APPENDIX 7 LANDSCAPE ASSESSMENT

Masterton Solar & Energy Storage

Landscape, Natural Character and Visual Assessment Report

This Landscape and Visual Assessment Report has been prepared as part of the application to construct a agrivoltaic facility at Masterton.
All work has been undertaken and/or reviewed by a Registered NZILA Landscape Architect.

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CONTENTS

INTRODUCTION

Masterton Solar and Energy Storage Ltd is proposing to develop a ground-mounted agrivoltaic development approximately 1.3 km southwest of Masterton within a block of land bounded by State Highway 2 to the north, Cornwall Road to the east and Hughes Line to the south. Mansergh Graham Landscape Architects Ltd ("MGLA") has been engaged to assess the landscape and visual effects of the proposed development.

The following assessment examines the potential effects of the proposal on the existing landscape and visual amenity values of the surrounding rural environment, within the context of the relevant planning provisions.

METHODOLOGY

A standard assessment approach has been used to identify the existing landscape and natural character of the site and its surroundings and to assess the potential effect of the proposed development on landscape and visual amenity.

In broad terms, the assessment consists of the:

a. Identification of the key elements or attributes of the proposed development.
b. Identification of the landscape values, natural character, key attributes, and social preferences within the context of biophysical, associative, and visual landscape interpretation; and
c. Identification of relevant assessment criteria within the context of the relevant statutory framework.

A combination of mapping analysis and field assessment has been undertaken to identify the potential effect of the proposed agrivoltaic development on the existing character and amenity values of the surrounding area. By considering the above, the likely effects of the proposal can be identified and rated.

The approach undertaken is consistent with the *Te Tangi a te Manu - Aotearoa New Zealand Landscape Assessment Guidelines.* Definition of the rating systems used, and a methodological flow chart is contained in the appendices.

For this assessment, the area to be occupied by the agrivoltaic development is referred to as "the agrivoltaic development site". The parent titles within which the agrivoltaic development site will be located are referred to as "the application site".

PROJECT DESCRIPTION & SITE LOCATION

Project Description

The application seeks to establish an approximately 138-ha agrivoltaic development, also known as a "**solar farm**", within the subject site. This will include erecting solar panels (photovoltaic modules), inverters, transformers, a battery energy storage system (BESS), a substation, and a site office. The proposal will also include establishing security fencing and undertaking landscaping in appropriate places. Site works associated with the construction of the development, including earthworks, tree trimming and, in places, removal, will also be required to enable the agrivoltaic development to be established.

The following subsections outline those various components of the proposal in greater detail.

Photovoltaic Modules (Solar Panels)

The proposal seeks to establish approximately 155,000 photovoltaic (PV) modules, which are also referred to as solar panels. Each module has dimensions of approximately 1.3m wide by 2.1m high. These modules are proposed to be mounted on approximately 1,825 single-axis tracking tables (bases). The PV tracking table will be set out in a rectilinear array within the proposed development. Each PV tracking table is proposed to be oriented north-south along its long axis, enabling it to track the sun in an east-west direction.

The proposed PV tracking tables are anticipated to contain either 50, 75 or 100 modules each. This will result in each PV tracking table being either 69m long, 103m long, or 136m long (approximately). The PV tracking tables will be approximately 2.94m high at a maximum tilt (60° tilt) and 2.3m wide at a minimum tilt (0° tilt). Each row of PV tracking tables is proposed to have a 2.7m (approximate) wide perimeter clearance, to allow for access and maintenance.

It is proposed that the PV tracking tables will operate during all daylight hours of every day of the year. It is noted that the tracking path for some of the PV tracking tables will be suboptimal for a period during each day. This is in response to the findings of the glint and glare modelling, which is discussed in greater detail below. Overall, it is proposed that the agrivoltaic development will generate a maximum export capacity of approximately 100MW.

Solar Inverters

There are proposed to be approximately 24 solar inverters, coupled with small transformers, within the development. These inverters are proposed to be located regularly, at approximately 350m to 400m intervals across the agrivoltaic development. These inverters convert the direct current (DC) energy generated by the panels into alternating current (AC) energy so that it can enter the substation. The agrivoltaic development's internal cabling is proposed to be 33kV.

Battery Energy Storage Area

Approximately 150 individual battery energy storage system (BESS) units are proposed to be located within the eastern part of the site. Each BESS will be approximately 6.1m long by 2.4m wide by 2.9m high (plus between 300mm to 800mm for foundations), located within repurposed shipping containers.

The BESS are to support the generation of energy from the PV modules, storing the energy generated during the day when generation is at its peak. That stored energy can then be released into the national grid during peak demand hours, predominantly in the evening, when demand from households is at its greatest.

It is proposed that the BESS will provide approximately 400 megawatt hours (MWh) of storage. The battery may also be charged directly from the grid under certain conditions, such as during high renewable energy (off-site) output combined with low demand. Stored energy would then be exported at times when it is needed by the grid.

Substation and Switching

A substation area is proposed to be located immediately south of the BESS area. The substation area is proposed to be up to 1 hectare and includes an approximately 30m^2 switching station building. The switching station building will create a new loop-in-loop-out connection point to the Masterton Substation, which is southeast of the substation area, on the opposite side of Cornwall Road.

The connection to the Masterton Substation will be made within the road corridor of Cornwall Road. There is a concurrent process being undertaken by the Applicant seeking TransPower approval to connect to the national grid in this location. As part of that approval process, the means of connection will be determined, with the two options available being either trenched underground or utilising existing pylons above ground.

It is also noted that there may be changes required to the existing Masterton Substation as a result of the connection of the agrivoltaic development. Any required changes to the substation, which are yet to be determined, do not form part of this resource consent application.

Fencing, Internal Access, Buffers, and Earthworks

A 10m wide buffer strip will be left around the external perimeter of the site for fencing, access, and mitigation planting. A 15m wide buffer (minimum) will be left on either side of the central water race (which generally traverses the site in a northwest-southeast-southerly direction, splitting the agrivoltaic development site roughly in half).

Fencing: A deer fence (between 1.8m to 2.4m high) would be established around the perimeter of the site for security.

Earthworks: Earthworks will include the formation of internal access tracks, removal of some of the former bunds associated with the former tannery effluent management, trenching of cables connecting the agrivoltaic development to the substation, and mounting of PV tables into the ground (piled).

Existing Infrastructure and Planting

Wetland Areas: The site contains six identified wetlands, with the largest being mature willow and saturated soils, in the southern part of the site. All wetland areas will be retained. The wetlands will be fenced and the agrivoltaic development will be set back 10m from these wetlands.

Existing Farm Infrastructure and Shelterbelts: The existing woolshed, utility sheds, stockyards, water races (including the Waikoukou Stream/Taratahi water race) and the shelterbelts along State Highway 2 and to the immediate west of the stockyards will be topped and retained. The highest of the existing bunds and the old oxidation ponds (Identified HAIL site) to the north of the woolshed will be removed. All other tress and shelter belts within the footprint of the PVC tables, BESS area and inverter locations will be removed.

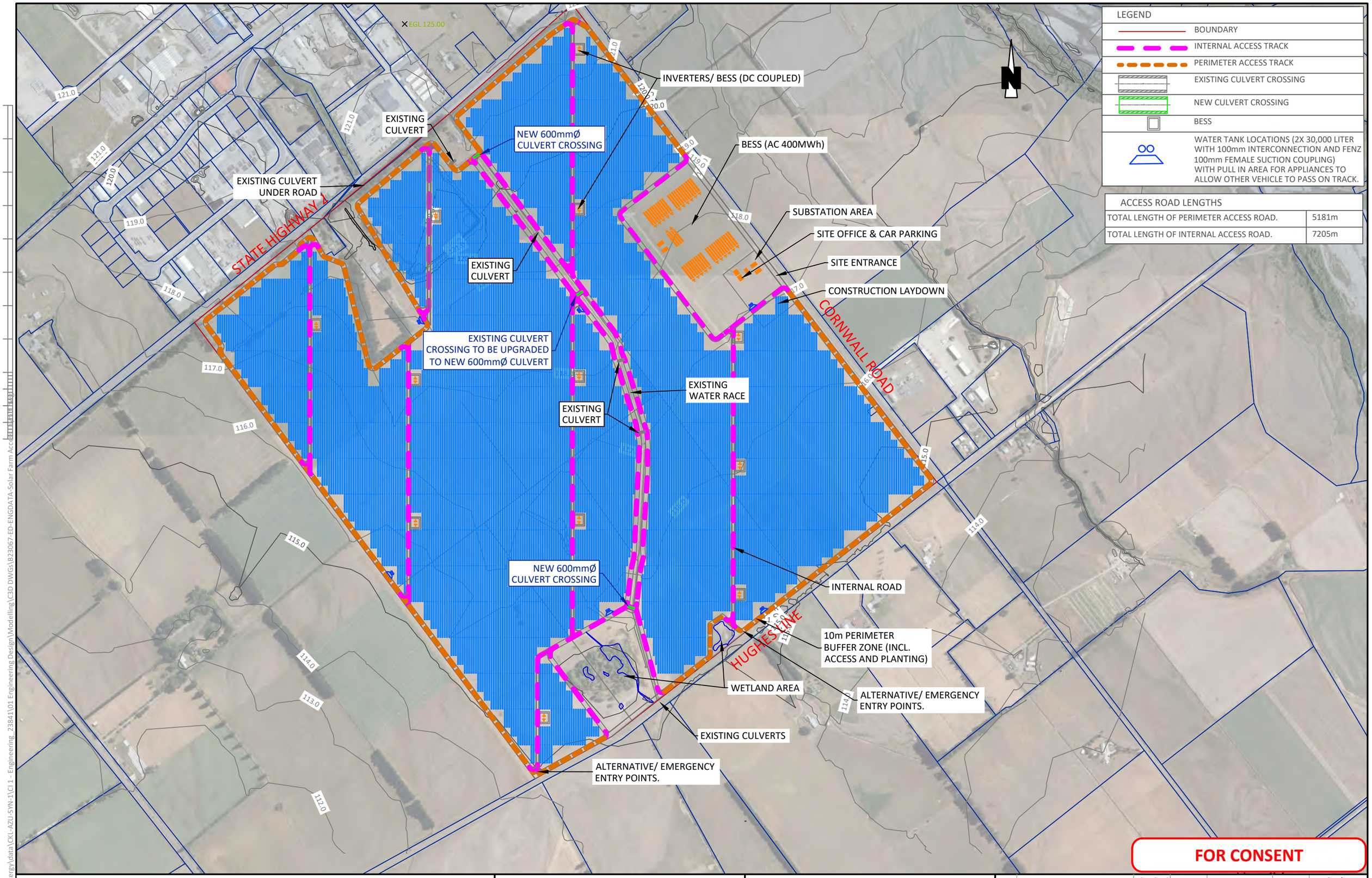
Proposed Mitigation Planting

Screen planting will be established between the northern end of the BESS and the intersection of Cornwall Road and Hughes Line and will extend approximately 575m along Hughes Line from the intersection. A short section of planting may also be required approximately 910m from the intersection to mitigate the effects of glare on drivers in late April and mid-August. All mitigation planting would be maintained at a height of between 2m and 3m. This can be seen in the following figure:

Figure 1: Mitigation Planting Plan

The agrivoltaic development will require regular maintenance (such as cleaning of the solar PV panels and ground maintenance). Sheep will be grazed within the site to help keep the grass down.

The following overall layout plan shows the general layout of the proposed development. Full site layout plans are appended to this report as appendix four.



FOR CONSENT

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SOLAR FARM
NZ CLEAN ENERGY
CORNWALL ROAD, MASTERTON

OVERALL LAYOUT ACCESS ROUTES

Issue	Description	Checked	Date
1	Culverts amended	GCW	13.10.23
2	Revised Layout	GCW	06.11.23
3	Revised Layout	GCW	08.11.23
4	Culverts amended	GCW	14.11.23
5	Track amended around Wetland	GCW	29.11.23

		Date
Designed:	RRC	09.10.23
Drawn:	RRC	09.10.23
Checked:	GCW	09.10.23

Scale: 1:7500 (A3 Original)

Job No: B23067 | Dwg No: 3000 | Rev: 5

C:\ProgramData\12DSynergy\data\CKL-AZU-SYN-1\C1 - Engineering_23841\01 Engineering Design\Modelling\C3D DWGs\B23067-ED-ENGDATA-Solar Farm Acc

Examples[1] of the key components of the proposed development are illustrated in the following figures:

Figure 2: Typical solar Single Axis Tracking PV table configuration.

Figure 3: Typical Inverter.

[1] Subject to change during detail design.

Figure 4: Example of BESS Units.

Figure 5: Typical Substation and switchyard.

Site Location

The application site is located on a rural site at 3954A State Highway 2, Waingawa, in the eastern half of the block contained between SH2 to the north, Cornwall Road to the east, Hughes Line to the south and East Taratahi Road to the west. The legal description and title of the site are:

a) Pt Lot 2 DP 2099 (RT WNF1/1189)
b) Pt Lot 3 DP 2099 (RT WNF1/1188)
c) Pt Lot 1 DP 46533 (RT WN17B/749)
d) Lot 1 DP 19148 (RT WN765/45)
e) Pt Lot 4 DP 2099 (RT WND1/413)
f) Lot 1 DP 17189 (WN638/13)
g) Lot 1 DP 3447 (WN248/15)
h) Pt Lot 4 DP 2099 (WN213/272)

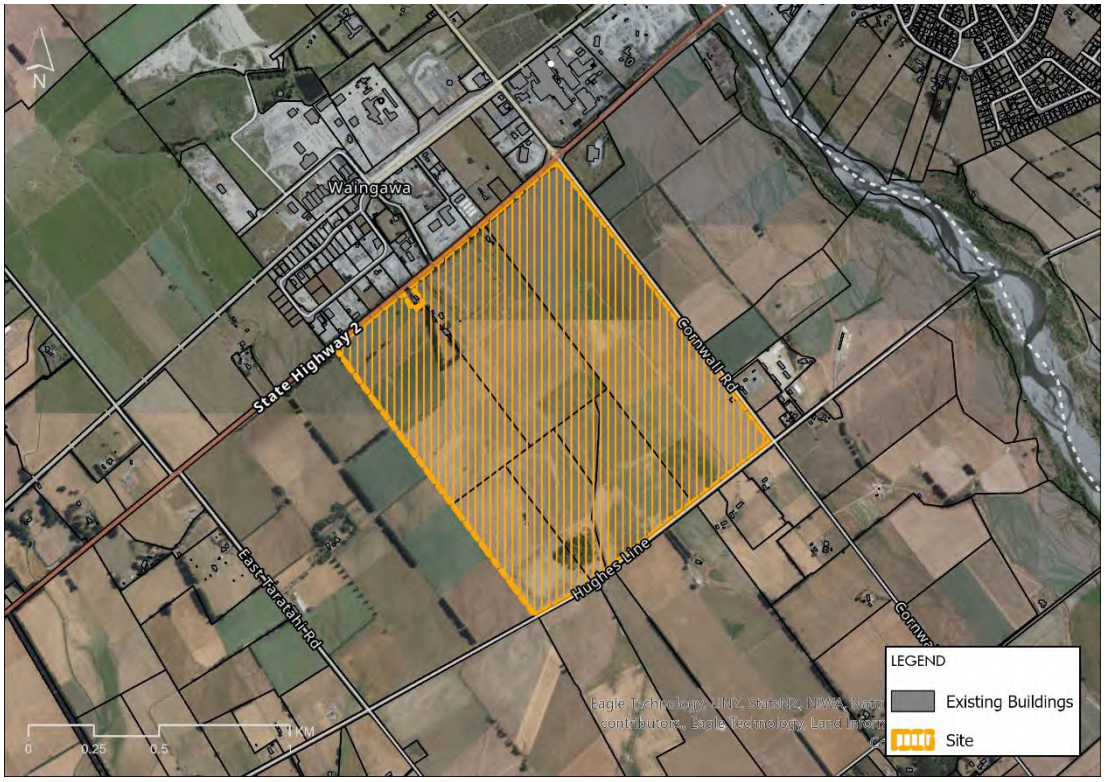


Figure 6: Site Location - 3954A State Highway 2, Waingawa.

The agrivoltaic development site is located within the General Rural Zone ("**GRUZ**") under the Proposed Wairarapa Combined District Plan.

The Waingawa River, approximately 750m to the east of the agrivoltaic development site, has been identified as a significant water body, as has a small area of wetlands (Ref SNc12) at the end of David Lowes Lane, north of the site. The site is not located in or near any Outstanding Natural Features of Landscapes ("ONFL"), Significant Natural Areas ("SNA"), Significant Amenity Landscapes ("SAL") or areas of High or Very High Natural character ("HNC"/"VHNC"). The closest Outstanding Landscapes (OL) are the Tararua Forest Park (approximately 12km to the north of the site) and the Maungaraki Ridge (approximately 17km to the southeast of the site). The closest SAL is the Maungaraki Range. The closest SNAs are the Waingawa wetland and the Tararua Range (to the north), the Tenair wetland (to the southeast) and the Lowes Bush wetland (to the southwest).

EXISTING LANDSCAPE CONTEXT AND VALUES

The following section of this report describes the existing landscape and identifies its associated values. The wider landscape surrounding the site is described to provide the context within which the application site and its surroundings (i.e. that part of the landscape potentially affected by the proposal) is experienced. While the proposed development is not likely to affect the existing wider landscape context (in a discernible way), it is important to understand the relationship between it and the landscape characteristics of the site and its immediate surroundings.

This approach is consistent with the current best practice approach and the recommendations contained within the *Te Tangi a te Manu - Aotearoa New Zealand Landscape Assessment Guidelines.*

The Wider Surrounding Landscape Context

Situated to the immediate west of Masterton, New Zealand, the landscape offers a unique blend of natural and man-made elements. Set within the larger geological context of the Wairarapa Valley, the area is bounded by the Tararua Range to the west. The formative processes shaping this landscape include tectonic activity, erosional forces, and sedimentary deposition, resulting in an undulating terrain characterized by valleys and low-lying hills.

Key Features Influencing the Landscape:

a. Location within the Wairarapa Valley and proximity to the Tararua Range.
b. Varied topography, ranging from undulating hills to flat plains.
c. The Waingawa and Waipoua Rivers, whose erosional activity has carved the landscape.
d. Pockets of native bush, notably within the Tararua Forest Park.
e. Agricultural land use, mainly sheep and cattle farming.
f. Commercial forests, predominantly consist of plantation pine.
g. Infrastructure elements such as local roads, rail links, and the Masterton Aerodrome.
h. Scattered rural settlements and isolated dwellings.
i. Recreational areas, including parks and hiking trails.
j. Small quarries and agricultural infrastructure like barns and sheds.

Over time, land development practices have altered the original native vegetation, transforming it into a mosaic of agricultural land, commercial forestry, and fragmented native bush.
These features provide the context within which the application site and its immediate surroundings are interpreted and assessed.

The various characteristics of the wider landscape can be seen in the following photographs:

Figure 7: Flat alluvial landscape associated with the mid Masterton Basin looking south towards the Maungaraki Range from SH2.

Figure 8: Flat open pasture within the site looking southwest to the more highly contained planting patterns and backdrop of the Maungaraki Range.

Figure 9: Open pastoral landscape with limited planting within the southern part of the site, looking towards the existing substation and agricultural contractors' buildings, to the southeast. Backdropped by the Maungaraki Range.

Figure 10: Flat alluvial landscape associated with the Masterton Basin and Waingawa River terraces looking towards the Waingawa industrial area, SH2 shelter rows and Tararua Range to the north.

Figure 11: Looking north from East Taratahi Road, more highly contained planting patterns (shelter rows and hedges), scattered rural dwellings and backdrop of the Tararua Range.

THE APPLICATION SITE AND SURROUNDING LANDSCAPE

The site is located approximately 1.2 km southwest of Masterton and is bounded by State Highway 2 to the north, Cornwall Road to the east and Hughes Line to the south. The topography of the landscape containing the application site is flat. Located to the west of the Waingawa River, the site is characterised by its agrarian land use.

Biophysical Factors

Geology and Geomorphology

Geologically, the Wairarapa is divided into four distinct landscape features. These are the Tararua and Rimutaka Ranges to the west, the Pahiatua Basin in the north, the central Masterton basin, and the eastern hill country and uplands. The ranges and hill country act to contain the lower basins, having influenced their formation.

The application site is located in the central Masterton basin on the late Pleistocene river deposits associated with the Waingawa River between the Masterton and Carterton fault lines.
Many of the more subtle geomorphological features in the wider landscape have been heavily modified by land development and farming practices, such as the development of the industrial area to the north and cultivation.

The proposed development site is set back from the upper river terrace associated with the Waingawa River by approximately 130m (at its closest point), and from the current riverbed and its vegetated margins (to the east) by approximately 700m by the open pastoral farmland to the east.

