitude of the effects on what is essentially both small permanent and transient viewing audiences. However, on balance the difference between what is consented and what is proposed generates only 'low' adverse visual effects. This is a conservative finding. Halving the proposed turbine numbers constitutes a significant reduction in potentially adverse visual effects. In addition, the surrendered eleven turbines were closest to the most occupants in the receiving environment. Any potential adverse effects on amenity values were determined during the initial consenting process to include a broader receiving environment compared to now.

[33] Sound and smell are also important as they affect one's appreciation of the landscape although these attributes are less relevant here.

For the foregoing reasons, existing amenity derived from the potentially affected landscape will change little despite the consented and more extensive windfarm. Therefore, there will be only 'low' effects in terms of the area's associative attributes. Any effect on amenity values are concluded to be similarly 'low'.

8 AVOIDANCE, MITIGATION AND REMEDIATION OF EFFECTS

Avoidance of effects has been primarily achieved through locating the proposed retained turbines to the north, away from the more relatively settled areas located along Coutts Road and Marokopa Road. Other avoidance techniques are no different to what has been consented to date which includes locating most of the access roading along the ridgeline - avoiding more visible and potentially erodible slope faces.

No mitigation measures are proposed, nor considered feasible or effective given the size of the proposed turbines. It is acknowledged that mitigation was not proposed in the original consent application.

As previously discussed, and no different to what has been consented to date, remediation includes the careful battering back of cut and fill slopes to natural grades where possible in areas where the access roading corridor is proposed. These exposed cut and fill areas will be fully revegetated to reduce erosion and prevent landscape scarring.

9 CONCLUSION

It is concluded that regardless of the size of the turbines - whether they are 110m or 172.5m tall, they are all very large structures. It would be not unreasonable to conclude that anyone looking at a wind turbine would have difficulty in determining its height whether it was 110m tall or 172.5m tall without the benefit of a comparison.

The purpose of this assessment is to consider the potential adverse landscape and visual effects of the *difference* in the proposal's attributes between what is consented and what is proposed. In other words, what are the effects of the extra height? This is achieved with the benefit of the report prepared by Energy3 provided by the Applicant. It is found that the difference in effects between the consented twenty-two 110m tall turbines and the proposed eleven 172.5m tall turbines will have at worst, 'low' adverse visual effects. Landscape effects arising from the proposal will be less than what has been consented and will be 'positive'.

The environment where the site is located is sparsely occupied, or otherwise passed through which provides one reason for locating a windfarm here. The area where the windfarm is proposed is well to the west of the tourist 'terminus' at Waitomo and substantially north of Marokopa Road. It is unlikely that many tourists would venture further west from the Waitomo caves, or northwards onto Taumatatotara Road to Taharoa.

It is understood that several dwellings near the proposal are on properties owned by those landowners who have agreed to have turbines on their properties.

The site is ideally located to accommodate renewable energy such as a windfarm. The site and setting include substantial modification for farming purposes which includes vegetation clearance practices and drainage works to 'improve' the land. Neither of which have been particularly kind to the landscape. For these reasons, the area is not particularly special and has rural amenity values which are concluded to be conservatively 'moderate[34]'.

The current proposal seeks to halve the consented turbine numbers. The remaining northern eleven now proposed are in similar consented locations (within 86m at most from their originally consented locations). The slower rotational speed of the proposed narrow type blades also helps to balance out any additional visual effects of the height increases.

[34] Average in amount, intensity, quality, or degree. (Oxford Dictionary definition).

10 LIMITATIONS

This report ('Report') has been prepared by WSP New Zealand Limited ('WSP') exclusively for Taumatatotara Windfarm Ltd. ('Client') in relation to the preparation of a Landscape and Visual Assessment report to be part of a wider Assessment of Environmental Effects which will be submitted to the Waitomo District Council ('Purpose') and in accordance with the agreement dated 14 October 2020 ('Agreement'). The findings in this Report are based on and are subject to the assumptions specified in the Report and other technical documents provided by the Client. WSP accepts no liability whatsoever for any use or reliance on this Report, in whole or in part, for any purpose other than the Purpose or for any use or reliance on this Report by any third party.