The subtle topographical patterns that influence the geophysical character of the site can be seen in the following shade map figure:

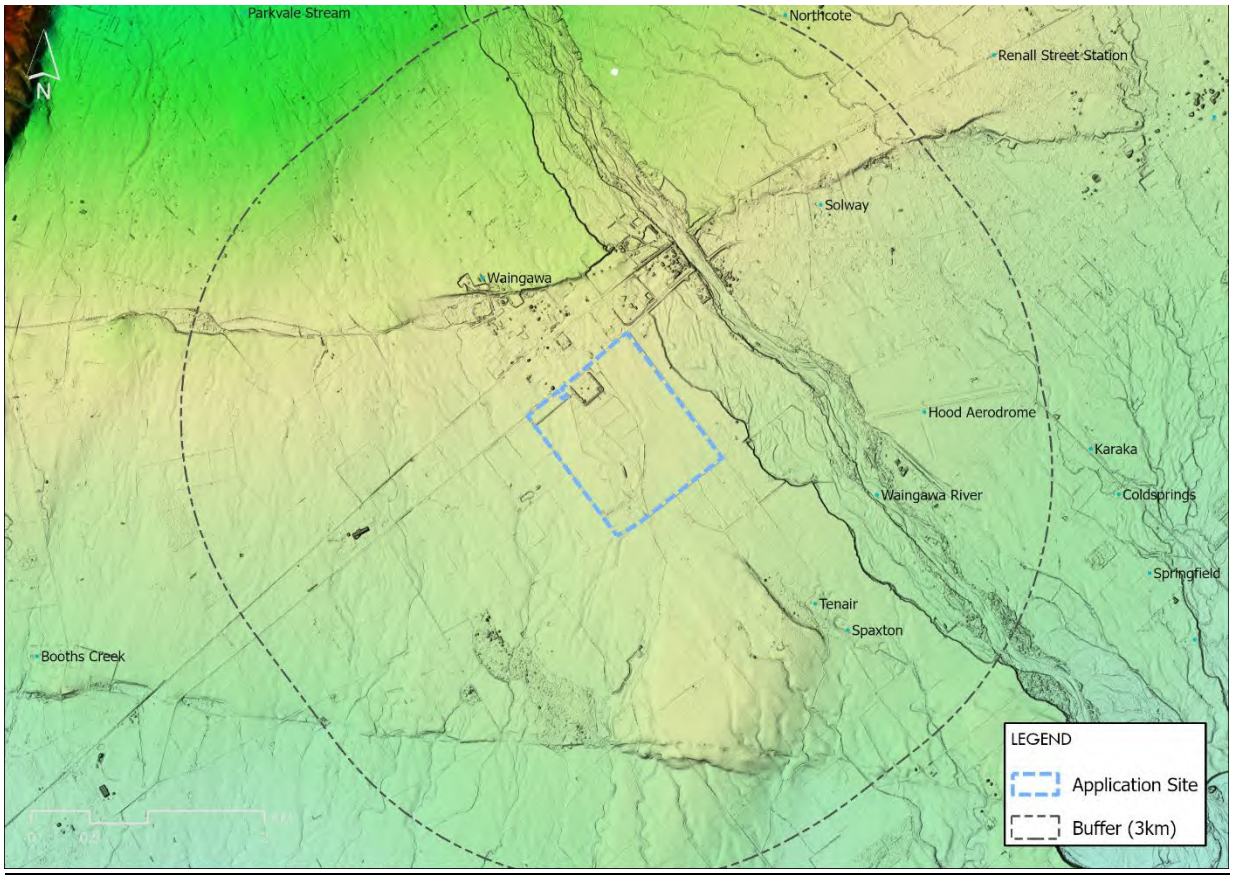


Figure 12: Topographic relief map showing subtle variation in the underlying alluvial landform.

Cadastral Patterns, Settlement, Rural Development and Planting Patterns

Subdivision patterns in this part of the Masterton basin (within 3km of the application site) comprise large rural lots, large industrial lots, medium size lifestyle lots and residential lots. Lots sizes and distribution patterns are typical of an urban-to-rural transect (Figure 11), with smaller lots associated with the residential; area in the west of Masterton giving way to larger industrial lots and then rural lots.

Figure 13: Rural to Urban Transect

Small pockets of residential and rural residential lots can be found amongst the larger rural lots and along the road network (Figure 12).

Figure 14: Cadastral patterns surrounding the application site.

Subdivision patterns are typically geometric, with lot boundaries tending to be rectilinear, except for where they follow landscape features such as the banks of the Waingawa River, Waikoukou Stream/ Taratahi water race and tracts of vegetation and/or areas of wetland.

<u>Vegetation Patterns</u>

From along SH2 and the surrounding road network, rural planting patterns also influence the character of the surrounding rural landscape, where shelterbelts, scattered clusters of deciduous specimen trees, curtilage and amenity planting characterise and compartmentalise the landscape to a greater extent.

The limited vegetation within the application site enables views from the south, east, and west, along Hughes Line and the slightly more elevated sections of Perry's Road, Cornwall Road, and East Taratahi Road. From the north, northwest and northeast, views are largely screened by pockets of vegetation within the surrounding rural landscape and the industrial area to the north.

Except for a tall established row of pines, macrocarpa and cypress, that forms a shelter belt along the northern boundary of the site and to the east of the woolshed, a short row of poplars growing on the existing bunding in the north-west of the site, and the dense grove of willow growing in the wetland area in the southern part of the site, there are few other tall trees or tracts of vegetation within the agrivoltaic development site. A few weedy and advantageous species have been established in and

around the old oxidation ponds associated with the former tannery that occupied the site. This can be seen in the following photographs:

Existing species observed within the site include:

a.	*Pinus* sp.	Pine
b.	*Cupressus macrocarpa*	Macrocarpa, Monterey Pine
c.	*Cupressus* sp.	Cypress
d.	*Populus* sp.	Poplar
e.	*Eucalyptus* sp.	Gum
f.	*Platanus* sp.	Plane
g.	*Kunzea ericoides*	Kanuka

Figure 15: Planting observed within the site.

Perceived and Experienced Factors

Landscape Expression, Cohesion and Memorability

The landscape has been modified by rural land use and areas of industrial development; however, the formative processes that created the underlying landform are still apparent, influencing the natural characteristics of this part of the landscape.

While the formative processes associated with the wider Masterton basin are still evident at a large scale, as shallow depressions, overland flow paths and old river channels, the formative processes and landscape features associated with the more recent Holocene alluvial deposits within the lower terraces and banks of the Waingawa River (in the vicinity of the application site) are more evident and manifest themselves as flood paths, dry river channels and the current active riverbed.

Human modification to the site and the surrounding landscape includes historic indigenous vegetation clearance and conversion to pastoral farmland, modification of natural drainage patterns and the construction of bunds, water courses and treatment ponds associated with a fellmongery (tannery) operation (in the early to mid-1970s). By the mid-2000s, fellmongery operations appeared to have ceased within the site.

The plain landscape is expressive of its alluvial origins, with its containing topography, the Rimutaka Range and Eastern Uplands forming the enclosing skylines.

While the site and its immediate area to the south and west manifest a rural character, the proximity of Masterton to the east and the presence of industrial land use to the north, and within scattered pockets of farmland to the east (such as the composting facility at the eastern end of Hughes Line) means that the site is peri-rural.

On a broad scale, the site is visually cohesive but unremarkable. As such it is not particularly memorable (in the sense that it can be easily differentiated from other parts of the surrounding rural landscape).

Aesthetic Qualities and Visual Amenity

Existing amenity values are primarily derived from the visual characteristics of the site and the wider landscape within which it is contained. The character of the site and its immediate surroundings is influenced by the relatively flat rural pastoral landscape of the Masterton Basin, contained by more dramatic bush-covered ridgelines of the Rimutaka Ranges to the north and the less dramatic hill country associated with the Eastern Uplands to the south. Views across the landscape are generally open, compartmentalised in placed by rural plantings, shelterbelts, and the occasional patch of native bush.

The more natural margins of the Waingawa River are juxtaposed by the modified appearance of the Waikoukou Stream/ Taratahi water race, which has been channelised through the application site into a series of linear water races.

Landscape and visual amenity values are influenced by the highly developed characteristics of the industrial development at Waingawa, Masterton to the east, and the electricity transmission network and substation of Cornwall Road the wider surrounding rural landscape.

Key landscape features that contribute to the wider landscape aesthetic qualities and visual amenity include:

a. Views of the open pastoral landscape, dissected by rural planting patterns (shelterbelts, and specimen trees), fence lines, transmission lines and riparian vegetation (Waingawa River margins).
b. Views of the Rimutaka Range and Eastern Uplands.
c. The Waingawa River.

Objectives and Policies within the Operative and Proposed Wairarapa Combined District Plan ("**OWCDP**" & "**PWCDP**") aim to protect the amenity values of the Waingawa River (Significant Water Body) to the east, Significant Natural Areas (Waingawa Wetland, Trenair wetland and Lowes Bush wetland) to the north, southeast and southwest, the Tararua Forest Park (Outstanding Landscape and

SNAs), to the north and Maungaraki Range Main Ridge (Outstanding Landscape and Significant Amenity Landscape), to the southeast of the site.

Attributes which contribute to amenity values in the surrounding landscape can be seen in the following photographs:

Figure 16: Visual amenity provided by tall roadside vegetation.

Figure 17: High amenity view across the Waingawa River to the Tararua Ranges to the North.

Figure 18: Views across the open rural landscape to the Eastern Uplands.

Associative Factors

Shared and recognised values within and surrounding the site include:

a. Amenity/aesthetic values associated with the open pastoral rural landscape, the Waingawa River, and views towards/experience of the Tararua Ranges and Maungaraki Range Main Ridge.
b. Limited recreational activities, including walkways (such as the river side tracks) and cycling routes.
c. The identified Significant Water Bodies of the Waingawa River and Waingawa Wetland (to the east and north of the site respectively).
d. The identified SNAs to the north (SNc12 Waingawa Wetland and SNm02, SNc07 and SNs02 Tararua Forest Park) and south (SNc09 Trenair Bush) of the site, and the Lowes Bush Scenic Reserve SNA (SNs01, PWCDP only), to the southwest of the site.
e. The identified Outstanding Landscapes (OL) of the Tararua Forest Park to the north of the site and Maungaraki Ridge (OWCDP only) to the southeast of the site.
f. The identified Special Amenity Landscape (SAL6, PWCDP only) of the Maungaraki Main Ridge.
g. The identified statutory area (PWCDP only) and Recommended Area for Protection (RAP 5, both PWCDP and OWCDP) of Allen/Lowes Bush Scenic Reserve (indigenous forest remnant, wetland), to the south of the site.

The statutory area of Lowes Bush Scenic Reserve has been identified as holding the following associative values for Ngāti Kahungunu ki Wairarapa Tāmaki nui-a-Rua:

> *This repo is a part of the traditional Taratahi lands of Ngāti Kahungunu. Lowes Bush Scenic Reserve and the wider wetlands are a key area for indigenous flora and fauna and mahinga kai. The traditional connection of Ngāti Kahungunu to what us now Lowes Bush Scenic Reserve is evidenced by the creation of eel fishing reserves when the surrounding land was alienated in the early 1850s.*
>
> *Lowes Bush Scenic Reserve has some of the best examples of indigenous flora, especially Kahikatea, and the preservation of these trees is a focus for Ngāti Kahungunu and the community in this area. This repo is important because of its relatively northern location where there are even fewer wetlands than the southern lakes' area of Wairarapa Moana.*
>
> *The marae community that includes Lowes Bush Scenic Reserve in their whenua tawhito (traditional lands) is Hurunui-o-Rangi and the hapū from that marae and for that land is Ngāi Tāneroa. Hurunui-o-Rangi is associated with Ngāti Kahungunu through whakapapa and tikanga, including the powhiri process. Ngāi Tāneroa has a whakapapa association with Ngāti Kahungunu through Kahungunu's uncle, Uhenga Ariki who was the husband of Tāneroa[2].*

And Rangitāne Tū Mai Rā (Wairarapa Tamaki nui-ā-Rua):

> *Lowes Bush Scenic Reserve lies on the Taratahi plains between modern day Masterton and Carterton. The plains between the Waingawa River and Wairarapa Moana were once a vast swamp land covered with lowland kahikatea forest. The bush was a popular bird-snaring area with creeks and swamps providing kōkopu, koura, tuna and Te Hau (a specific variety of eel). Lowes Bush is one of the last significant remnants of the Kahikatea Swamp.*
>
> *Although the swamp lands meant that Rangitāne travellers preferred to use the Ruamahanga River to travel south from Masterton, there was an overland route across the Taratahi plains and on to the Papawai area. The Taratahi name means 'one peak'. It refers to the area known today by non-Māori as Mount Holdsworth, which is the most prominent peak in the Tararua Ranges when viewed from Hauhaupounamu (modern day Carterton).*

[2] Page 14, Appendix 1: Ngāti Kahungunu ki Wairarapa Tāmaki nui-a-Rua Statutory Acknowledgement. Full Proposed Plan.

During the second half of the nineteenth century Rangitāne ancestors associated with the Taratahi area included Raniera and Marakaia Tawaroa and Ngatuere Tawhirimatea Tawhao. Rangitāne know of an old Rangitāne pā site to the east of the scenic reserve[3].

Ngāti Kahungunu ki Wairarapa Tāmaki nui-a-Rua and Rangitāne Tū Mai Rā (Wairarapa Tamaki nui-ā-Rua) have also identified associative values for the peaks of the Tararua Range (Arete (hill), Mount Hector (peak), Pukeahurangi / Jumbo and Pukeamoamo / Mitre), the Ruamahanga River (with headwaters in the Tararua Range) and its tributaries (which includes the Waingawa River). These include:

Ruamahanga River is the most significant river in the South Wairarapa District and runs from its source in the northern Tararua Ranges, south through the Wairarapa plains to Lake Wairarapa, and out to the sea at Palliser Bay. All of the main valley rivers run into it including the Kopuaranga, Waipoua, Waingawa, Tauweru, Waiohine and the Huangarua. For Rangitāne o Wairarapa, the river is an ancestral waterway, which many hapū refer to as their awa in their pepeha. The waters of the river are seen as the blood which flows through the veins of Papatūānuku, the earth mother. The waters are referred to as 'Te Wai Ora', (the life giving water), which is important for maintaining the health and well-being of all life forms[4].

The Tararua Ranges are a key feature in Rangitāne identity and history. Rangitāne traditions state that the iwi is descended from the original ancestors who first journeyed through the area and named the Tararua Ranges[5].

Of the associated values identified above, the key associations relate to sites of significance to Ngāti Kahungunu ki Wairarapa Tāmaki nui-a-Rua and Rangitāne Tū Mai Rā (Wairarapa Tamaki nui-ā-Rua), the surrounding natural features (including the Tararua Range, Maungaraki Range, Waingawa River, SNA wetland areas), as well as the surrounding rural landscape.

Existing Landscape Character and Values

When considered within the context of the landscape biophysical, perceptual, and associative attributes, the existing landscape character and values of the site are influenced by its industrial and rural location, between the Waingawa River (with associated riparian margin vegetation), to the east and the backdrop of the Tararua Range (to the north) and Maungaraki Range/ Ridge (to the southeast).

The key attributes that contribute to the existing landscape value and visual amenity of the site and its wider surroundings include:

a. The spatial relationship between the natural areas, including the Waingawa River, the wetlands within the site and the wetland areas within the wider surrounding landscape (the SNAs to the north and southeast of the site and Lowes Bush Scenic Reserve, to the south), the Tararua Range and Maungaraki Range/ Ridge and the modified rural landscape and industrial area of Waingawa.
b. The aesthetic values associated with views towards the bush-clad slopes of the Tararua Range Forest Park backdropping the site to the north and the Maungaraki Range/ Ridge, backdropping the site to the southeast.

[3] Page 12, Appendix 2: Rangitāne Tū Mai Rā (Wairarapa Tamaki nui-ā-Rua) Statutory Acknowledgement. Statutory Areas: Rangitāne Tū Mai Rā (Wairarapa Tamaki nui-ā-Rua) Claims Settlement Act 2017. Full Proposed Plan.
[4] Page 10. Appendix 2: Rangitāne Tū Mai Rā (Wairarapa Tamaki nui-ā-Rua) Statutory Acknowledgement. Statutory Areas: Rangitāne Tū Mai Rā (Wairarapa Tamaki nui-ā-Rua) Claims Settlement Act 2017. Full Proposed Plan.
[5] Page 17. Appendix 2: Rangitāne Tū Mai Rā (Wairarapa Tamaki nui-ā-Rua) Statutory Acknowledgement. Statutory Areas: Rangitāne Tū Mai Rā (Wairarapa Tamaki nui-ā-Rua) Claims Settlement Act 2017. Full Proposed Plan.

c. The aesthetic and natural values associated with the Significant Water Bodies, Significant Natural Areas (SNAs), Amenity and Outstanding Landscape Areas (OLA) landscape features of the Waingawa River and Waingawa Wetland, Trenair Bush, Lowes Bush Scenic Reserve, the Tararua Range Forest Park and the Maungaraki Range/ Ridge.
d. Modification to the application site and surrounding landscape by historical clearance of indigenous vegetation and conversion of the land to pastoral farmland and the urban and industrial areas of Waingawa (including the old tannery treatment ponds and the irrigation system within the site) and Masterton.

The broader landscape surrounding the site, including the more elevated natural landscapes to the north, west and south provides the background context within which the site is interpreted. Key features that enhance the broader landscape character and amenity values include the Tararua Range Forest Park, the Maungaraki Range Ridge, the Waingawa Wetland, Tenair Bush and Lowes Bush SNAs and the Waingawa River. These features are of ***high*** landscape value due to their contribution to local character and amenity. They will be, however, unaffected by the proposed agrivoltaic development.

Landscape values of the application site and immediate surrounding landscape range between ***low*** (where the landscape has been highly modified by industrial development associated with the, now disused, oxidation ponds, within the site and adjacent industrial areas and ***moderate*** (immediate surrounding rural landscape). When considered collectively, the overall landscape value of the site and its immediate surroundings is ***low-moderate.***

EXISTING NATURAL CHARACTER

Section 6(a) of the RMA requires, amongst other things, the preservation of the natural character of wetlands, lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development.

The Waingawa River, Waingawa Wetland, Tenair, and Lowes Bush Scenic Reserve are at a sufficient distance from the application site for their natural character values to remain unaffected. Natural character effects assessment of the proposal on these features has therefore not been undertaken.

Natural character effects related to the Waikoukou Stream/ Taratahi water race and the natural wetland areas within the site have been assessed.

Natural character is defined as the distinct combination of an area's natural characteristics and qualities, including the degree of naturalness.

The *Te Tangi a te Manu Aotearoa New Zealand Landscape Assessment Guidelines* state:

> *Current best practice is to integrate natural science and experiential aspects. The context and purpose of the assessment influences whether the focus is on naturalness (degree of natural character) informed by attention to natural characteristics and qualities or on the specific characteristics and qualities themselves.*[6]

Natural character is described in terms of its biotic, abiotic, and experiential characteristics and is rated from *very low* to *very high* using a 7-point scale.

The following description is a precis of the natural character values associated with the site and how these are interpreted in the context of the wider study area.

The existing natural characteristics of the site and surrounding environment are influenced by the following factors and are described in terms of:

- *Physical natural elements and processes including abiotic aspects (e.g., landform and water, hydrological processes, geomorphology, climate) and biota aspects (flora and fauna, ecology).*
- *How they are perceived and experienced including how natural the area appears (how apparent or dominant the human structures or activities are), and how the area's natural aspects are experienced and appreciated….*[7]

Existing Natural Character Values

The key attributes and characteristics of the wetlands, rivers, and streams (and their margins) potentially affected by the proposed development include:

Physical Factors: Natural Elements and Processes (Abiotic and Biotic)

a. The Waikoukou Stream/ Taratahi water race (within the site) and its margins have been substantially modified. The stream has been channelised into a water race and no natural margins or riparian areas remain. The natural overland flow paths have been modified by earthworks associated with the construction of the old tannery oxidation ponds and the irrigation system within the site.

[6] Para 9.57 *Te Tangi a te Manu Aotearoa New Zealand Landscape Assessment Guidelines*

[7] Para 9.21. *Te Tangi a te Manu Aotearoa New Zealand Landscape Assessment Guidelines*

b. Six natural wetlands have been identified within the site, none of which contain indigenous vegetation (previously modified through the clearance of indigenous vegetation and introduction of exotic vegetation). Most of the wetland areas are clustered within the willow woodlot located within the south of the site and provide bat roost and skink habitat.

Experiential Factors: How the Natural Elements and Processes are Perceived and Experienced

a. The formative patterns and processes associated with the Waikoukou Stream/ Taratahi water race have been highly modified (channelised and exotic planting patterns (including pastoral grassland) and have replaced indigenous stream margin species).
b. The presence of the Waingawa industrial zone (and other large industrial buildings such as the Ballance agri-nutrients store), the substation (near the intersection of Cornwall Road and Hughes Line), Masterton and the modifications associated with the development of the rural landscape (channelising of streams, land clearance and exotic vegetation) reduces the extent of naturalness of these features and reduces the sense of remoteness associated with this area.
c. The wetland areas within the site have memorable scenic qualities (willow woodlot), enhanced by the presence, and sounds of wildlife mainly terrestrial bird species, bats, lizards and skinks).
d. The aesthetic coherence is diminished where the more natural-appearing landscape adjoins a more highly developed/modified landscape.

When taken together, these attributes result in a ***very low*** to ***low*** natural character value for the Waikoukou Stream/ Taratahi water race and its margins, and the wetlands within the application site and its immediate surrounding landscape. This can be seen in the following photographs.

Figure 19: Channelised section of the Waikoukou Stream/ Taratahi water race.

Figure 20: Willow woodlot containing natural wetland areas within the southwest of the site.

ASSESSMENT OF EFFECTS ON LANDSCAPE NATURAL CHARACTER AND VISUAL AMENITY

Ratings

The rating system used is consistent with the recommended 7-point scale contained within *Te Tangi a te Manu - Aotearoa New Zealand Landscape Assessment Guidelines.*

Document	Effect Rating						
Te Tangi a te Manu - Aotearoa New Zealand Landscape Assessment Guidelines	Very Low	Low	Low - Moderate	Moderate	Moderate -High	High	Very High
Act/Policy	Threshold						
RMA	Less than Minor		Minor	More than Minor		Significant	

Where the level of effect ranges between ratings on this scale, a split rating is provided (e.g., *Low-Moderate* to *Moderate*). A *Low* effect rating that is *less than minor* is identified as such.

EFFECTS ON NATURAL CHARACTER

The proposed development will not result in modifications to the existing abiotic or biotic attributes of the Waingawa River, Waingawa Wetland, Tenair, and Lowes Bush Scenic Reserve due to physical and visual separation.

The proposed agrivoltaic development will involve minimal earthworks, mainly for internal roads and the construction of the BESS and substation pads. The PV table piles will be driven directly into the ground, preserving the remnant overland flow paths and ephemeral water courses. The existing water courses within the site (channelised) will not be altered.

Most of the natural wetland areas identified within the site are located within the willow wood lot within the southern part of the site and will be fenced off, with the proposed development setback 10m from these wetland areas.

Overall, the proposed development will have a ***no effect*** outside of the site and a ***very low*** adverse effect on the remnant natural character values of the wetlands, Waikoukou Stream/ Taratahi water race and their margins within the site.

LANDSCAPE EFFECTS

This section of the report considers the effects of the proposed development on the existing landscape attributes and characteristics identified within the existing landscape context and values section of this report.

Effects on Landscape Character

When effects on landscape character are considered collectively, the proposal will have a ***low*** adverse effect on the key features and the overall characteristics of the landscape within and immediately surrounding the application site. The proposal will not affect existing landscape character outside the visual catchment within which it is contained. Because this is well below the minor effects threshold of the RMA, these effects are not discussed in this report.

Although the proposed development will introduce a new element to the landscape, diminishing the open spatial and rural qualities, its use for solar power generation aligns with that of the existing substation situated at the intersection of Cornwall Road and Hughes Line. While the character of the surrounding landscape is predominantly rural, it is influenced by the utility and function of the electrical infrastructure network and the presence of the existing substation in the vicinity. The addition of an agrivoltaic development will shift the balance from a predominantly rural landscape towards a landscape with a stronger emphasis on electrical generation, while still retaining its rural essence (due to the retention of agricultural land use). With the establishment of the proposed agrivoltaic development, the site will become a hybrid landscape, which blends elements of agricultural land use with renewable energy infrastructure.

The location of the proposal adjacent to the existing industrial zone (located on the northern side of SH2) and the existing substation will allow it to integrate successfully with the existing surrounding land use patterns and will reinforce and consolidate the existing compact form of Waingawa industrial area and Masterton (where industrial development already straddles both sides of SH2).

The proposed location of the agrivoltaic development adjacent to the existing Waingawa industrial zone will serve to mitigate broader effects on rural character. This development approach consolidates growth alongside an already established area, ensuring that other rural regions remain undisturbed. While acknowledging that the character of the site will transform, it is important to note that this is not indicative of rural sprawl.

Within the context of the wider surrounding rural landscape and adjacent industrial area, the proposed development will not:

a) Affect existing topographical patterns within the site or its surroundings (to the extent that it would affect landscape character).
b) Affect wider rural land-use patterns.
c) Affect the characteristics of any outstanding landscape areas, amenity landscape areas or Significant Natural Areas experienced from within the landscape immediately surrounding the application site (Such as the Tararua Ranges and the Maungaraki Ranges).
d) Affect wider perceptions of rural amenity and character.

The proposal will alter the site's character from predominantly rural, with an electrical infrastructural component, to a landscape characterised by the proposed development.

Due primarily to the relative scale of the development seen within the wider context of the surrounding rural environment, and the limited number of locations from where the full extent of the change will be experienced, the adverse effects of the proposal on amenity values associated with the wider existing landscape character will be ***low-moderate***.

Outstanding Natural Features and Landscapes, Significant Amenity Landscapes and Areas of High or Very High Natural Character.

The site is not located in or near any Outstanding Natural Features of Landscapes ("ONFL"), Significant Natural Areas ("SNA"), Significant Amenity Landscapes ("SAL") or areas of High or Very High Natural character ("HNC"/"VHNC"). The closest Outstanding Landscapes (OL) are the Tararua Forest Park (OWCDP and PWCDP), approximately 12km to the north of the site, and the Maungaraki Ridge (OWCDP), approximately 17km to the southeast of the site. The closest SAL is the Maungaraki Range (PWCDP). The closest SNAs are the Waingawa wetland and the Tararua Range (to the north), the Tenair wetland (to the southeast) and the Lowes Bush wetland (PWCDP), to the southwest.

The features will not be physically affected by the proposed agrivoltaic development. Effects on the amenity values associated with views towards these features are discussed in the following section.

EFFECTS ON VISUAL AMENITY

Section 7c of the Resource Management Act (RMA) requires the maintenance and enhancement of amenity values.

The *Te Tangi a te Manu - Aotearoa New Zealand Landscape Assessment Guidelines*[8] states:

> *Visual matters are integral to landscape rather than a separate category or factor. Physical, associative, and perceptual dimensions are each experienced visually (as well as through other senses).*[9]

The visual effects of the proposed development have been assessed from twelve representative view locations surrounding the site and rated using a standardised rating system (appended to this report as appendix two).

While the proposed agrivoltaic development will be visible from all identified view locations, the effects will vary depending on the context in which they are seen, and the screening that is provided by several factors including topography, vegetation, existing buildings, and distance. Due to a combination of existing vegetation within and surrounding the site, intervening topography, and the development within the Industrial Zone to the north, there are relatively few locations surrounding the site, where direct views of the agrivoltaic development site can be obtained.

A summary of the findings is presented below.

Visual Catchment

As part of the initial investigation into the potential visibility of the proposed development, a zone of theoretical visibility (ZTV) analysis was carried out. The ZTV analysis used a digital surface model (DSM) derived from lidar elevation data to identify locations in the surrounding landscape from where

[8] The *Te Tangi a te Manu - Aotearoa New Zealand Landscape Assessment Guidelines* were adopted by the NZILA in May 2021, replacing the NZILA Best Practice Note: Landscape Assessment and Sustainable Management 10.1 (NZILA BPN 10.1).

[9] Para 4.30. Te Tangi a te Manu - Aotearoa New Zealand Landscape Assessment Guidelines (Final)

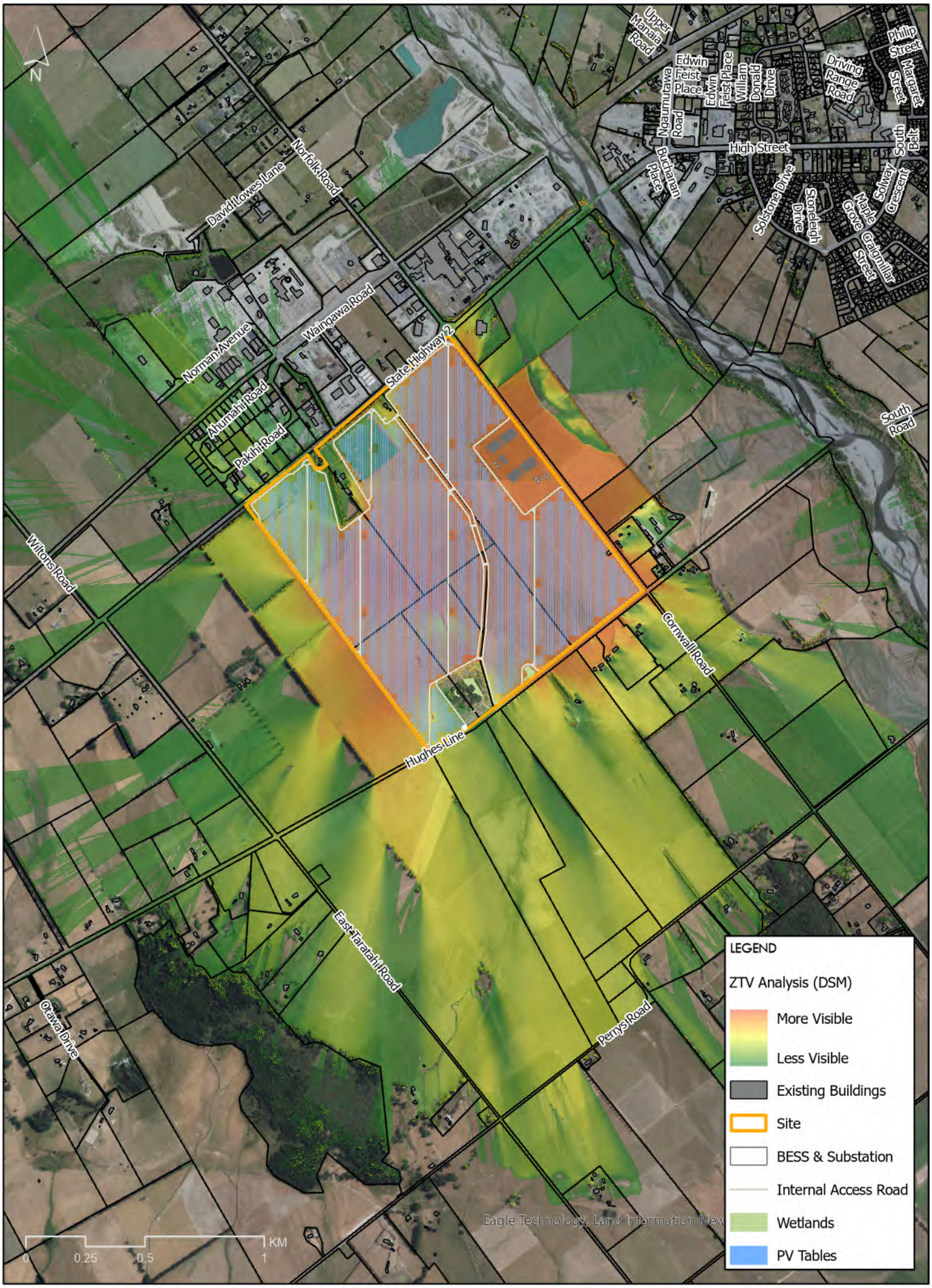
the development would be potentially visible. Existing features such as buildings, shelterbelts and large areas of vegetation that will screen the proposed development from view are included in the DSM.

A ZTV map has been produced, to identify the visual catchment within which the proposal would be potentially visible (at its maximum height).

Key findings from the ZTV analysis and site investigation are:

a. The proposed site is potentially visible from a limited area to the northwest, north, east, southeast, south, and southwest (with views from the west and north largely screened from view by the existing rural planning patterns to the west, and the industrial zone to the north).
b. Field verification confirmed that the large industrial buildings within the Waingawa industrial zone in combination with a planted earth bund alongside the industrial zone along SH2 as well as extensive shelter row planting along the northern boundary of the application site will significantly restrict views of the proposed development from surrounding public (and private) locations to the north.
c. Field verification also confirmed that extensive existing vegetation in the rural landscape to the west of the site (shelterbelts, hedges, and specimen trees) will significantly restrict views of the proposed agrivoltaic development from surrounding public (and private) locations to the west.
d. The nearest publicly accessible viewing opportunities are afforded from SH2 (to the north), Cornwall Road (to the east), and Hughes Line (to the south), located immediately adjacent to the site.
e. The nearest residential dwelling is located immediately adjacent to, and surrounded on three sides (to the east, west and south) by the application site (accessed off SH2). The next closest dwellings are located approximately 100m – 200m to the south and southeast of the site (along Hughes Line). Intervening curtilage planting and rural vegetation, restrict views from each of these dwellings, with the substation located at the corner of Cornwall Road and Hughes Line and dwellings and ancillary buildings also restricting views from the dwellings located further southeast of the site along Hughes Line.
f. Site inspection identified that the clearest views of the site would be from the dwelling accessed off SH2), Cornwall Road and Hughes Line, all of which are located immediately alongside the application site.

The following ZTV analysis map shows the general visibility of the proposed development.



Zone of Theoretical Visibility (DSM)

Masterton Solar & Energy Storage | Scale 1:20,000 at A4 | November 2023 | Map No-01 | R0

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View Locations and Viewing Audience

Several potential view locations were investigated as part of the assessment, with twelve selected as being representative of the range and types of views available to the public.

The potential viewing audience was identified to likely comprise:

a. Residents along SH2, Cornwall Road, Hughes Line, Perry's Road and East Taratahi Road;
b. Members of the public using SH2 (motorists); and
c. Members of the public using Cornwall Road, Hughes Line, Perry's Road and East Taratahi Road (Motorists, pedestrians, cyclists, equestrians etc).

Several potential view locations were investigated but not included in this assessment for the following reasons:

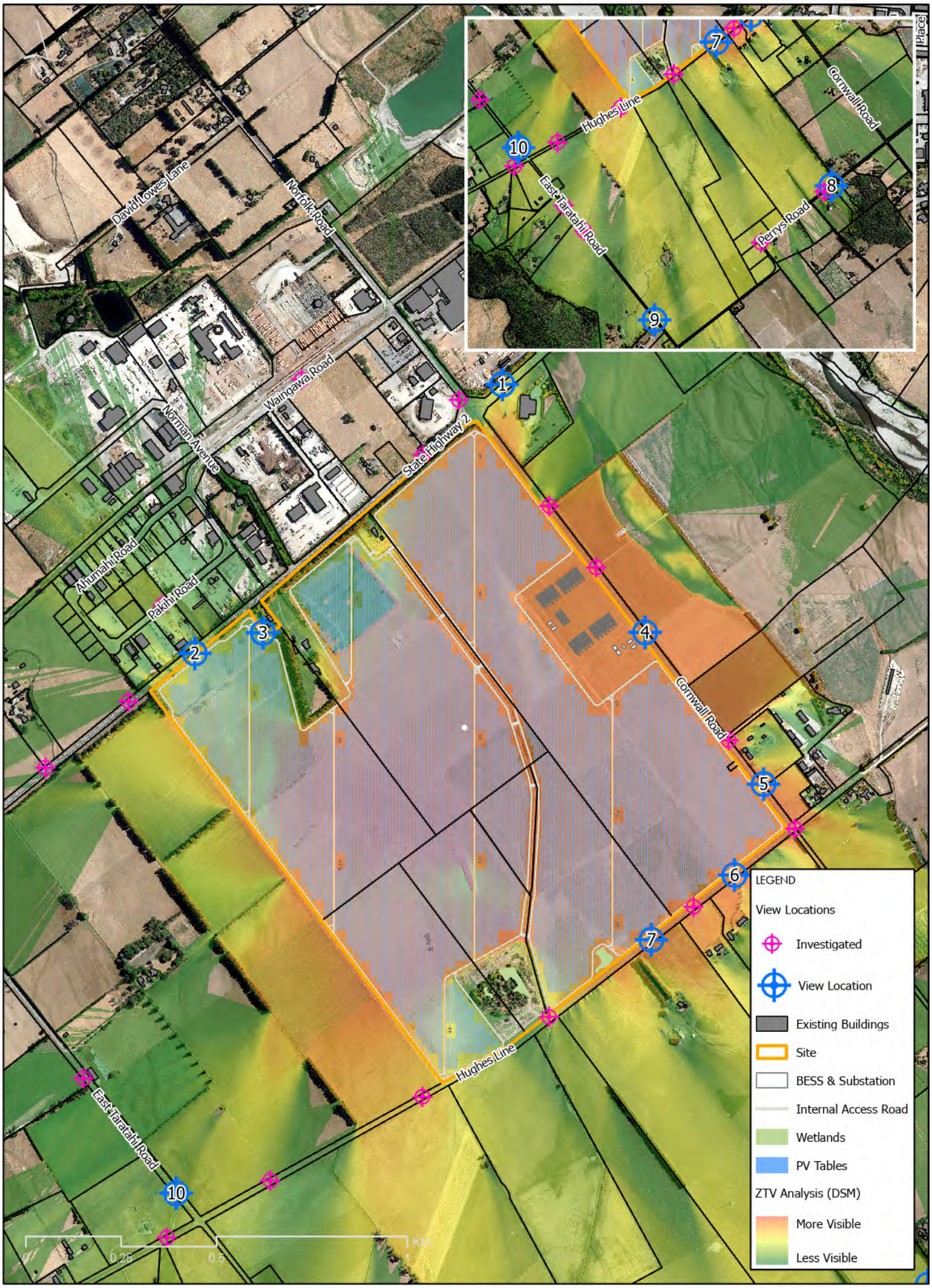
a. While visible, the effect of the proposed agrivoltaic development on landscape character, natural character and/or visual amenity would be well below the minor threshold of the RMA) (i.e., have no or negligible effect); and
b. The potential view location was like another view location.

Potential view locations from the walkway alongside the Waingawa River, to the east of the site were investigated, however, it was found that the proposed development would be screened from view by intervening topography (associated with the river trench and adjacent river terraces) and the vegetation within the river margins.

Potential view locations were also investigated from within the Waingawa industrial zone (Waingawa and Pakihi Road), but it was found that the proposed agrivoltaic development would be very difficult to discern from the industrial zone due to the industrial buildings and activities located within this zone, the vegetated screen bund which runs alongside the northern side of State Highway 2 (SH2), and the shelterbelt planting along the northern site boundary.

Field investigation identified that views of the site to the west, from along East Taratahi Road and Wiltons Road would be very difficult to discern due to extensive intervening planting between these roads and the site.

All selected and investigated view locations are identified on the view location map below. Photographs from each VL identified and assessed and photomontages from VL2, VL4, and VL6 (prepared in accordance with NZILA best practice document 10.2) are included in Appendix seven.



View Location Map

Masterton Solar & Energy Storage

Scale 1:12,500 at A4 | November 2023 | Map No-02 | R0

mansergh graham LANDSCAPE ARCHITECTS

Visual Absorption Capability

One of the main factors that will influence a development's visual effect is the visual absorption capability of the surrounding landscape. This is the ability of the landscape to integrate a development or feature into its existing visual character without significant change.

Each view location has been rated in terms of its visual absorption capability (VAC). Factors considered in determining the site's VAC rating include:

a. The degree to which the development is visible;
b. Visual and physical links with other similar elements or activities in the landscape (e.g. other industrial buildings);
c. The level of modification to the surrounding landscape (short and long term);
d. Appropriateness of scale;
e. Distance;
f. Backdrop; and (in some instances);
g. Atmospheric conditions.

Notable views of the site are generally restricted to within 1.5km of the site. Views of the proposed agrivoltaic development from locations more than this distance diminish to the point that they are generally less frequent due to intervening topography, vegetation, or buildings.

The site's ability to absorb the proposed development ranges from *Poor* to *Very Good*. The definitions for the ratings and the visual absorption ratings for all view locations are attached in appendix three of this report.

The *Very Good* ratings occur from locations that are generally some distance from the site (beyond 500m), or where the development will be screened by vegetation or buildings and backdropped by topography, vegetation, and/or screened by or seen within the context of the existing Waingawa industrial development. *Neutral* to *Good* ratings occur from locations where the development will be partially screened by and seen within the immediate context of the existing substation.

The *Poor* ratings occur from locations where direct views are available, with little screening provided by intervening topography, vegetation, or existing buildings (within 200m of the site) and limited energy generation context.

Solar Glint and Glare

Glare is defined as a source of continuous bright light (as opposed to a momentary flash), reflected off the surface of an object and experienced by an observer in a fixed location or from a slow-moving observer. Glint is a momentary flash of bright light and is more typically received by moderate to fast-moving observers[10] (motorists along roads or those using boats in surrounding waterbodies) or from moving reflectors (such as a moving solar tracking table, car windscreen or wind turbine blade).

Both glint and glare are considered to be visual effects.