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expenses (including any indirect, consequential or punitive losses or damages or any amounts for loss of profit, loss of revenue, loss of opportunity to earn profit, loss of production, loss of contract, increased operational costs, loss of business opportunity, site depredation costs, business interruption or economic loss) of any kind whatsoever, suffered on incurred by a third party.

TABLE 1:

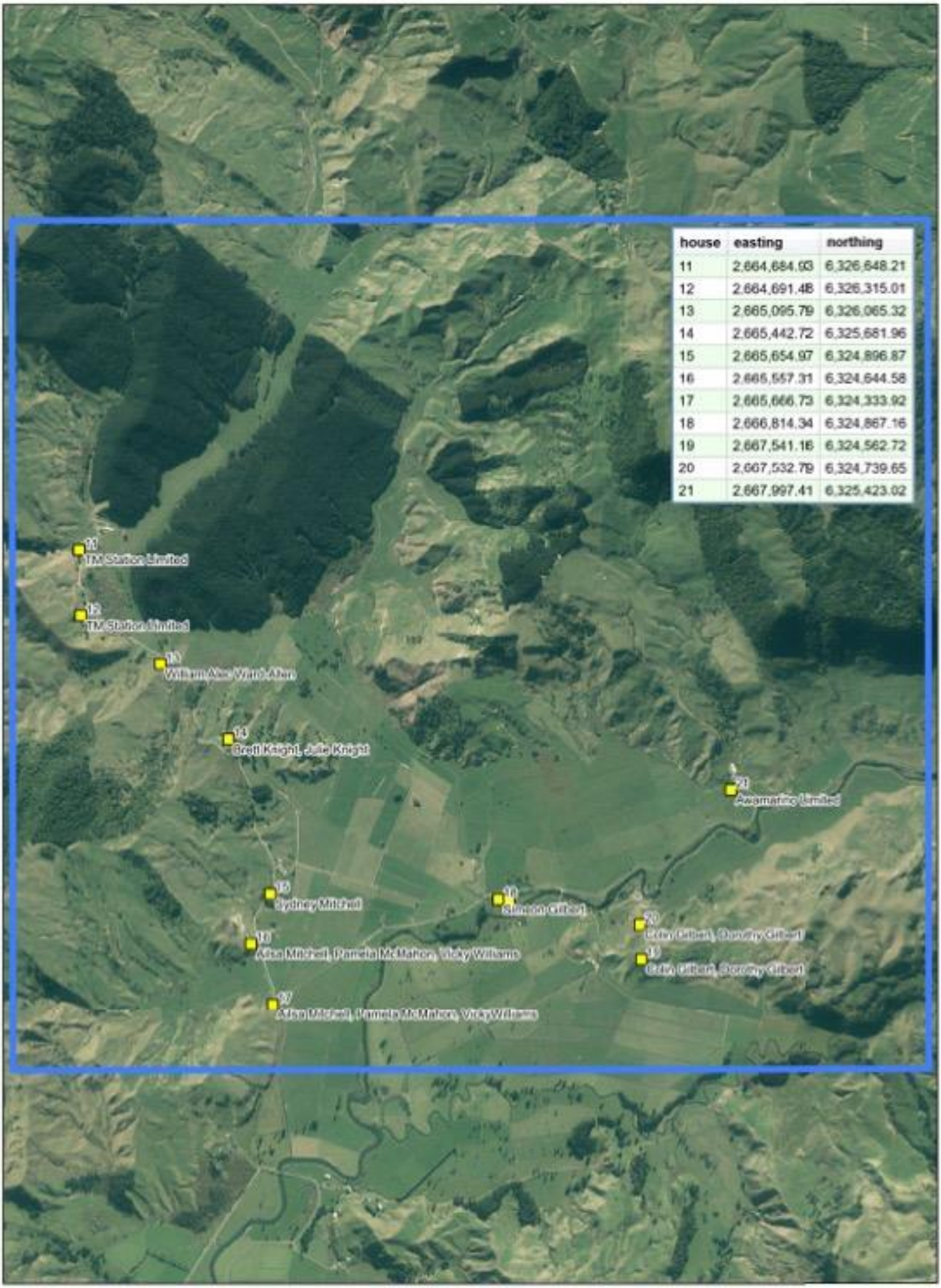
Comparison between proposed and consented turbines and net change