Solar glint and glare are a relatively common phenomenon in the existing environment and is temporary. Glint and glare are a function of:

a. the angle of incidence at which light strikes the surface of the panel; and
b. index of refraction of the front surface of the panel.

Under clear sky conditions the single-axis tracking photovoltaic system (with the solar PV panels on tables arranged in north-south arrays across the site, enabling east-west sun tracking), as proposed, has the potential to produce glare in the early morning and early evening, when the sun is low on the horizon and there are no obstructions (e.g., topography, vegetation, structures, etc.) between the sun and the PV panels.

PV Panel Design

The proposed photovoltaic panels are designed to maximise the amount of light that is received by the photovoltaic cells within the panel. The use of an anti-reflective coating means that any reflected light will be diffuse, rather than specular, reducing the effects of any glare that occurs on the receiver, with approximately only 4% of the sun's rays reflected off the surface of the panel. This is illustrated in the figure below:

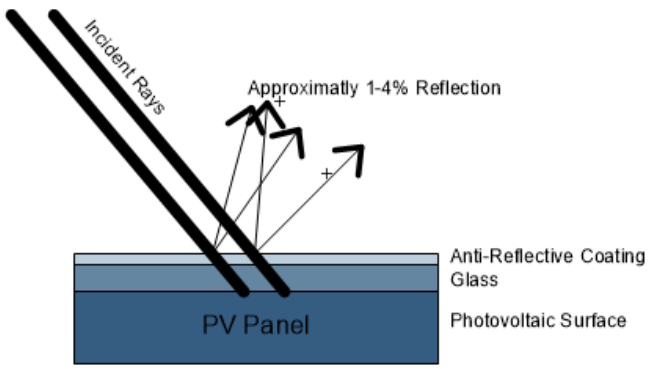


Figure 21: Diffuse Reflection

Glint and Glare Analysis Methodology

A glint and glare analysis has been undertaken for the application site using *ForgeSolar GlareGauge* analysis software. The software conforms to the American Federal Aviation Authority (FAA) guidelines. The analysis takes into consideration the methodological recommendations from similar

[10] *Solar Photovoltaic and Building Development – Glint and Glare Guidance*. PagerPower Urban and Renewables. September 2022.

overseas studies and guidelines, including Appendix C of the New South Wales (NSW) guidelines for the implementation and assessment of large-scale solar farms in Australia[11].

The Appendix C of the New South Wales Guidelines recommends the following:

> *The glint and glare assessment should represent a 'worst case' scenario that assumes no cloud cover throughout the year. The assessment should address the general requirements outlined below and in **Table 7**. The glint and glare assessment include:*
>
> - *a description of the proposed PV panels, indicating:*
>   - *the axis of rotation and maximum tilt angle*
>   - *the light absorption efficiency and/or refractive index values at different angles*
>   - *whether any backtracking is proposed and the time and duration of these operations*
>
> - *results of the glint and glare analysis for each assessable receiver*
> - *identification of existing vegetation or built structures and a qualitative assessment of whether these features would eliminate or reduce the modelled impacts*
> - *a justification for excluding any modelled glare results because they would be insignificant due to the size, position and luminance of the glare source, or high ambient luminance.*
> - *details of strategies to either avoid or mitigate impacts including re-siting or sizing the project, altering the tracking patterns, implementing vegetation screening, or entering into agreements with landholders if all other measures have been exhausted.*[12]

[11] Large-Scale Solar Energy Guideline. Department of Planning and Environment. NSW Government..August 2022.

[12] Page 50. Large-Scale Solar Energy Guideline. Department of Planning and Environment. NSW Government..August 2022.

Table 7 of the guidelines is included below:

Table 7: Glint and glare requirements			
	Scope	***Methodology***	***Performance objective***
Residential receivers	*All residential viewpoints within 3 km of the proposed solar array that have a line of sight.* *Representative viewpoints may be used for residential receivers that are clustered together (see additional guidance in the technical supplement).*	*Analysis of the daily and yearly glare impacts in minutes.* *All residential receivers must be assessed at a height of 1.5 m above ground level.*	*See impact ratings and performance objectives for residential receivers outlined in **Table 2**.*
Road and Rail	*All roads and rail lines within 1km of the proposed solar array.*	*Solar glare analysis to identify whether glint and glare are geometrically possible within the forward looking eyeline of motorists and rail operators.*	*If glare is geometrically possible then measures should be taken to eliminate the occurrence of glare. Alternatively, the applicant must demonstrate that glare would not significantly impede the safe operation of vehicles or the interpretation of signals and signage.*
Aviation	*All air traffic control towers and take off/landing approaches to any runway or landing strip within 5km of the proposed solar array.*	*Solar glare analysis that is worst case in all scenarios accounting for all aircraft using the airport (e.g. gliders, helicopters etc).*	*Any glint and glare should be avoided unless the aerodrome operator agrees that the impact would not be material (e.g. occurs at times when there are no flights or would not pose a safety risk to airport operations).*

Table 2 of the NSW guidelines provides the following guidance in terms of effect levels and duration:

Table 2: Impact rating and performance objectives for glare impacts to residential dwellings		
High glare impact	**Moderate glare impact**	**Performance objective**
> 30 minutes per day > 30 hours per year	< 30 minutes & > 10 minutes per day < 30 hours & > 10 hours per year	< 10 minutes per day < 10 hours per year
Significant amount of glare that should be avoided.	Implement mitigation measures to reduce impacts as far as practicable.	No mitigation required.

Because the potential for glint and glare only exists in locations with a direct line of sight to the proposed agrivoltaic development, the visual catchment identified through the ZTV analysis was used to identify and select observer points (OP) for analysis and potentially affected dwellings and occupied buildings and roads within 3km of the site.

Analysis points and routes are identified in the following figure:

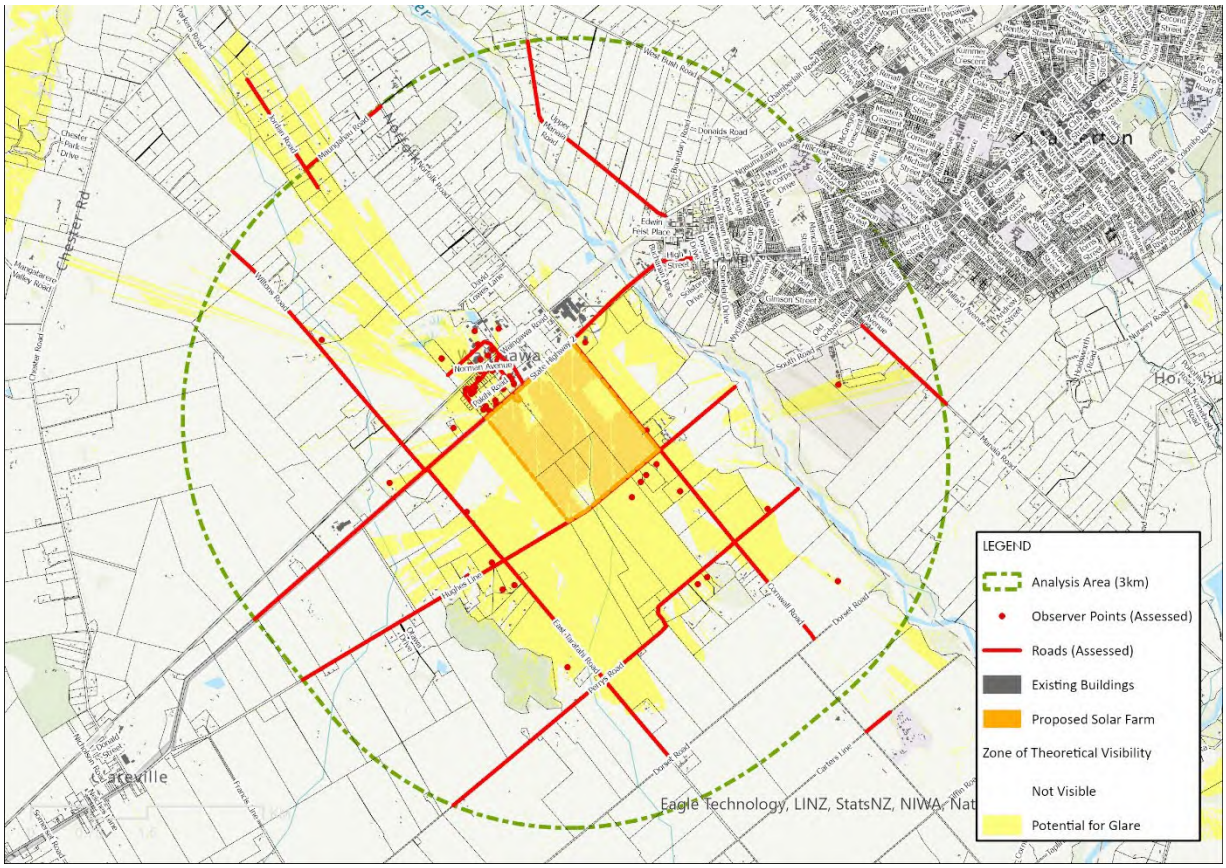


Figure 22: 3km Analysis area, Roads, and Observation Points

Maps and a table showing all the locations assessed are found in Appendix 6.

It should be noted that the effect of glint or glare diminishes over distance, as reflected light is increasingly diffused. Overseas guidance documents (refer to appendix six) suggest:

> *There is no technical limit (distance) within which solar reflections is possible for a surrounding dwelling receptor however, the significance of a reflection decreases with distance. This is because the proportion of an observer's field of vision that is taken up by the reflecting area diminishes as the separation distance increases*[13]*;*

These documents also recommend that effects associated with glint and/or glare on surrounding roads and dwellings should be considered within 1km of the solar farm site[14] as follows:

Overall

- *National roads, or those with greater significance, within approximately 1km of a proposed solar PV development that may have a view of the PV panels should be assessed. Dwellings within approximately 1km of a proposed solar PV development that may have a view of the PV panels should be assessed.*
- *Terrain heights and an additional height to account for the solar panel and eye level within the relevant floor of the dwelling should also be considered.*

Dwellings

[13] Page 50. *Solar Photovoltaic and Building Development – Glint and Glare Guidance*. PagerPower Urban and Renewables. September 2022.
[14] *IBID*

- *Identify dwellings in the immediate surrounding area (out to approximately 1km from the solar PV development boundary) that may have visual line of sight to the solar panels.*
- *If visual line of sight exists between the proposed solar PV development and a dwelling, then a solar reflection could be experienced if it is geometrically possible. If there is no line of sight, then a reflection cannot be experienced.*
- *An additional height should be added to the ground level at a dwelling to represent a viewing height.*
- *For dwellings, a recommended additional height of 1.8 metres above ground level should be added to account for eye level on the ground floor, with additional floors being assessed as required. Additional heights should be considered where a receptor is higher than a first floor. Modelling is recommended for ground floor receptors because it is typically the most occupied during daylight hours*[15]*.*

Roads

- *Identify roads in the immediate surrounding area (out to approximately 1km from the solar PV development boundary) that may have visual line of sight to the solar panels;*
- *If visual line of sight exists between the proposed solar PV development and the road, then a solar reflection could be experienced if it is geometrically possible;*
- *Assess a length of road, choosing individual receptor locations no more than 200 metres apart*
- *An additional height should be added to the ground level height to represent the typical viewing height from a road user. For road users, a height of 1.5 metres is recommended*[16]*;*

For this study, the potential glint and glare of the proposed agrivoltaic development was assessed to 3km surrounding the site so that the effects of glint and glare on landscape and visual amenity (as opposed to its nuisance value) could be taken into consideration as part of the landscape and visual assessment.

Observer Point and Route Selection

Dwellings, within the visual catchment of the application site (ZTV) and 3km of the site, were identified in the aerial photography and selected as Observer Points (OPs) for analysis.

Route receptor locations, along the sections of road and rail that traverse the visual catchment were identified. Analysis points for each route were identified at 100m intervals, with the driver's eye-level height of 1.2m.

Existing Screen and Proposed Mitigation Planting

Existing screen planting was identified from the aerial photography and a screen height of 3m was applied to vegetation within the site (to allow for topping), and 10m was applied to existing shelterbelts outside of the site for analysis purposes (allowing for trimming). The proposed landscape and visual amenity planting were mapped and a screen height of 2m (the minimum visual mitigation height at which the screening will be maintained) applied.

Preliminary Analysis and Glare Mitigation Planting

Preliminary analysis indicated that green and yellow glare would potentially affect a small part of Hughes Line. Glare mitigation planting was added to the model and the analysis was re-run.

Hood Aerodrome

Glint and glare analysis of the take-off and landing approaches of the runways at the Hood Aerodrome are not addressed in this report.

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[15] Page 51. *IBID*.

[16] Page 59. *Solar Photovoltaic and Building Development Glint and Glare Guidance.*

Software Limitations and Assumptions

While the *ForgeSolar GlareGauge* software is used extensively throughout the world to help predict glint and glare and uses an algorithm developed by the Sandia National Laboratories in the USA for the assessment of effects on observers, routes and flightpaths, the software works on the following key assumptions and limitations:

(1) *Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.*
(2) *The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results.*
(3) *Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.*
(4) *Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.*
(5) *The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)*
(6) *The algorithm assumes that the PV array is aligned with a plane defined by the approximate total heights of the PV vertices. For increased accuracy, the user should perform runs using minimum and maximum values for the vertex heights to bound the height of the plane containing the solar array. Doing so will expand the range of observed solar glare when compared to results using a single height value.*
(7) *The algorithm does not automatically consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.*
(8) *The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.*
(9) *The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.*
(10) *The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modelling methods.*
(11) *Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.*
(12) *Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.*

As such, the results of the glint and glare analysis should be considered a worst-case scenario and indicative of where glint and glare are more likely to occur.

Locations potentially affected by glint or glare are shown on the above Glare Analysis Map.

Glint and Glare Assessment Report Results

The ocular impact of solar glare can be quantified into three categories (indicating the potential effects of after image from each category):

- Green - low potential to cause after-image (flash blindness)
- Yellow - potential to cause temporary after-image.
- Red - potential to cause retinal burn (permanent eye damage. Red glare is only likely to occur where the sun's rays are focused by a concave reflector and do not usually result from reflection off solar voltaic panels.)

The analysis indicates that glare will **not** be experienced at any of the fixed observer locations (OP).

Without mitigation, up to 69 minutes of green glare and 6 minutes of yellow glare per annum may be experienced from along a short section of Hughes Line in late April and mid-August. No other roads or the railway line will be affected.

Summary of Effect of Glint and Glare on Surrounding Observer Points and Routes

Location Type	With Visual Mitigation	Additional Glare Mitigation Required
Observer points (Private dwellings and commercial buildings)	***No Effect***	None
Routes (Road and Rail)	***No Effect*** (except for along a short section of Hughes Line in late April and mid-August)	3m glare mitigation planting is required as shown in the mitigation planting plan.

During situations such as extreme weather events or failure of certain equipment may be caused as the mounting system stows at a predetermined angle (often 5°) to protect the array during such events.

The limitations of the software are also important to note (as discussed in the software limitations section above). The Glint and Glare simulation uses a “Clear Sky” model simulation, which represents the worst-case scenario (i.e., does not include clouds or other atmospheric conditions which would reduce glint and glare). In addition, because the glint and glare software only uses two elevation reference points to analyse the glint and glare potential from surrounding viewer location points (the agrivoltaic development and the viewer location point), the analysis does not take into consideration intervening topography, vegetation, or buildings, which may screen, or partially screen the glint and glare associated with the proposed development from view. The degree of screening provided by existing topography, vegetation and/ or buildings located between the agrivoltaic development site and each of these OPs and sections of road identified as having glint or glare also needs to be considered. This has been discussed in the following analysis of visual effects from the identified view locations section of this report.

The glint and glare analysis represents a worst-case scenario and must be read within the context of the viewshed (ZTV) analysis provided on pages 32-33 of this report.

A copy of the ForgeSolar analysis report is found in Appendix six.

Analysis of Visual Effects from Identified View Locations

Refer to the View location map on page 35 of this report.

View Locations One and Two: State Highway 2 (SH2)

View Locations (VL) 1 and 2 are representative of the first views for motorists from the eastern and western approaches (respectively) to Waingawa, from along SH2, to the north and northwest of the site.

Views from these locations are shaped by several factors, including the busy SH2 infrastructure with its crash barriers and wire division fencing, the industrial area of Waingawa to the north of SH2, the Ballance agri-nutrient store at the corner of SH2 and Cornwall Road, and the rural landscape to the south of SH2. A vegetated bund separates SH2 from the industrial zone to the north, while extensive shelter rows and specimen tree planting line most of the southern side of SH2, limiting views across the broader rural landscape, including the application site to the south. In these areas, the rural landscape is characterized by flat, low-lying terrain typical of the Masterton Basin and the Waingawa River valley, featuring open pasture, shelter rows, hedgerows, clusters of specimen trees, remnant wetland bush stands, transmission lines, and post and wire fencing.

The Maungaraki Range serves as a backdrop to the site when viewed from these locations.

Existing visual amenity values are derived from fleeting views (between gaps in vegetation) across the rural landscape to the Maungaraki Range in the distance to the south. The State Highway corridor is characterised by its transitional nature at the gateway into Masterton and its location between the industrial landscape area to the north and the rural landscape to the south.

Because these viewer locations are at a similar elevation to the proposed development site, most of the development will be out of sight, concealed by the PV tables that are closer to the observer. Screening from the shelter row/ hedge planting along this stretch of SH2, the large Ballance agri-nutrients store and rural planting patterns within the surrounding landscape will further restrict views of the proposed agrivoltaic development from these viewer locations.

The proposed development will mainly be experienced at an oblique angle and fleetingly by motorists, between gaps in the shelter row (VL2), and between this vegetation and the Ballance agri-nutrients store located at the corner of Cornwall Road and SH2 (VL1). As it is not possible to stop easily along this stretch of SH2 due to the intensive highway infrastructure and the speed environment, these viewer locations are assessed as transitory, with the viewing audience likely to be less sensitive to any change in the characteristics of the site.

From VL1, the low profile of the proposed development, seen below the skyline of the Maungaraki Range, and against the dark tones of the vegetative backdrop will allow the proposal to appear grounded within the landscape, aiding in integrating it with its surrounds. From VL1 the proposal will be observed more directly for slightly longer periods, as motorists slow to a stop at the roundabout intersection of SH2 and Cornwall Road. From VL2, the proposal will be more prominent (due to proximity) and obscure the base of the Maungaraki Range but will be seen more fleetingly, between gaps in vegetation along SH2 as motorists travel at a higher speed (without stopping).

While a small part of the proposed development will be able to be seen from along the state highway, it will not be prominent and will be experienced within the context of the visually complex surrounding landscape patterns.

The construction of the agrivoltaic development will result in a small shift in the landscape character experienced from these locations, introducing a new element which is not frequently experienced into the view. Where experienced through the gaps in the shelter row, the existing views across the open pastoral landscape will give way to a hybrid landscape, which blends elements of agricultural land use with renewable energy infrastructure.

The proposed development's presence will be characterized by the coexistence of solar panels with retained pasture and grazing sheep. This juxtaposition creates a unique character type, where traditional agricultural activities harmonize with modern energy production. It can be described as a "rural-agricultural energy landscape," reflecting the dual purpose of the land for both farming and sustainable power generation. This new character type will embody a synergy between traditional rural practices and environmentally conscious technologies.

From VL1 and VL2 the effect of the development on visual amenity will be ***low*** (*less than minor*). No additional mitigation is required for these locations.

View Location Three: 3920 State Highway 2 (SH2)

VL3 represents the views of the proposed agrivoltaic development from the property at 3920 SH2 (Lot 1 DP 27627), which is surrounded by the application site on three sides (east, west & south). The visual assessment was undertaken from the southwestern property boundary. Consideration was given to the effects from within the property by extrapolating the likely views from surrounding locations and using analytical modelling.

The mature pine shelter belt that runs along the SH2 boundary, tall mature trees within the property and the tall mature pine shelter row to the south of the dwelling (west of the yards within the site) create a sense of containment and enclosure.

The existing planting within the property and the site restricts views to the wider rural landscape from the lower storey and garden, allowing only narrow viewshafts to the south, east, and west. Existing views (from the view location point) are characterised by a flat pastoral landscape within the application site, dissected by an earth bund (foreground), and rows of tall pine and poplar trees (fore to midground) within the application site. Between the trees, snippets of the Maungaraki Range and Tararua Ranges can be attained, enhancing the amenity of the view.

From the upper storey of the dwelling, wider views of the surrounding rural landscape to the south, and west, will be attainable. Glimpses of the industrial (Waingawa) landscape to the north may be possible. To the east of the dwelling, views into the, now disused, tannery oxidation pond area are attainable. These views are expected to be of lower visual amenity than the views to the west and south due to the more unkempt nature of this part of the application site.

The proposed development will have a notable effect on the outlook from the property at 3920 SH2 with the introduction of the PVC panels and perimeter access track nearby.

The construction of the agrivoltaic development will result in a more significant shift in the landscape character experienced from this location, introducing a new element which is not currently

experienced into the view, with the PVC panels to the west located within approximately 15m of the property boundary.

The agrivoltaic development's presence will be characterized by the coexistence of solar panels with retained pasture and grazing sheep. This juxtaposition creates a unique character type, where traditional agricultural activities combined with modern energy production will introduce a dual-purpose land use comprising farming and sustainable power generation. This new character type will embody a synergy between traditional rural practices and environmentally conscious technologies.

To the west, the proposed gravel permitter track, and the PV tables will likely be visible from the lower storey of the dwelling and the garden. The perimeter access road, which will run between the boundary and the closest PVC table will be slightly wider, but similar in appearance to the existing farm tracks within the site. To the east and southeast, the PV tables and access track will also be visible but will be slightly further away than the PV tables to the west (which are located more immediately alongside the property boundary. Parts of the BESS and substation may also be seen to the southeast (in the distance) above the PV tables.

The topping and removal of the shelterbelt along SH2 (to the east and west) and the reduction in the height of the pines around the yard will open up views to the south from the upper storey of the dwelling, with broader views over the proposed agrivoltaic development, including views of the gravel track around the perimeter of the PV tables, the inverters and internal access roads (within the solar field) and the BESS and substation area, will likely be afforded from the upper storey of this dwelling.

Due to proximity, the 2.9m high PV tables (at maximum tilt) will appear visually prominent within the various views from this location and are likely to intrude into the existing views across the open pastoral landscape to the Maungaraki Range.

From the upper storey of this residence, the proposed development will have an adverse effect on the open spatial characteristics in the application site by introducing a new feature into the landscape, changing the appearance of the landscape from one predominantly covered in pasture to one predominantly covered in solar panels and associated (BESS/substation) development (within the site).

The darker colour of the PV panels will visually contrast the lighter tones of the pasture within the site, and the geometric form of the solar panels, the BESS, the substation and associated gravel pad, the perimeter track and internal roads will juxtapose the existing natural form of the open pasture and vegetation within the site and surrounding rural landscape. This will draw further attention to the agrivoltaic development and highlight the change in character within the site.

From the lower storey and garden, views of the open rural landscape will be largely lost. Views of the wider surrounding rural planting patterns and the Maungaraki Range seen backdropping the site will likely be mostly screened when the PV tables are at full tilt. The Maungaraki Ridgeline will likely still be visible beyond the agrivoltaic development when the PV tables are positioned horizontally (at a 0-degree tilt).

While the proposed development will significantly alter the character of views of the application site from the upper storey of this dwelling, views beyond the site to the wider rural landscape however will be retained. The rural characteristics of the view experienced form the upper storey of this

dwelling will therefore not be lost but the ratio of open space observed within the view will be reduced. Due to the broad nature of the view from the upper storey, which likely includes glimpsed views of the Waingawa industrial area to the north, the proposed development will be seen within the much wider surrounding context, aiding in integrating it with its surrounds.

The adverse effects observed form the garden and lower storey of this dwelling will only be temporary while the proposed mitigation planting becomes established. As discussed in the mitigation strategy section of this report, planting will be established along the southwestern boundary of the property (infilling the gaps in the existing curtilage planting already surrounding the dwelling).

While the recommended mitigation planting will also obstruct views across the site and wider rural landscape, creating a contained instead of open outlook, it will reduce the effect of the agrivoltaic development on the existing rural outlook.

It will not be possible to mitigate views of the proposed development from the upper storey of this dwelling, due to the elevated nature of the view and the proximity of the dwelling to the boundary.

A permanent landscape character change within the application site (rural to agrivoltaic development) will therefore be experienced from the upper storey windows of this dwelling. However, as assessed above, while the proposed development will change the ratio of built and natural development seen within the view from the upper storey of this dwelling, it will not result in a loss of rural outlook (as views to the wider surrounding rural landscape and the Maungaraki Range / Ridge will be retained).

Temporary adverse effects on existing landscape and visual amenity values associated with the proposed agrivoltaic development from within the garden and the lower storey of this dwelling will therefore be ***moderate-high***, reducing to ***low-moderate*** with the establishment of the recommended mitigation screen planting. From the upper storey of this dwelling, adverse effects on existing landscape and visual amenity values will likely remain ***moderate-high***.

View Locations Four - Seven: Cornwall Road and Hughes Line

View Locations Four to Seven (VL4-7) are representative of views for motorists and residents along Cornwall Road and Hughes Line, to the east, southeast, and south of the site. VL4 is representative of views for potential future residents within the undeveloped land to the east of the site. VL5-7 represent views for existing residents to the south and southeast, accessed off Hughes Line.

These view locations afford views of the flat low-lying topography of the Masterton Basin and alluvial plains associated with the Waingawa River. The landscape features that characterise the surrounding landscape include open pasture, 220kV pylons, transmission lines, fencing, shelter rows, mature trees, the willow woodlot within the site, and stands of native bush. The substation at the corner of Cornwall Road and Hughes Line and an agricultural contractor's buildings break the skyline ridge and form focal points in the views from Cornwall Road and Hughes Line. The Tararua Range Forest Park massif provides a dramatic backdrop to the north and northwest, contributing to the existing visual amenity values from these locations.

The absence of planting along the eastern and southern boundaries of the site will allow clear views of the proposed solar PV tables, and perimeter track.

Public Views

From VL4, the BESS, substation and switchyard will be visible and will be visually prominent. The extent of the change within the site will also be more noticeable from this VL, with the PV tables seen surrounding and backdropping the BESS/substation. The BESS units, large metal containers with exterior venting fans and ventilation, will closely resemble shipping containers and will be arranged in blocks of parallel rows, aligned with the road. At the end of each row of BESS units an inverter unit will be visible, housed in a small (by comparison) electrical cabinet. The PV table structures will allow some views through and beneath the pasture within the site and continued grazing. In comparison, the BESS and substation area will appear more built-up (taller, larger structures on a large gravel pad) and more industrial than the photovoltaic panels, resulting in a slightly greater effect on landscape character and associated visual amenity.

Without mitigation, the PV tables, BESS, and substation will be clearly visible from VL4. The BESS and substation area will become increasingly difficult to make out from locations further southeast VL5 – VL7 due to the distance away and the screening provided by the adjacent PV tables.

From VL5-VL7 the PV tables will sit relatively low in the landscape, backed by planting, integrating them with the surroundings. However, the closest PV tables will appear more prominent, obscuring parts of the landscape beyond. Due to the relative elevation of the viewer (being at a similar elevation to the site), most of the development will be screened behind the PV tables in the foreground, with opportunities to look further into the site limited to along the rows between the PV tables.

During the day, the visual prominence, and extent of visual penetration into the site will change as the panels track the sun. The development will appear more prominent in the morning, when the panels are at a higher angle than during the middle of the day, when the panels will be closer to horizontal, reducing their visual mass when viewed from the adjacent roads.

From VL6 and VL7, the closest PV tables will obscure the pastoral foothills of the Tararua Ranges. The main spine of the ranges and skyline will remain visible above the development. The BESS, substation, switchyard, and associated buildings obstruct immediate views to the west from VL4.

Overall, existing landscape character and visual amenity values will change more noticeably from locations around VL4 due to the proximity of the BESS and substation area. However, these effects will be transitory, as viewers (motorists, pedestrians etc) will have passed other industrial and agricultural features before encountering the agrivoltaic development, reducing adverse effects.

Views for motorists from Cornwall Road and Hughes Line are at higher speeds and a more oblique angle, reducing viewer sensitivity to change. At the intersection of Cornwall Road and Hughes Line, the agrivoltaic development becomes slightly more visually prominent as motorists slow down, but adverse effects are still fleeting.

There is potential for glare from the solar panels to draw attention to the site for motorists further west of VL7 on Hughes Line.

From the public view locations along the road, the effects will be transitory, with viewers experiencing views of the agrivoltaic development within the context of the wider rural landscape, the existing substation and the Waingawa industrial zone. Viewer sensitivity to such changes is, therefore, lower than might be expected for a permanent resident with a similar view. As such, the

adverse effects on existing rural character and visual amenity values from these locations will likely be ***low*** (*minor* (VL5 – VL7)) to ***low-moderate*** (VL4).

While screen planting is not required to mitigate the public views along Hughes Line (VL6 and VL7) or most of Cornwall Road, it is required to mitigate the effects associated with the more visually prominent BESS/ substation development on motorists (in and around VL4). It is also required to mitigate adverse effects associated with the proposal from potential future residents adjacent to VL4 and existing permanent residents located adjacent to VL5 – VL7 (as discussed in the following paragraphs) and the potential effects resulting glare (refer to the solar glint and glare section of this report).

The proposed mitigation planting along Cornwall Road and Hughes Line (refer to the mitigation strategy section of this report) will screen views of the proposed development from VL4 – VL7, except for the taller components of the BESS (the substation switchyard), which will remain visible from VL4. While this proposed planting will create a more highly contained and compartmentalised character along these roads, it will reduce the effect of the development on the existing rural outlook.

Once the mitigation planting becomes established adverse effects from the public locations along the road will reduce to ***very low*** (VL5 – VL7) and ***very low*** to ***low*** (*less than minor* ((VL4)) from these locations.

Potential Future Development Along Cornwall Road

While there are currently no houses in the vicinity of VL4, the potential exists for a future dwelling under the PWCDP. Permanent residents in this area are likely to be more sensitive to changes in the landscape compared to public viewers (passing motorists/walkers etc). A future house constructed near VL4 would have a direct view of the BESS (Battery Energy Storage System) and substation, making any adverse effects from the development on landscape and visual amenity more noticeable compared to existing homes to the southeast and south. This could potentially have a ***moderate*** *effect*, depending on how close the future dwelling is to the BESS. However, the proposed mitigation planting would reduce these effects to a ***very low*** to ***low*** level, while preserving views of the Tararua Range.

573, 577 and 580 Hughes Line

VL5 is representative of views from the properties located at 573, 577 and 580 Hughes Line. Site investigation and desktop analysis suggest that views of the development will be partially screened from the main living courts for the dwellings at 573 and 577 by surrounding curtilage planting and utility buildings. While a narrow view shaft towards the agrivoltaic development will be afforded from within the western part of the property at 580 Hughes Line, views from the dwelling and the main outdoor living court will be substantially screened (minimising the likelihood of potential adverse effects).

From 573 Hughes Line, the existing shelter belts, a water tank, a utility shed, and a close-boarded post and rail fence located along the western property boundary will partially screen the application site from view. Where visible between these features, the site will be partially screened by, and seen within the context of the existing substation on Cornwall Road.

From 573 Hughes Line, unmitigated, a relatively small portion of the proposed PV tables will be visible in the foreground, introducing a new element into the site. The proposed BESS/substation will be

very difficult to discern due to the distance out (approximately 600m away). The proposed development will be seen immediately adjacent to the existing substation and will be experienced as an extension of the energy generation development (rather than a new type of development within the landscape). The much larger substation development will remain the focal feature within the view.

The proposal will reduce open spatial character within the site and may obscure parts of the base of the Tararua Range from view (when the PV tables are at full tilt). This will adversely affect existing visual amenity values associated with the rural outlook and the backdrop of the ranges experienced from this property.

Mitigated (refer to the recommended mitigation section of this report), the PV tables will be substantially screened. Views of the upper parts of the Tararua Range will be maintained, aiding in maintaining existing visual amenity values experienced from this property. While this planting will result in the reduction of open spatial character observed within the vista, it will reduce the effect of the development on the existing rural outlook.

Temporary adverse effects on landscape character and visual amenity values from the properties adjacent to VL5 are likely to range between ***no effect*** from 577 Hughes Line (extensive intervening screen planting and buildings), ***very low*** adverse effect from 580 Hughes Line (views of the proposal afforded from within western part of property, but not likely from dwelling or main outdoor living court) and ***low-moderate*** adverse effect from 573 Hughes Line (narrow view shaft to the northwest afforded from the outdoor living court of this property). Temporary effects from 573 Hughes Line will be reduced to ***low*** with the establishment of the mitigation screen planting.

510 – 558 Hughes Line

VL6 and VL7 are representative of views afforded from the cluster of properties located at 510 – 558 Hughes Line. The proposed agrivoltaic development will be experienced within views to the north and northwest, from these properties. Because the dwellings (and associated outdoor living courts) within these properties are oriented north/ northwest (towards the site), the proposed development is more likely to be experienced within these resident's main outlook.

There is a greater degree of intervening vegetation surrounding the properties at 558 and 510 Hughes Line, compared to 542 and 532 Hughes Line (where there is limited intervening vegetation). The mature shelter row along the northern site boundary of 558 Hughes Line will likely screen views of the proposal to the north (with only a narrow view shaft to the northwest likely seen).

The change that will be experienced from these properties will be similar to the public view (as described above). The difference is that views from these dwellings are setback from the road (approximately 100-200m), meaning the proposed development will be seen lower in the landscape and will be less visually prominent than when seen from the road. Due to the viewing angle and setback, more of the Tararua Range is likely visible form these dwellings than from the road.

Viewer sensitivity for these permanent residents is likely to be greater than for viewers travelling through the landscape (experienced form Cornwall Road). A permanent resident is more likely to observe changes in the surrounding landscape as they occur. While slightly less prominent due to setbacks from the road, the effects of the development on existing visual amenity values experienced by these residents will be higher than the public views.

From these properties, the development will be experienced within a limited existing energy infrastructure context (the existing substation will be seen in the distance, partially screened by the proposed PV tables and intervening vegetation in the foreground). The proposal will therefore be seen to introduce a new development type (agrivoltaic) within the site.

Like from the road, the proposed solar PV tables will obscure views of the open pastoral land within the application site and the base of the Tararua Range from these properties. The reduced rural outlook within the view and the partial obstruction of the Tararua Range will adversely affect visual amenity values. It should be noted that views of the surrounding rural landscape to the east, southwest and south will be retained from these properties as well as foreground views to the north and northwest (within each of these properties).

The proposed mitigation planting will screen most of the PV tables from view from each of these properties, with only the top of the PV panels likely visible when the tables are at maximum tilt and the mitigation hedge planting is at minimum height (the hedge will be maintained between 2-3m high). The proposed height of this planting will ensure that views to the Tararua Ranges beyond (above this planting), are retained, aiding in in preserving existing visual amenity values experienced from these properties.

Temporary adverse effects associated with the proposed development from the properties adjacent to VL6 and 7 are likely to be ***moderate*** from 558 and 510 Hughes Line (greater degree of existing screen planting) and ***moderate-high*** from 542 and 532 Hughes Line (less existing intervening planting). These temporary effects will reduce to ***low*** *(less than minor)* for 558, 510, 542 and 532 Hughes Line, with the establishment of the mitigation screen planting.

View Locations Eight – Ten: Perrys Road and East Taratahi Road

View Locations (VL) 8 - 9 represent elevated rural locations, for residents and road users along Perrys and East Taratahi Roads, to the south and southwest of the application site respectively. VL10 represents slightly elevated views for residents and road users of East Taratahi Road, to the west of the site.

From these locations, more extensive views are afforded over the site (where it is overlooked due to slight elevation). The view is predominantly rural from these locations, with limited industrial or energy infrastructure context visible. The application site sits nestled into the dark band of the SH2 road corridor planting, in the background of the view, at the base of the Tararua Range. Views across the landscape are characterised by the open nature of the pastoral landscape, with the occasional rural dwelling and associated ancillary buildings and curtilage planting. Rural planting patterns and curtilage planting surrounding rural dwellings have created a more highly compartmentalised landscape character within this part of the landscape than seen within the application site, with more frequent rural shelterbelts, hedgerows, and specimen tree planting.

Visual amenity values are derived from views across the rural landscape towards the dramatic, rugged peaks of the Tararua Range Forest Park in the backdrop which provides the focus of these vistas, drawing attention to the skyline.

Due to elevation (enabling overlooking), a greater extent of the proposed development (including parts of the internal access roads, and internal equipment (ie inverters)) may be visible from these viewer locations. However, the extensive intervening vegetation, and dwellings/ farm buildings

within the surrounding rural landscape will restrict views of the proposal to relatively narrow viewshafts from these locations. In addition, views of the site from these locations will be more difficult to discern due to the distance away (approximately 750m – 1.5km) and will be seen within the context of broad views across the wider surrounding rural landscape.

While the proposed agrivoltaic development will introduce a new development type within the landscape (hybrid rural-agricultural energy landscape), its low profile and small scale (in comparison to the wider surrounding rural landscape and the backdrop of the Tararua Range massive) means that it will represent a relatively small portion of the wider, visually complex landscape from these locations.

Like the views for the public along the Cornwall Road and Hughes Line, due to the orientation of Perrys Road and East Taratahi Road and the associated direction of travel, views representative of motorists/horse riders/walkers, are only likely to draw attention for a brief period.

From the view locations along the road (i.e. the public views), the effects will be transitory, with viewers experiencing views of the proposed development within the context of the wider rural landscape. As such, the adverse effects on existing rural character and visual amenity values from VL8 – VL10 will likely be ***very low***. Mitigation planting is therefore not required to mitigate the adverse effects on motorists from these viewer locations. The mitigation planting proposed along Hughes Line to mitigate visual effects from the properties adjacent to VL 6 and VL7 and the additional glint and glare mitigation planting (refer to the mitigation strategy section of this report and the mitigation planting plan in appendix five) will further reduce adverse effects from VL8.

518 and 534 Perrys Road and 353 Hughes Line

From most of the properties located near VL8 – VL10, a combination of intervening planting and buildings (dwellings, barns/utility buildings) will likely restrict views of the proposed development. There appears to be less/limited screening between the cluster of dwellings at 518 and 534 Perrys Road (VL8) and 353 Hughes Line (VL10) and the application site. The following paragraphs assess likely effects form these properties only.

Like from the public views from the road, the proposal will appear subservient within the view from these properties, difficult to distinguish within the visual complexity of the surrounding landscape, due to distance out. The focus of these vistas will more likely be drawn towards the open pastoral rural landscape within the foreground and the rugged peaks of the Tararua Range skyline, rather than the proposed development (which will form part of the distant backdrop to these views).

Views from these properties will therefore remain predominantly rural in character and views to the Tararu Ranges will not be affected, limiting adverse effects on visual amenity values derived from views across the rural landscape. As such, the adverse effects on existing rural character and visual amenity values from these locations will likely range between ***very low*** and ***low*** *(less than minor),* depending on the degree of screening afforded by intervening vegetation and buildings. Further reducing from VL8 (with the establishment of the proposed mitigation planting along part of Hughes Line).

It should be noted that visual mitigation planting was not deemed necessary along the western application site boundary, or the western extent of Hughes Line due to the absence of representative permanent residence within the vicinity of those site boundaries.

SUMMARY OF LANDSCAPE, NATURAL CHARACTER AND VISUAL EFFECTS

Effects ratings are summarised in the following table:

Summary of Effects *(adverse effect unless stated otherwise)*		
	Without Mitigation Planting	*With Mitigation Planting*
Landscape Effects		
Landscape character	***low-moderate***	***low-moderate***
Natural character	***no effect*** *to* ***very low***	***no effect*** *to* ***very low***
Visual Amenity Effects		
VL1 – public *SH2*	***low*** *(less than minor)*	***low*** *(less than minor)*
VL2 – public *SH2*	***low*** *(less than minor)*	***low*** *(less than minor)*
VL3 – private *3920 SH2*	***moderate-high*** *- lower storey and property* ***moderate-high*** *- upper storey*	***low-moderate*** *- lower storey and property only*
VL4 - public and private *Cornwall Road*	***low-moderate*** *- public* ***moderate*** *- private*	***very low*** *to* ***low*** *(less than minor) - public and private*
VL5 - public and private *Cornwall Road*	***low*** *(minor) - public* ***no effect*** *- 577 Hughes Line* ***very low*** *- 580 Hughes Line* ***low-moderate*** *- 573 Hughes Line*	***very low*** *- public* ***no effect*** *- 577 Hughes Line* ***very low*** *- 580 Hughes Line* ***low*** *(less than minor) - 573 Hughes Line*
VL6 - public and private *Hughes Line*	***low*** *(minor) - public* ***moderate*** *- 558 and 510 Hughes Line*	***very low*** *- public* ***low*** *(less than minor) - 558 and 510 Hughes Line*
VL7 - public and private *Hughes Line*	***low*** *- public* ***moderate-high*** *- 542 and 532 Hughes Line*	***very low*** *- public* ***low*** *(less than minor) -542 and 532 Hughes Line*
VL8 - public and private *Perrys Road*	***very low*** *- public* ***very low*** *to* ***low*** *(less than minor) - 518 and 534 Perrys Road*	***No effec****t to* ***very low*** *- public* ***No effec****t to* ***very low*** *- 518 and 534 Perrys Road*
VL9 - public and private *East Taratahi Road*	***very low*** *- public*	***very low*** *- public*
VL10 - public and private *East Taratahi Road*	***very low*** *- public* ***very low*** *to* ***low*** *- 353 Hughes Line*	***very low*** *- public* ***very low*** *to* ***low*** *- 353 Hughes Line*
Overall Landscape Character Effects (including visual)	***LOW-MODERATE***	***VERY LOW*** *to* ***LOW***
Natural Character Effects	***NO EFFECT*** *to* ***VERY LOW***	

RECOMMENDED MITIGATION

As identified in the landscape and visual effects section of this report, mitigation is required to reduce adverse effects associated with the proposed agrivoltaic development from VL3 (Permanent resident at 3920 SH2) and VL4 – 7 (views of the BESS/ substation and permanent residents of Cornwall Road and Hughes Line). The following mitigation measures are recommended to reduce the adverse effects of the proposed development on landscape and visual amenity:

- Retention of the existing shelter row planting (pine) immediately south of the residence at 3920 SH2 (within the application site).
- The implementation of mitigation screen planting (recommended *griselinia littoralis* hedge), to be maintained between 2-3m high, infilling the gaps in the existing curtilage planting along the southwestern site boundary at 3920 SH2 (VL3).
- The implementation of mitigation screen planting (recommended *griselinia littoralis* hedge), to be maintained between 2-3m high, to the east of the property at 3920 SH2.
- The implementation of mitigation screen planting (recommended double row *griselinia littoralis* hedge) maintained between 2-3m high, along the eastern and southern boundaries of the application site to screen the proposed agrivoltaic development from view from VL4 – VL7.