Design specifics	Proposed (narrow blade)	Consented	Change (%)
Overall height (metres)	172.5	110	+ 58
Hub height (metres)	95	60	+ 58
Blade stem chord (metres)	2.8	2.3	+ 22
Blade chord (widest) (metres)	4	4.4	reduced
Tower diameter (top) (metres)	3	2.3	+ 30
Tower diameter (bottom) (metres)	4.1	3.2	+ 28
Rotor diameter (metres)	155	100	+ 55
Hub diameter (metres)	5.76	4.1	+ 40
Nacelle width (metres)	5.8	4.2	+ 38
Nacelle length (metres)	17.4	12.5	+ 39
Footing dimensions (metres)	18 x 18	14 x 14	+ 28
Roading width (straight sections) (metres)	4	4	same
Roading on corners (metres)	14	10	+ 40
Rotational Speed (RPM)	11.1	18	reduced
Multiplier (for shadow flicker)	265	265	same
Shadow Flicker extent (metres)	1060	1166	reduced
Number of turbines	11	22	reduced

The above comparison table includes technical information provided by the Applicant. This information is also relied upon when assessing the landscape and visual effects of the current application to vary the consent.

APPENDIX 1

NEAREST 3RD PARTY HOUSES



house	easting	northing
11	2,664,684.93	6,326,648.21
12	2,664,691.48	6,326,315.01
13	2,665,095.79	6,326,065.32
14	2,665,442.72	6,325,681.96
15	2,665,654.97	6,324,896.87
16	2,666,557.31	6,324,644.58
17	2,665,666.73	6,324,333.92
18	2,666,814.34	6,324,867.16
19	2,667,541.16	6,324,562.72
20	2,667,532.79	6,324,739.65
21	2,667,997.41	6,325,423.02