This proposed mitigation has been identified in the Mitigation Plan (Appendix 5). A double row of *griselinia littoralis* is recommended in all locations identified as mitigation panting on the Mitigation Plan. A plant species suitability table and plant species palette have been attached to this report (Appendix 5), providing a list of other suitable plant species options.

The recommended mitigation planting will be compliant with the Electricity (Hazards from Trees) Regulations 2003, which require 2.5m clearance between the conductors of the 33kV lines running along Cornwall Road and Hughes Line and the planting beneath. No horizontal offset is required. A copy of the *Electrical (Hazards from Trees) Regulations 2003: Schedule Growth limits zones* is contained in Appendix five.

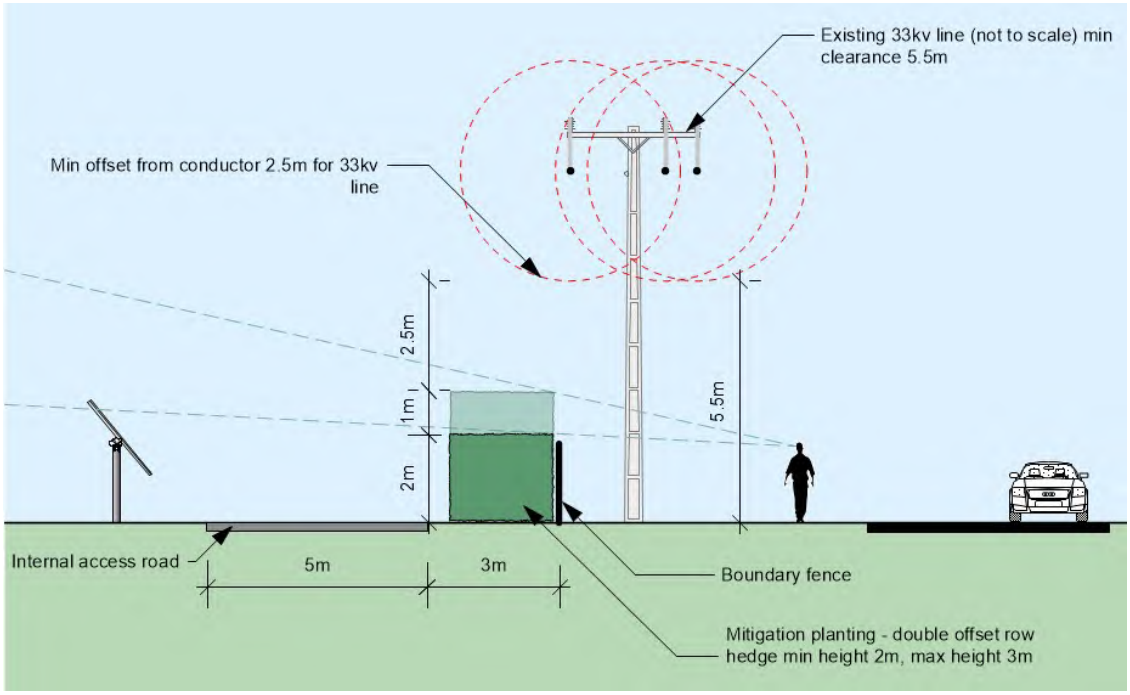


Figure 23: Diagram showing the distance from tree requirements.

RELEVANT STATUTORY AND NON-STATUTORY PROVISIONS

Planning documents that have been taken into consideration include the Resource Management Act (RMA), the Natural Resources Plan for the Wellington Region, The Wellington Regional Policy Statement, the Operative Wairarapa Combined District Plan (OWCDP), and the Proposed Wairarapa Combined District Plan (PWCDP).

Only the key issues contained within the relevant planning framework, relating to landscape, visual and amenity matters have been considered.

Resource Management Act 1991

The proposal must meet the requirements of the Resource Management Act (RMA), and it is therefore important that the assessment of visual, landscape and amenity effects address the requirements of Part 2, of the Act. The key sections relevant to this application are s6(a), s6(b), and s7(c).

Concerning s6(a), the proposed agrivoltaic development will not affect the existing natural character values of the Waingawa River (to the east of the site). Effects on the six natural wetlands within the southern part of the site will have ***no effect*** to ***very low***, with effects limited to perceptual effects only. The proposed agrivoltaic development will be set back 10m from all wetland areas and not result in any physical modification to these areas. This is discussed in the natural character section of this report.

Concerning s 6(b), the application site is not adjacent to or contains any identified Outstanding Features or Landscapes (ONFL). The closest ONFL to the site (identified in the Operative District Plan) is the Tararua Forest Park (to the north) and the Maungaraki Ridge (to the southeast). The Tararua Range has been identified as an ONFL under the proposed Wairarapa Combine District Plan (PWCDP), while the Maungaraki Ridge has been identified as a Significant Amenity Landscape under the PWCDP.

As discussed in the landscape character section of this report, the proposal will not affect the Maungaraki Ridge ONFL due to separation distance and because only the eastern side of the ridge (not visible from Waingawa) has been identified as OL and only the skyline ridge of this OL will be visible within the context of the proposed agrivoltaic development.

The proposed development will be seen against the backdrop of the Tararua Forest Park OL from a small number of surrounding viewer locations and will partially obscure views to the base of this OL. It will not affect the values and attributes identified as contributing to the identification of this OL however, which include the skyline ridge and indigenous vegetation cover (seen along the upper slopes of the Forest Park), which will remain visible above the proposed mitigation planting from surrounding viewer locations.

Concerning Section 7(c), with the mitigation planting in place, the adverse effects of the proposed agrivoltaic development on the existing visual amenity values will range from ***very low*** to ***low*** from most surrounding viewer locations. The exception to this is the effects from 3920 SH2 (VL3) will likely be ***low-moderate*** (mitigated) from the lower storey and property, and ***moderate-high*** from the upper storey of the dwelling (which cannot be easily mitigated).

Natural Resources Plan

Regarding Section 5.4: wetlands and beds of lakes and rivers, as identified in the natural character section of this report, the application site contains six areas of natural wetland. These natural wetland areas have already been highly modified by exotic vegetation and have been identified as having low ecological value. As detailed in the natural character section of this report, the proposed agrivoltaic development will avoid (be setback) from these wetland areas. The Waingawa River is the closest river to the proposal. The proposed agrivoltaic development will be setback approximately 750m from this river.

With regard to 3.4 *Natural character, form and function*, *Objective 014(e) and Policy P24*, the effects of the proposed agrivoltaic development on the natural character of the Waingawa River will be avoided due to physical and visual separation. Effects on the natural character of the wetland areas within the site will be avoided, with the development setback a minimum of 10m.

With regard to 3.8 Sites with significant values, 4.4 *Natural character, form and function*, 4.7.6 *Natural Features and landscapes,* Objective O26 and *Policy P23, P52 c), Protecting natural character and natural features and landscapes,* the proposed agrivoltaic development site does not contain any outstanding natural landscapes or features. It will not have any adverse effects on the Maungaraki Ridge ONFL due to visual and physical separation (approximately 17km to the southeast).

The closest outstanding landscape (Tararua Forest Park) is located approximately 12km to the north of the site. As identified in the s6b assessment above, the proposed development will not affect the attributes and values which contribute to the identification of the Tararua Forest Park as an OL.

Wellington Regional Policy Statement

Regarding *Section 3.6: Indigenous Ecosystems***,** there are no identified indigenous ecosystems within the site (only four kanuka trees have been identified within the northwest of the site). The main wetland area in the south of the site consists of exotic willow species and has not been identified as containing significant indigenous biodiversity values. The proposed development will be setback from this wetland area. Therefore, there will be no effects on indigenous ecosystems associated with the proposed agrivoltaic development. The closest SNAs are located approximately 900m to the north and 1km to the southeast of the site. These will not be impacted by the proposal due to visual and physical separation.

With regard to Section 3.7: Landscape, Objective 17 and Policies 26 and 50, as previously identified, the application site does not contain any outstanding natural features and landscapes and will avoid physical adverse effects on the nearest outstanding landscapes (the Tararua Range, located 12km to the west of the site and the Maungaraki Ridge, located 17km to the southeast), due to separation distance. As discussed in the visual effects section of this report, there will be some localised adverse effects on visual amenity values associated with the partial obstruction of the Tararua Forest Park seen backdropping the site from a small number of locations. However, it should be noted that the regional policy statement is only relevant to the development proposed within an OL and does not apply to views towards an OL.

Regarding Section 3.9: Regional Form, Design and Function, as discussed in the landscape and visual effects sections of this report, the proposed agrivoltaic development has been appropriately located opposite the existing Waingawa industrial zone (located on the northern side of SH2) and the existing substation located at the corner of Cornwall Road and Hughes Line. This position will allow for

integration with the existing land use patterns and will reinforce and consolidate the existing compact form of the Waingawa industrial area and Masterton Township (where industrial development already straddles both sides of SH2). Locating the proposed agrivoltaic development in this location will also ensure that the fragmentation of open rural space will be avoided.

Operative Wairarapa Combined District Plan

The proposed agrivoltaic development is located within the Rural Special Zone under the Operative Wairarapa Combined District Plan (OWCDP). The OWCDP has a suite of objectives and policies which pertain to landscape, natural character and amenity (both directly and indirectly). These are included in the Objectives and Policies of Part A, Section 4 - Rural Zone, and Part B, Section 9 – Landscape, 11 – Indigenous Biodiversity, 18 – Subdivision, Land Development and Urban Growth, 19 – General Amenity Values and 21 – District Wide Land Use Rules.

4 RURAL ZONE

4.3 OBJECTIVES AND POLICIES

4.3.1 Objective Rur1 – Protection of Rural Character & Amenity

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.

4.3.2 Rur1 Policies

…

(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 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.

4.3.3 Explanation

…Some parts of the productive rural environment are subject to a number of significant environmental hazards, where too intensive development and landholdings may create significant future management problems, such as exacerbated risks from flooding and erosion, high ground water tables, and the adverse effects of large-scale industrial activities and public facilities (for example, airports, landfills and sewage treatment plants).

Many of these areas are also peri-urban environments, in which intensive horticultural or viticulture areas are facing pressure from intensive sporadic urban growth, particularly residential development. The purpose of the Rural (Special) Zone is to recognise that such sporadic and unplanned intensification is generally inappropriate in these parts of the rural environment, and to place limitations as necessary to avoid future problems. The conversion of rural environment to urban areas should be carefully managed and evaluated…

4.3.7 Objective Rur3 – Interzone Management

To ensure the amenity values of adjoining zones are reasonably protected from the adverse effects of activities within the Rural Zone.

4.3.8 Rur3 Policy

(a) Manage the effects of Rural Zone activities to ensure that the environmental qualities and characteristics in the adjoining zones are not unreasonably degraded, bearing in mind their location adjacent to a functioning primary production environment.

The proposed agrivoltaic development is located within the Rural (Special) Zone under the OWCDP.

Regarding 4.3.2 c) and d) and 4.3.7 and 4.3.8, although the proposed agrivoltaic development will reduce the open spatial characteristics within the application site, it will not change the character of the wider surrounding rural landscape. Its position, immediately adjacent to the existing industrial zone within Waingawa (along the northern side of SH2) and the existing substation located at the corner of Hughes Line and Cornwall Road will aid in integrating the proposed agrivoltaic development with the wider surrounding landscape, consolidating the existing node of development at Waingawa and Masterton. The proposed agrivoltaic development has been located within an appropriate position, which will mirror the pattern of urban development which has occurred in Masterton (where industrial and energy generation development currently straddles both sides of SH2), reinforcing the existing node of industrial development within Waingawa and avoiding sporadic development within the rural landscape.

The proposal will be seen as an extension of the existing electricity activities currently occurring immediately to the east of the site (substation at the corner of Cornwall Road and Hughes Line) and will therefore not introduce a new type of development within the vicinity.

Regarding 4.3.2 d), due to the flat topography of the site and surrounding landscape, the visual bulk, scale, and density of the proposed agrivoltaic development will not be appreciated from surrounding viewer locations (with only the nearest PV tables visible from each viewer location). The exception to this is from viewer location (VL) 3, where the agrivoltaic development will be overlooked from the upper storey of the dwelling represented by this VL. Adverse effects on landscape and visual amenity values from this viewer location have been discussed in the visual effects section of this report.

As discussed in the visual effects section of this report, with the mitigation planting in place, the rural character of the site, when viewed from surrounding viewer locations will be maintained. This will maintain the attributes which contribute to rural character identified within 4.3.2 e), particularly (i) … predominance of vegetation. While the character of views towards the site will change from an open rural landscape to a compartmentalised landscape character (contained by screen planting along the eastern and southern site boundaries), views of the site will remain rural. Regarding 4.3.2 e) ii), the proposed agrivoltaic development will allow for the continuation of farming within the application site (sheep farming will occur within the area fenced off for the agrivoltaic development), ensuring continued productive working land use within the application site.

The dark tones of the proposed agrivoltaic development PV panels will allow it to appear visually recessive and unobtrusive when seen against the darker tones of the existing vegetation which

backdrops the site from most surrounding viewer locations, aiding in integrating the proposal within the surrounding rural environment.

As discussed in the landscape character section of this report, the proposed development will have ***low-moderate*** adverse effects on the landscape character of the surrounding landscape. Adverse effects on visual amenity values will range from ***very low*** to ***low*** from most surrounding viewer locations. Adverse effects will likely be ***moderate-high*** from the upper storey of the dwelling represented by VL3 (as detailed in the visual effects section of this report).

4.5 Rural Zone – Rules & Standards

4.5.2 Standards for Permitted Activities

Permitted activities shall comply with all of the following standards for the Rural Zone:

(a) Maximum Building Height

(i) Dwellings: 10 metres.

(ii) Other Buildings: 15 metres.

…

(b) Maximum Height to Boundary

(i) 3 metres height at the boundary with a 45˚ recession plane.

(c) Minimum Building Setback (excluding dwellings)

(i) 10 metres from the front road boundary of sealed roads.

(ii) 25 metres from the front road boundary of unsealed roads.

(iii) 5 metres from all other boundaries.

(iv) 25 metres from any Significant Waterbody listed in Appendix 1.9.

(v) 5 metres from any other waterbody.

The proposed agrivoltaic development will meet the building height requirements of these rules and standards as the proposed PV tables will be 2.9 tall at maximum tilt and will therefore also meet the above height to boundary standards.

With regard to 4.5 c) iv), the proposed agrivoltaic development will be located approximately 750m away from the Waingawa River Significant Waterbody and at least 10m from the identified wetlands within the site.

9 LANDSCAPE

9.3 Objectives, Policies and Methods

9.3.1 Objective Lan1 – Outstanding Landscape & Natural Features

To identify and protect the Wairarapa's outstanding landscapes and natural features from the adverse effects of inappropriate subdivision, use and development.

As discussed in the landscape character section of this report, the application site does not contain any outstanding natural landscapes or features. The proposed agrivoltaic development will not result in any adverse effects on the Maungaraki Ridge outstanding landscape (approximately 17km to the southeast of the site) as only the eastern side of the ridge has been mapped as outstanding (which is not visible from Waingawa). The closest outstanding landscape is located approximately 12km to the west (Tararua Forest Park). The proposed development will not have any physical adverse effects on this OL due to separation distance. While the Tararua Range will be seen backdropping the proposed development from some surrounding viewer locations, it does not break the skyline of this OL, and views to the Forest Park will be maintained above the proposed mitigation planting from surrounding viewer locations.

It should also be noted that views towards OIs are not protected under the OWCDP.

11 INDIGENOUS BIODIVERSITY

11.3 Objectives, Policies and Methods

11.3.1 Objective Bio1 – Biological Diversity

To maintain and enhance the biological diversity of indigenous species and habitats within the Wairarapa.

11.3.2 Bio1 Policies

…

(h) Avoid, remedy or mitigate the adverse effects to indigenous wildlife and indigenous ecosystems that result from the use, development or subdivision of a site.

As discussed in the landscape and natural character sections of this report, the site predominantly consists of exotic vegetation, including grazed pasture, exotic shelterbelts, occasional stand-alone exotic trees, and a wood lot dominated by willow trees (within the south of the site). The only indigenous vegetation found within the site was four kānuka trees in the north-western area.

The willow woodlot wetland area within the south of the site was found to be highly modified by past land use, containing exotic willow species only. However, it does contain several natural wetlands and was identified as being a potential bat roost and skink habitat.

11.3.4 Objective Bio2 – Significant Vegetation and Habitats

To protect the areas of significant indigenous vegetation and significant habitats of indigenous fauna within the Wairarapa.

…

(c) Ensure that adverse effects on the values of Significant Natural Areas are avoided, remedied or mitigated.

The site does not contain any Significant Natural Areas (SNAs). The nearest SNAs are located 900m to the north (Waingawa wetland) and 1km to the southeast of the site (Tenair wetland). As previously identified, these will not be impacted by the proposal due to visual and physical separation.

16 NETWORK UTILITIES AND ENERGY

16.3 Objectives, Policies and Methods

16.3.1 Objective NUE1 – Management of Network Utilities

To enable the efficient development, maintenance and operation of network utilities, while avoiding, remedying or mitigating adverse effects on the environment.

16.3.2 NUE1 Policies

(a) …

(b) Establish environmental standards that set an appropriate weight on avoiding, remedying or mitigating the adverse effects on the environment while taking into account the technical and operational requirements of network utilities and their importance to the efficient functioning of the Wairarapa.

(c) …

(d) Avoid, remedy or mitigate any adverse effects of network utilities on the amenity and character of the Wairarapa environment, particularly outstanding landscapes and natural features.
(e)…
(f) Encourage network utility operators to avoid, remedy or mitigate adverse environmental effects by co-siting or sharing facilities where technically and economically practicable.
(g) …

16.4 Anticipated Environmental Outcomes

(a) The continued development and provision of essential network utility services, which avoids, remedies or mitigates adverse effects on the environment.
(b) Greater domestic self-sufficiency in energy use and efficiency and other services.
(c) Network utilities located underground in urban areas, and/or co-sharing road corridors or other locations.
(d) The adverse effects of network utilities and energy generation on the identified the landscape and character of the Wairarapa, particularly its outstanding landscapes and natural features are minimised as far as practicable.
(e) Efficient use and development of Wairarapa's renewable energy resources, contributing towards an increased proportion of New Zealand's energy consumption being derived from renewable sources.
(f) New buildings and subdivision located away from high voltage transmission lines.
(g) Renewable energy generation facilities may have established in appropriate locations and their on-going efficient operation in a manner that appropriately remedies or mitigates adverse effects.

In terms of 16.3.2 b) and d), as previously identified, the proposed agrivoltaic development is not located within an outstanding natural feature or landscape. The rural character of the site will be maintained due to the proposed mitigation planting along the eastern and southern site boundaries. While this planting will alter the character of views from open pastoral to a more highly compartmentalised character (contained by mitigation planting), the site will continue to be experienced as rural.

Regarding 16.3.2 f), the proposed agrivoltaic development will be co-sited with the existing substation development located at the corner of Cornwall Road and Hughes Line. This will aid in the mitigation of adverse effects associated with the proposed development as the substation provides context for the development.

18 SUBDIVISION, LAND DEVELOPMENT & URBAN GROWTH

18.3 Objectives, Policies and Methods

18.3.1 Objective SLD1 – Effects of Subdivision & Land Development

To ensure subdivision and land development maintains and enhances the character, amenity, natural and visual qualities of the Wairarapa, and protects the efficient and effective operation of land uses and physical resources.

18.3.2 SLD1 Policies

(a) Manage subdivision and land development in a manner that is appropriate for the character and qualities of the environmental zone in which it is located, while recognising that such change may alter the character and qualities.

Regarding 18.3.1 and 18.3.2, as discussed in the above rural character provisions assessment, the rural character of the site will be retained through the proposed mitigation planting which will ensure that rural vistas are retained from surrounding viewer locations.

19 GENERAL AMENITY VALUES

19.3 Objectives, Policies and Methods

19.3.1 Objective GAV1 – General Amenity Values

To maintain and enhance those general amenity values which make the Wairarapa a pleasant place in which to live and work, or visit.

19.3.2 GAV1 Policies

(a) …
(e) Manage the intensity, location and direction of artificial lighting to avoid light spill and glare onto adjoining sites and roads, and to protect the clarity and brightness of the night sky.
(f) Within the Dark Sky Management Area, manage the light colour temperature, shielding and hours of operation of outdoor artificial lighting to mitigate skyglow to protect the clarity and brightness of the night sky.
(g) Manage activities with unacceptable visual effects on amenity values, in accordance with the qualities of each environmental zone. As a guide to determining if an activity has unacceptable visual effects, consideration will be given to other policies relevant to a particular activity or environmental zone.
(h) …

19.4 Anticipated Environmental Outcomes

(a) The maintenance of amenity values appropriate to the surrounding environment.
(b) Minimised conflict over amenity between established uses and temporary activities.
(c) Preservation of the brightness and clarity of the night sky within the Dark Sky Management Area.

Again, amenity values derived from views across the rural landscape will be maintained due to the proposed mitigation planting which will ensure that rural vistas are retained from surrounding viewer locations. Views towards the Tararua Forest Park OL, and the Maungaraki Ridge skyline will also be maintained (seen above the proposed mitigation planting).

With the mitigation planting in place adverse effects on visual amenity values were found to range between ***very low*** and ***low*** (below the minor threshold of the RMA) from most surrounding viewer locations. Adverse effects were found to be ***moderate-high*** from the upper storey of the dwelling represented by VL3.

With regard to 19.3.2 f), the proposed agrivoltaic development site is located within the dark sky management area. The proposed development will not require any outdoor artificial lighting and the clarity and brightness of the night sky will therefore be protected.

Regarding glare, only a small section of Hughes Line (southwestern extent) was found to be adversely affected by glare. Mitigation includes either screen planting proposed along this stretch of Hughes Line, or control of the tilt angle of the PV tables during the affected period, to mitigate these adverse effects on visual amenity values.

21 DISTRICT WIDE LAND USE RULES

21.1.4 Outstanding Landscapes

The site does not contain any outstanding landscapes. The closest outstanding landscapes to the site are the Tararua Forest Park (OLm01), approximately 12km to the north, and the Maungaraki Ridge (OLc02), approximately 17km to the southeast.

As previously identified, the proposed agrivoltaic development will not result in any adverse effects on the Maungaraki Ridge outstanding landscape due to visual and physical separation (only the eastern side of the ridge has been included as OL). The proposed agrivoltaic development is also physically separated from the Tararua Forest Park OL.

21.1.5 Significant Natural Areas

The application site is physically separated from the nearest Significant Natural Areas (located 900m to the north and 1km to the southeast of the site).

21.1.6 Indigenous Vegetation and Habitats

21.4.2 Indigenous Vegetation

> *(a) Any disturbance, removal, damage or destruction ("modification") of indigenous vegetation within 20 metres of a river or a water body. This rule does not apply to entirely artificially created water bodies (e.g. duck ponds, existing farm drains) or vegetation in gardens.*

The ecological report[17] found that the only native vegetation found within the site was limited to four kānuka trees in the north-western area. No indigenous vegetation was found within 20m of the 6 natural wetlands found within the site.

> ***21.1.11 Glare and Artificial Light***
>
> *(a) The emission of light (including glare) meets the following standard:*
> *(i) A maximum artificial light level of 8 lux (lumens per square metre) measured at 1.5m above ground level at the site boundary.*

There will be no lights proposed and the development will therefore be compliant with the above artificial lighting rules. The effects of solar glare on the small section of Hughes Line will be mitigated by, either, the proposed screen planting, or control of the tilt angle of the PV tables during the affected period.

[17] Ecological Considerations – high level

Proposed Plan – Wairarapa Combined District Plan

The proposed agrivoltaic development is located within the General Rural (GRUZ) Zone under the Proposed Wairarapa Combined District Plan (PWCDP). The PWCDP has a suite of objectives and policies which pertain to landscape, natural character and amenity (both directly and indirectly). These are included in the Objectives, Policies Rules and Standards of *NE - Natural Environment, RE – Rural Environment, Natural Environment Values, ECO - Ecosystems and Indigenous Biodiversity, NATC – Natural Character, NFL – Natural Features and Landscapes and GRUZ - General Rural Zone.*

NE - Natural Environment

> ***NE-O1 Natural character, landscapes, features, and ecosystems***
>
> *The natural environment contributes positively to the Wairarapa's sense of place and identity.*
>
> ***NE-O6 Healthy ecosystems***
>
> *The biological diversity of indigenous species and habitats within the Wairarapa are maintained and enhanced, and restored where degraded.*

The proposed mitigation planting will enhance and restore indigenous species and habitats within the site. Positively contributing to biological diversity within the site and the wider surrounding rural landscape.

RE – Rural Environment

Objectives

> ***RE-O4 Character of the rural environment***
>
> *The character of the rural environment is maintained and enhanced.*

As discussed in the landscape and visual effects sections of this report, the character of the wider surrounding rural landscape will be maintained. While the proposed agrivoltaic development will alter the landscape character within the site (from rural to energy generation), the site will still be experienced as rural due to the extensive proposed mitigation planting, which will screen the development from view from surrounding viewer locations.

Natural Environment Values

ECO - Ecosystems and Indigenous Biodiversity

Objectives

> ***ECO-O1 Indigenous biodiversity***
>
> *The biological diversity of indigenous species and habitats within the Wairarapa is maintained and enhanced, or restored where degraded.*
>
> ***ECO-O2 Significant indigenous vegetation and habitats***
>
> *Areas of significant indigenous vegetation and significant habitats of indigenous fauna within the Wairarapa are protected from inappropriate subdivision, use, and development.*
>
> ***ECO-P7 Appropriate modification of other indigenous vegetation***

Provide for the modification of vegetation outside of habitats comprising significant indigenous vegetation or significant habitats of indigenous fauna where:
a. the indigenous vegetation is kanuka, manuka, or tauhinu;
b. other indigenous vegetation where loss of mature indigenous vegetation is minimised;
…

ECO-P8 Management of effects on other indigenous vegetation

Manage the modification of indigenous vegetation outside of habitats comprising significant indigenous vegetation or significant habitats of indigenous fauna to ensure any adverse effects on the biological diversity of indigenous species and habitats are avoided, remedied, or mitigated, considering:
a. the significance and values of the vegetation and habitat;
b. the extent of modification, including measures to avoid or minimise the loss, damage, or disruption to ecological processes, functions, and integrity of the vegetation and habitat; and
c. the effects of the modification on the significance and values of the vegetation and habitat, including potential cumulative effects.

ECO-P9 Support and encourage protection and restoration of natural habitats on private land

Support and encourage the protection of natural habitats on private land, including restoring and protecting linkages and ecological corridors.

Rules

ECO-R2 Modification of indigenous vegetation outside of a Significant Natural Area

All zones *1. Activity status:* ***Permitted***
Where one or more of the following applies:
a. …
b. Compliance is achieved with ECO-S1;
c. …

Standards

ECO-S1 Modification of indigenous vegetation

1. Indigenous vegetation is not within 20m of a natural inland wetland;
2. The indigenous vegetation is kanuka, manuka, or tauhinu; and
3. …

Matters of discretion:
1. The matters identified in Policy ECOP8.

Regarding ECO-O1, indigenous vegetation within the site is limited to four kanuka trees (located in the northwest of the site). There are no indigenous habitats (the wetland areas within the site consist of exotic species).

In terms of ECO-O2 Significant indigenous vegetation and habitats, no significant indigenous vegetation or habitats have been identified within the site. The closest Significant Natural Areas are located approximately 900m to the north (Waingawa wetland) and 1km to the southeast of the site

(Tenair bush wetland). The PWCDP has included the nearby Lowes Bush wetland (approximately 1km to the southwest of the site) as a proposed SNA (it is not identified as an SNA under the OWCDP).

With regard to ECO-P7 and ECO-P8, the four kanuka trees within the site will be removed as they fall within the footprint of the agrivoltaic development. Extensive indigenous planting has been proposed along the eastern and southern site boundaries and adjacent to the dwelling located at 3920 SH2 (VL3). From a landscape perspective, this planting will remedy the loss of the kanuka trees within the site and will enhance indigenous vegetation patterns within the site and surrounding rural landscape (which meets ECO-P9).

The removal of the four kanuka within the site meets the rules and standards of ECO-R2 and ECO-S1.

NATC – Natural Character

Objectives

NATC-O1 Preserve and enhance natural character

The natural character of the Wairarapa's rivers, lakes, and natural inland wetlands and their margins is preserved, and enhanced where appropriate, and protected from inappropriate subdivision, use, and development.

Policies

NATC-P1 Retain special qualities and natural character of surface waterbodies

Manage the design, location, and scale of subdivision, use, and development adjoining surface waterbodies so they preserve the special qualities and natural character of surface waterbodies.

NATC-P2 Restoration and enhancement

Provide for and encourage the restoration and/or enhancement of the natural character of surface waterbodies and their margins.

NATC-P4 Restrict earthworks in proximity to Significant Waterbodies

Only allow other earthworks within 25m of Significant Waterbodies where:
a. natural character values of Significant Waterbodies are preserved or enhanced; and
b. significant adverse effects on the values of Significant Waterbodies are avoided and all other adverse effects are avoided, minimised, or remedied.

NATC-P5 Buildings and structures

Discourage buildings and structures within 10m of surface waterbodies within the General Rural Zone, 5m of any surface waterbody in any other zone, and 25m of Significant Waterbodies across all zones and only allow buildings and structures within these setbacks where:
a. there is a functional need or operational need for their location within the setback;
b. the location, intensity, scale, design, and form of the building or structure preserves natural character values; and
c. any potential cumulative effects on natural character values are minimised.

NATC-P6 Modification of vegetation in proximity to Significant Waterbodies

Allow modification of vegetation within 25m of Significant Waterbodies where it involves pest

plant species or is associated with primary production, and only allow other modification of vegetation when:
a. natural character values of Significant Waterbodies are preserved or enhanced; and
b. significant adverse effects on the values of Significant Waterbodies are avoided and all other adverse effects are avoided, minimised, or remedied.

With regard to NATC-P1, as discussed in the natural character section of this report, the wetland areas identified within the site will be retained, with the proposed agrivoltaic development setback a minimum of 10m from these wetlands.

As previously identified, the setback distances from the Waingawa River Significant Waterbody and the nearest river terrace of the Waingawa River means that these features will not be affected.

NFL – Natural Features and Landscapes

Objectives

NFL-O1 Outstanding Natural Features and Landscapes

The identified Outstanding Natural Features and Landscapes are protected from the adverse effects of inappropriate subdivision, use, and development.
NFL-O2 Special Amenity Landscapes

The identified Special Amenity Landscapes within the Wairarapa are maintained and where practicable enhanced.

Policies

NFL-P1 Identify Outstanding Natural Features and Landscapes

Outstanding Natural Features and Landscapes within the Wairarapa have been identified as being natural features and landscapes where:
a. they are exceptional or out of the ordinary; and
b. their natural components dominate over the influence of human activity.
While taking into account the following criteria:
i. natural science factors;
ii. sensory factors; and
iii. shared or recognised features.

NFL-P2 Identify Special Amenity Landscapes

Identify Special Amenity Landscapes that are distinctive, widely recognised, and highly valued by the community for their contribution to the amenity and quality of the environment of the Wairarapa, based on the criteria in Policy NFL-P1.

As identified in the OWCDP outstanding natural feature or landscape (ONFL) assessment, the proposed agrivoltaic development site is not located within an ONFL.

With regard to NFL-O2 and NFL-P2, the nearest Special Amenity Landscape (SAL6) identified in the PWCDP is the Maungaraki Main Ridge, located approximately 17km to the southeast.

The Maungarki Range will not be affected by the proposed agrivoltaic development due to physical and visual separation.

The PWCDP does not contain any objectives or policies requiring the protection of viewshafts towards ONFLs or SALs from other parts of the district.

LIGHT – Light

Objectives

LIGHT-O1 The role of artificial light and effects on amenity values

To maintain and enhance amenity values that make the Wairarapa a pleasant place in which to live, work, and visit, by managing use of artificial light.

LIGHT-O2 Brightness and clarity of the night sky

To preserve the brightness and clarity of the Wairarapa night sky.

Policies

LIGHT-P1 Avoid light spill and glare on adjoining sites and roads

Manage the intensity, location, and direction of artificial lighting to minimise light spill and glare onto adjoining sites and roads.

LIGHT-P2 Protect the clarity and brightness of the night sky
Manage the light colour temperature, shielding, and hours of operation of outdoor artificial lighting to mitigate skyglow to protect the clarity and brightness of the night sky.

LIGHT-P3 Effects of artificial light on amenity values are compatible with the receiving zone
Manage activities with unacceptable visual effects from artificial light on amenity values, in accordance with the qualities of each environmental zone.

Rules

LIGHT-R1 Outdoor artificial light and glare

***All Zones** 1. Activity status: **Permitted** Where:*
a. Compliance is achieved with:
i. LIGHT-S1;
ii. LIGHT-S2; and
iii. LIGHT-S3.

All Zones 2**. Activity status: **Restricted discretionary
Where:
a. Compliance is not achieved with LIGHT-R1(1).

Matters of discretion:
1. The effect of non-compliance with any relevant LIGHT standard that is not met and the matters of discretion of any standard that is not met.

Standards

LIGHT-S1 Standards for outdoor artificial light and glare

1. A maximum artificial light level of 8 lux (lumens per square metre) measured at 1.5m above ground level at the site boundary.
2. All outdoor lighting shall have a colour temperature of light emitted of 3000K Kelvin or lower.
3. All outdoor lighting with a light output of 500 lamp lumens or greater shall be

shielded or tilted so as to not emit any light at or above a horizontal plane measured at the light source.

Exception: The provisions do not apply to specific types of activities or lighting which have a functional need or operational need, such as navigational aids and vehicle lights.

Note: The standards for light must be measured and assessed in accordance with Standards AS 4282-2019 Control of the Obtrusive Effects of Outdoor Lighting.

Matters of discretion:
1. The extent to which the light will adversely affect adjoining sites.
2. The effects of light direction on the safe and efficient operation of the road network.
3. The extent to which the lighting is necessary for functional and operational requirements, such as security, heritage, public amenity, or safety.
4. The hours during which the lighting will operate.
5. Proposed methods to avoid, remedy, or mitigate potential adverse effects including the height, orientation, angle, light colour temperature, and shielding of the light source.
6. The extent to which the light will contribute to skyglow and adversely affect the quality of viewing of the night sky.

No lighting (except for emergency lighting around the substation and BESS area) is proposed. The development is therefore compliant with the above artificial lighting rules. Any emergency lighting will be designed to meet the requirements of the plan.

The effects of glare on a short section of Hughes line will be mitigated through the implementation of screening or control of the tilt angle of the PV tables during the affected period (mitigating the effects of up to 69 minutes of green glare and 6 minutes of yellow glare per annum).

GRUZ - General Rural Zone

Objectives

GRUZ-O1 Purpose of the General Rural Zone

The General Rural Zone is used primarily for primary production, activities that support primary production, and other activities that have a functional need or operational need to be located within the General Rural Zone.

GRUZ-O2 Rural character

The predominant character of the General Rural Zone are maintained and enhanced, which include:
a. areas of viticulture, crops, pasture, forestry (indigenous and plantation), and the presence of a large number of farmed animals;
b. sparsely developed landscape with open space between buildings that are predominantly used for agricultural, pastoral and horticultural activities (e.g. barns and sheds), low density rural living (e.g. farmhouses, seasonal worker accommodation, and a small degree of rural lifestyle), and community activities (e.g. rural halls, domains, and schools);
c…
e. the presence of rural infrastructure, including rural roads, state highways, the National Grid and the on-site disposal of wastewater, and a general lack of urban infrastructure, such as street lighting, solid fences, and footpaths.

GRUZ-O5 Reverse sensitivity

Sensitive activities are designed and located to avoid or mitigate reverse sensitivity effects and incompatibility with primary production, other land uses activities and key transport corridors in the General Rural Zone.

GRUZ-O7 Protection of highly productive land and other land with special characteristics

Recognise and protect:
a. highly productive land; and
b. land that utilises the finite combination of climate and soil characteristics which make it suitable for high value crops including viticulture, orchards and olives.

Policies

GRUZ-P2 Incompatible activities

Avoid activities and development that:
a. are incompatible with the purpose, character, and amenity of the General Rural Zone;
b. will result in fragmentation of land and the productive potential of land; or
c. will result in reverse sensitivity effects and/or conflict with permitted activities in the General Rural Zone including primary production and ancillary activities.

GRUZ-P3 Rural character

Provide for subdivision, use, and development where it does not compromise the purpose, character, and amenity of the General Rural Zone, by:
a. enabling and promoting openness and predominance of vegetation;
b. enabling and promoting a productive working landscape;
c. enabling primary production and ancillary activities;
d. …
e. …
f. …
g. retaining a clear delineation and contrast between the Wairarapa's rural areas and urban areas; and
h. avoiding, remedying, or mitigating reverse sensitivity effects.

GRUZ-P6 Reverse sensitivity

Avoid or mitigate the potential for reverse sensitivity effects by:
a. avoiding the establishment of any new sensitive activity near existing intensive primary production, primary production activities, waste management facilities, quarrying activities, and rural industry in circumstances where the new sensitive activity may compromise the operation of the existing activities;
b. managing potential reverse sensitivity effects caused by the establishment of new sensitive activities near other primary production activities, including through the use of setbacks and separation distances;
c. ensuring adequate separation distances between existing sensitive activities and new intensive primary production activities, quarrying activities, and rural industry; and
d…

GRUZ-P9 Highly productive land

Avoid subdivision, use and development of highly productive land, except as provided in the National Policy Statement for Highly Productive Land.

With regard to GRUZ-O1, GRUZ-O2 a), GRUZ-O7, and GRUZ-P9, the proposed agrivoltaic development will allow for the continued grazing of the site (sheep) beneath the PV tables, maintaining primary production within the site.

Regarding GRUZ-O2 b) and e), the proposal will introduce an energy generation component to the site (in juxtaposition to the pastoral landscape). However, due to the flat terrain within and surrounding the site and the proposed mitigation planting, there will be very limited opportunity to view the density and scale of the proposed agrivoltaic development from surrounding viewer locations.

The development is consistent with the requirements of Policy GRUZ-P3, as the proposal will not compromise rural character and amenity due to the retention of a predominance of vegetation within views of the site (mitigation planting will replace open pastoral landscape within views of the site from surrounding viewer locations). A clear delineation will be retained between the rural landscape and the urban areas within the wider surrounding landscape as the site has been located immediately adjacent to the existing Waingawa industrial zone and within proximity to Masterton (where urban development already straddles both sides of SH2). The location of the proposal will also avoid the fragmentation of rural land (GRUZ-P2 b).

With regard to GRUZ-O5 and GRUZ-P6 Reverse sensitivity, the proposed agrivoltaic development has been located adjacent to the existing substation (to the east of the site) and the Waingawa industrial area (to the north). The proposed mitigation planting will screen the development from view from locations within the surrounding rural landscape, avoiding adverse reverse sensitivity effects.

> ***GRUZ-R18 Commercial and industrial activities not otherwise provided for***
> *1. Activity status:* ***Discretionary***
> *Where:*
> *a. It is not otherwise provided for in the permitted, controlled, and restricted discretionary rules of the General Rural Zone chapter; and*
> *b. The gross floor area does not exceed 2,000m2.*
> *2. Activity status:* ***Non-complying***
> *Where:*
> *Compliance is not achieved with Rule GRUZ-R18(1).*
>
> ***GRUZ-R19 Any activity not otherwise listed in this chapter***
> *1. Activity status:* ***Discretionary***

Standards

> ***GRUZ-S1 Maximum height***
>
> *1. The maximum height of any building or structure shall be:*
> *a. 10m above ground level for any residential unit;*
> *b. 15m above ground level for any frost protection fan; and*
> *c. 12m above ground level for all other buildings and structures.*
>
> *Matters of discretion:*
> *1. The location, design, and appearance of the building or structure.*
> *2. Visual dominance, shading, and loss of privacy for, residential units on adjacent sites.*
> *3. Bulk and dominance of the building or structure.*
> *4….*

GRUZ-S2 Maximum height in relation to boundary
1. 3m height at the boundary with a 45˚ recession plane on all side and rear boundaries.