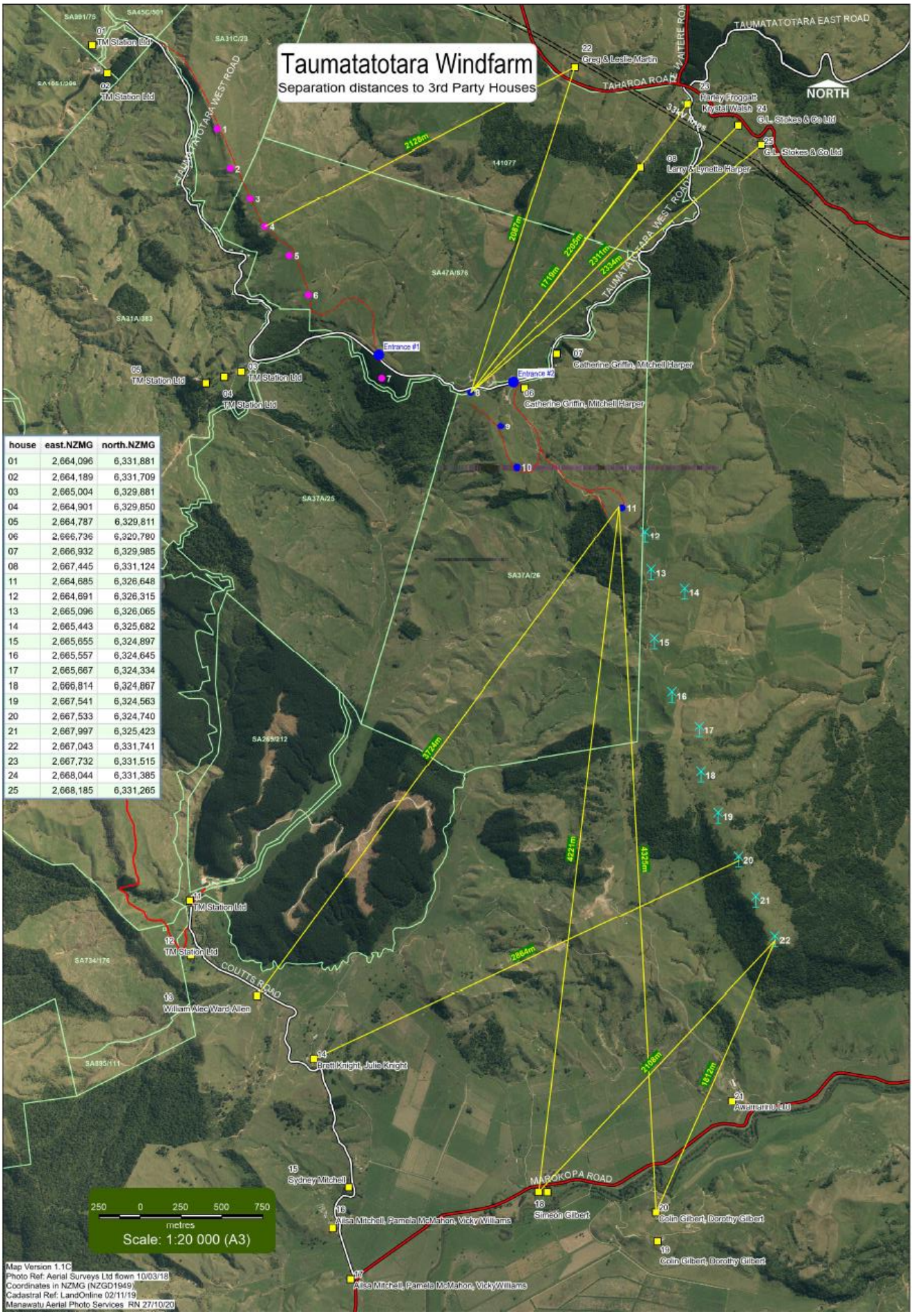
T4 Windfarm

Coordinates in NZMG (NZGD1949)
Cadastral Ref: LandOnline 03/08/19
Manawatu Aerial Photo Services RN 26/08/19

Scale 1:25 000 (A4)

APPENDIX 2

CONSENTED TURBINE LOCATIONS PLAN



house	east.NZMG	north.NZMG
01	2,664,096	6,331,881
02	2,664,189	6,331,709
03	2,665,004	6,329,881
04	2,664,901	6,329,850
05	2,664,787	6,329,811
06	2,666,736	6,329,780
07	2,666,932	6,329,985
08	2,667,445	6,331,124
11	2,664,685	6,326,648
12	2,664,691	6,326,315
13	2,665,096	6,326,065
14	2,665,443	6,325,682
15	2,665,655	6,324,897
16	2,665,557	6,324,645
17	2,665,667	6,324,334
18	2,666,814	6,324,867
19	2,667,541	6,324,563
20	2,667,533	6,324,740
21	2,667,997	6,325,423
22	2,667,043	6,331,741
23	2,667,732	6,331,515
24	2,668,044	6,331,385
25	2,668,185	6,331,265

APPENDIX 3

SEVEN POINT SCALE OF EFFECTS

Scale of Effects (7 Point)

Defined and agreed at NZILA assessment methodology workshop (Christchurch), Dec 4, 2017
(part of a national roadshow facilitated by retired Environment Court Judge Gordon Whiting).
Results currently being compiled.

The below seven-point scale is used to describe effects:

- Very High: Total loss to the key attributes of the receiving environment and/or visual context amounting to a complete change of landscape character

- High: Major change to the characteristics or key attributes of the receiving environment and/or visual context within which it is seen; and/or a major effect on the perceived amenity derived from it.

- Moderate-High: A moderate to high level of effect on the character or key attributes of the receiving environment and/or the visual context within which it is seen; and/or have a moderate-high level of effect on the perceived amenity derived from it.

- Moderate: A moderate level of effect on the character or key attributes of the receiving environment and/or the visual context within which it is seen; and/or have a moderate level of effect on the perceived amenity derived from it. *(Oxford English Dictionary Definition: Moderate: adjective-average in amount, intensity or degree)*.

- Moderate-Low: A moderate to low level of effect on the character or key attributes of the receiving environment and/or the visual context within which it is seen; and/or have a moderate to low level of effect on the perceived amenity derived from it.

- Low: A low level of effect on the character or key attributes of the receiving environment and/or the visual context within which it is seen; and/or have a low level of effect on the perceived amenity derived from it. *(Oxford English Dictionary Definition: Low: adjective-below average in amount, extent, or intensity)*.

- Very Low: Very low or no modification to key elements/features/characteristics of the baseline or available views, i.e. approximating a 'no-change' situation.