The proposed agrivoltaic development will be 2.9 tall at maximum tilt and will therefore meet the above height in relation to boundary standards. With mitigation, the proposed agrivoltaic development will not visually dominate residential units on adjacent sites. The proposal will not result in a loss of privacy or cause shading to residential units on adjacent sites.

GRUZ-S3 Minimum setbacks
1. Buildings or structures must not be located within:
a. 10m of any front road boundary of sealed roads;
b. 10m of any other boundary;
c. 25m of any front boundary of unsealed roads;
d. 25m of any significant waterbody; and
e. 10m of any surface waterbody.
2…

This standard GRUZ-S3 does not apply to:
1. Bridges and river crossings.
2. Fences.
3. Water intake, pump shed, and any associated water conveyance infrastructure.

Matters of discretion:
1. The extent to which building design, siting, and external appearance adversely impacts on rural character and amenity.

2. Site topography and orientation and whether the building can be more appropriately located to minimise adverse visual amenity effects or maintain, enhance, or restore indigenous biodiversity values.

3. Effect on nearby properties, including outlook, privacy, shading, and sense of enclosure.

4. The extent to which the reduction in the setback is necessary due to the shape or natural and physical features of the site.

5. The ability to mitigate adverse effects through the use of screening, planting, landscaping, and alternative design.

6. The extent to which the reduction in setback would impact on the future ability for road widening requirements.

7. Methods to avoid or mitigate reverse sensitivity effects.

The proposed agrivoltaic development will be a minimum of 10m from all road boundaries and meet the minimum setback standards of GRUZ-S3 a) – c). As previously identified, it will be separated by approximately 750m from the Waingawa River Significant Waterbody (much more than the 25m setback standard). The proposed agrivoltaic development will also be setback a minimum of 10m from the identified natural wetlands within the site.

The Taratahi water race within the site has not been identified as a natural stream (it is channelised) and the setbacks of GRUZ-S3 therefore do not apply.

FINDINGS & CONCLUSIONS

The existing landscape in and around the application site and the various features and land uses within it, influence how the proposed agrivoltaic development will integrate with its surroundings and the effects it will have on existing landscape character (including rural character), natural character, landscape, and visual amenity values. Analysis of the proposal found that:

a. The landscape within and immediately surrounding the application site is characterised by a combination of urban (Masterton) industrial (Waingawa industrial area, north of SH2), energy infrastructure and development (existing substation), arterial infrastructure (SH2) and rural land uses (south of SH2). The rural landscape is characterized by flat, low-lying terrain typical of the Masterton Basin and the Waingawa River valley, featuring open pasture, shelter rows, hedgerows, clusters of specimen trees, remnant wetland bush stands, transmission lines, and post and wire fencing. When considered collectively, the overall landscape value of the site and its immediate surroundings is ***low-moderate.***

b. Overall, the site is of ***very low*** to ***low*** natural character value. It is not located within any identified protected landscape features. The Waingawa River is identified as a Significant Waterbody. The closest Outstanding Landscapes (OL) are the Tararua Forest Park (approximately 12km to the north of the site) and the Maungaraki Ridge (approximately 17km to the southeast of the site). The closest Significant Amenity Landscape (SAL) is the Maungaraki Range. The closest SNAs are the Waingawa Wetland and the Tararua Range (to the north), the Tenair Wetland (to the southeast) and the Lowes Bush Wetland (to the southwest). These ONFLs, SAL, Significant Waterbody and SNAs will not be affected by the proposed expansion due to separation distance. The existing Waikoukou Stream/Taratahi water race and natural wetland areas identified within the site are highly modified (channelised stream and exotic vegetation within the wetland areas) and have ***low*** natural character values.

c. Overall, the proposed development will have a ***no effect*** to ***very low*** adverse effect on the remnant natural character values of the wetlands, and Waikoukou Stream/ Taratahi water race and their margins within and immediately adjacent to the site. The Waingawa River, Waingawa Wetland, Tenair, and Lowes Bush Scenic Reserve are at a sufficient distance from the application site for their natural character values to remain unaffected.

d. Within the context of the surrounding rural, energy development and industrial landscape, the proposed agrivoltaic development will have a ***low-moderate*** adverse effect on existing landscape character values. While there will be a change in the existing appearance of the site and its surroundings at the local level (from predominantly rural with energy generation elements to predominantly energy generation with underlying agricultural production), the introduction of the proposed agrivoltaic development will not affect the characteristics of the wider rural landscape.

e. The landscapes' ability to absorb the proposed development ranges from ***poor*** to ***very good***. For the majority of surrounding viewer locations, visual absorption capability is ***neutral*** to ***very good*** because the proposed solar site is contained or backdropped by the Tararua Range (to the north) or the Maungaraki Range (to the southeast) and screened by vegetation (to the north and west) and/or screened by or seen within the context of the existing Waingawa industrial development or the existing substation. Poor ratings occur from locations where direct views are available, with little screening provided by intervening topography, vegetation, or existing buildings (within 200m of the site) and limited energy generation or industrial context.

f. With the mitigation planting in place, the adverse effects of the proposed agrivoltaic development on the existing visual amenity values will range from ***very low*** to ***low*** from most surrounding viewer locations. The exception to this is the effects from 3920 SH2 (VL3), which will likely be ***low-moderate*** (mitigated) from the lower storey and property, and ***moderate-high*** from the upper storey of the dwelling (which cannot be easily mitigated).

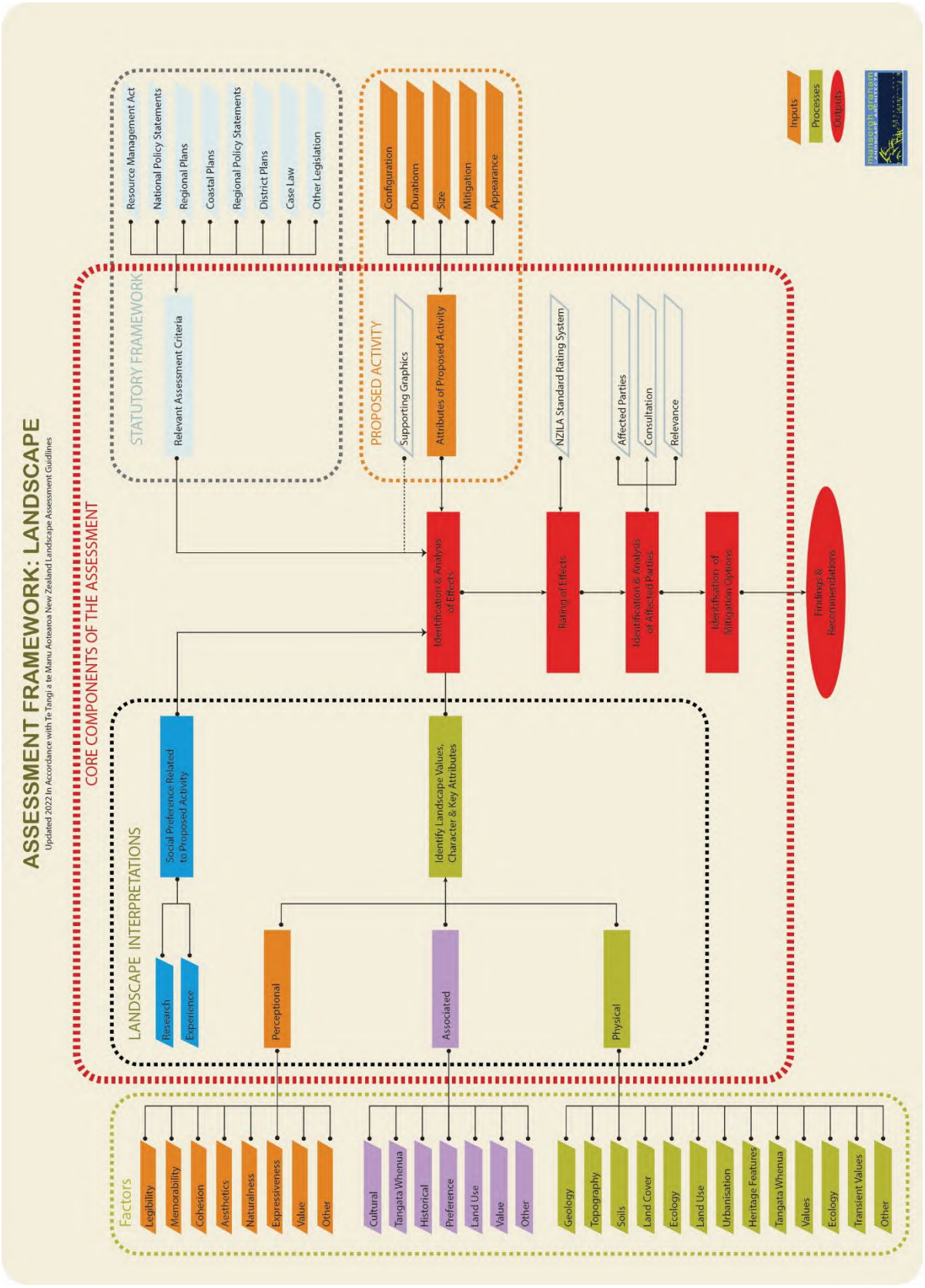
g. The proposed solar development will not result in any long-term or permanent glare effects on dwellings surrounding the site or traffic travelling past the site. Potential glare along a short stretch of Hughes Line will be mitigated through the proposed mitigation planting or control of the tilt angle of the PV tables during the affected period.

h. The proposed agrivoltaic development is consistent with the requirements of the relevant landscape, rural character, natural character and amenity provisions of the Operative Wairarapa Combined District Plan and the Proposed Wairarapa Combined District Plan.

Except for the property located at 3920 State Highway 2 (VL3), the adverse effects of the proposed agrivoltaic development on the existing landscape, natural character and visual amenity values will be **at or below the *minor*** threshold of the RMA.

From a landscape perspective, the proposed development is consistent with the overall requirements and intent of the relevant landscape and amenity objectives and policies of the OWCDP, PWCDP, NRP, WRPS and sections 6(a), 6(b) and 7(c) of the RMA. There is therefore no reason that consent should not be granted subject to the implementation of the recommended mitigation (screen planting).

APPENDIX ONE: METHODOLOGICAL FLOW CHART



APPENDIX TWO: LANDSCAPE AND VISUAL AMENITY EFFECT - RATING SYSTEM

The following standardised rating system has been developed by Mansergh Graham Landscape Architects Ltd and is consistent with the recommended rating system identified in the Te Tangi a te Manu - Aotearoa New Zealand Landscape Assessment Guidelines.

LANDSCAPE AND VISUAL AMENITY EFFECT - RATING SYSTEM	
Effects Rating	**Use and Definition**
Very High	*Use* The development/activity would: a. Have a very high level of effect on the character or key attributes of the receiving environment and/or the vista within which it is seen; and/or b. Have a very high level of effect on the perceived amenity derived from it. *Oxford English Dictionary Definition* Very: adverb 1 in a high degree. 2 with superlative or own without qualification: the very best quality. High: adjective 1 extending above the normal level. 2 great in amount, value, size, or intensity. 3 great in rank or status. 4 morally or culturally superior.
High	*Use* The development/activity would: a. Have a high level of effect on the character or key attributes of the receiving environment and/or the vista within which it is seen; and/or b. Have a high level of effect on the perceived amenity derived from it. *Oxford English Dictionary Definition* High: adjective 1 extending above the normal level. 2 great in amount, value, size, or intensity. 3 great in rank or status. 4 morally or culturally superior.
Threshold under the RMA. Ratings above this threshold are "Significant". Ratings below this threshold are "More than Minor". Threshold under the NZCPS. Ratings above this threshold are "Significant".	
Moderate-High	*Use* The development/activity would: a. Have a moderate-high level of effect on the character or key attributes of the receiving environment and/or the vista within which it is seen; and/or b. Have a moderate-high level of effect on the perceived amenity derived from it. *Oxford English Dictionary Definition* Moderate: adjective 1 average in amount, intensity, or degree. High: adjective 1 extending above the normal level. 2 great in amount, value, size, or intensity. 3 great in rank or status. 4 morally or culturally superior.
Moderate	*Use* The development/activity would: a. Have a moderate level of effect on the character or key attributes of the receiving environment and/or the vista within which it is seen; and/or b. Have a moderate level of effect on the perceived amenity derived from it. *Oxford English Dictionary Definition* Moderate: adjective 1 average in amount, intensity, or degree.
Threshold under the RMA. Ratings at or above this threshold are "More than Minor". Ratings below this threshold are "Minor".	
Low-Moderate	*Use* The development/activity would: a. Have a low-moderate level of effect on the character or key attributes of the receiving environment and/or the vista within which it is seen; and/or b. Have a low-moderate level of effect on the perceived amenity derived from it. *Oxford English Dictionary Definition* Low: adjective 1 below average in amount, extent, or intensity. 2 lacking importance, prestige, or quality; inferior. Moderate: adjective 1 average in amount, intensity, or degree.
Low	*Use* The development/activity would: a. Have a low level of effect on the character or key attributes of the receiving environment and/or the vista within which it is seen; and/or *b.* Have a low level of effect on the perceived amenity derived from it.
Threshold[18] under the RMA. Ratings above this threshold are "Minor". Ratings at or below this threshold are "Less than Minor".	
Low (continued)	*Oxford English Dictionary Definition* Low: adjective 1 below average in amount, extent, or intensity. 2 lacking importance, prestige, or quality; inferior.
Very Low	*Use* The development/activity would: a. Have a very low effect on the character or key attributes of the receiving environment and/or the vista within which it is seen; and/or b. Have a very low effect on the perceived amenity derived from it. *Oxford English Dictionary Definition* Very: adverb 1 in a high degree. 2 with superlative or own without qualification: the very best quality. Low: adjective 1 below average in amount, extent, or intensity. 2 lacking importance, prestige, or quality; inferior.
Detectable Effect Threshold	
No Effect	The development/activity would have no detectable effect on the receiving environment.
Note: Ratings may be positive (e.g. high level of enhancement) or negative (e.g. high adverse effect).	

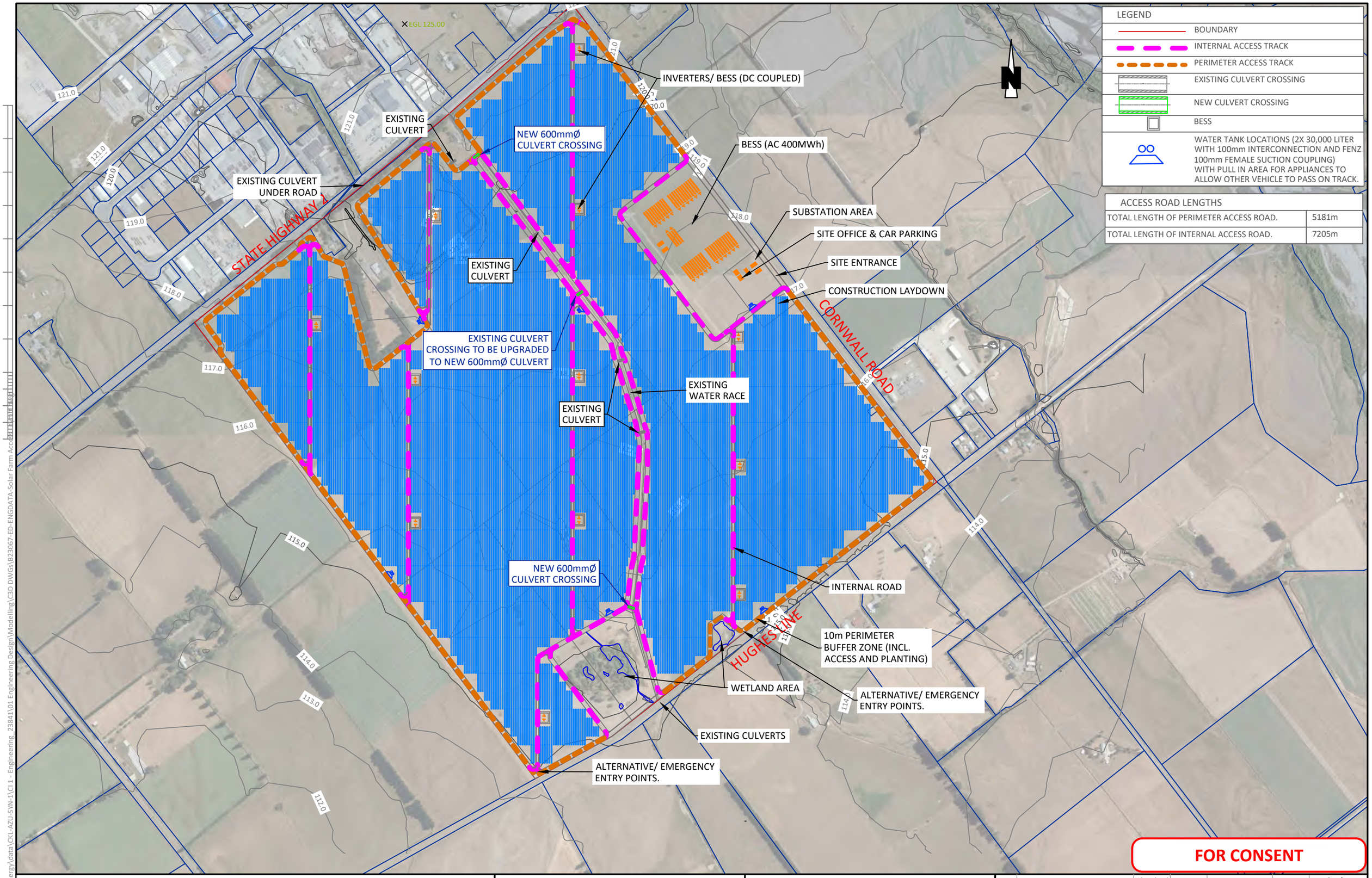
[18] Note: the threshold between less than minor and minor differs from the draft version but is consistent with the final (print) version of *Te Tangi a te Manu - Aotearoa New Zealand Landscape Assessment Guidelines.*

APPENDIX THREE: VISUAL ABSORPTION CAPABILITY RATINGS

The following standardised rating system has been developed by Mansergh Graham Landscape Architects Ltd and is consistent with the recommendations of *Te Tangi a te Manu - Aotearoa New Zealand Landscape Assessment Guidelines (Final Version).*

Visual Absorption Capability Definition Ratings	
VAC Rating	**Use**
Very Good	The proposed development/activity would be completely screened, almost completely screened, or completely absorbed by existing landscape features. Any views of the development would be either unidentifiable or at a great distance, and/or; The development/activity would not affect the existing character of the surrounding landscape or view in which it is seen, and/or; The development/activity would introduce a visual element into the landscape or view which may be viewed very frequently or continuously in that or similar landscape types.
Good	The proposed development/activity would be mostly screened or visually absorbed by existing landscape features, but still be identifiable. The development/activity may act as a tertiary focal attraction within the landscape or view in which it is seen, and/or; The development/activity would not affect the existing character of the surrounding landscape or view in which it is seen, and/or; The development/activity may introduce a visual element into the landscape or view which may be viewed frequently in that or similar landscape types.
Neutral	The proposed development/activity would neither be screened nor become a visual intrusion or focal attraction within the landscape or view in which it is seen. The proposed development/activity may act as a minor focal attraction from some locations, and/or; The development/activity would alter the existing character of the surrounding landscape or view in which it is seen, and/or; The development/activity would introduce a visual element into the landscape or view which may be viewed occasionally in that or similar landscape types.
Poor	The proposed development/activity would be clearly visible but would not act as a primary focal attraction, and/or; It would be expected that the proposed development/activity would alter the existing character of the surrounding landscape or view in which it is seen, and/or; The development/activity may introduce a new visual element into the landscape or view. The development/activity may be viewed infrequently in that or similar landscape types.
Very Poor	The proposed development/activity will be highly visible and may act as a primary focal attraction or feature. It would also be expected that the proposed development/activity will significantly alter the existing character of the surrounding landscape or view in which it is seen, and/or; The development/activity will introduce a new visual element into the landscape or view, which will be significantly different in appearance, or scale from the landscape elements surrounding it, and/or; The development/activity would be found very rarely in that or similar landscape types.

APPENDIX FOUR: SITE LAYOUT PLANS



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SOLAR FARM
NZ CLEAN ENERGY
CORNWALL ROAD, MASTERTON

OVERALL LAYOUT ACCESS ROUTES

Issue	Description	Checked	Date
1	Culverts amended	GCW	13.10.23
2	Revised Layout	GCW	06.11.23
3	Revised Layout	GCW	08.11.23
4	Culverts amended	GCW	14.11.23
5	Track amended around Wetland	GCW	29.11.23

		Date
Designed:	RRC	09.10.23
Drawn:	RRC	09.10.23
Checked:	GCW	09.10.23

Scale: 1:7500 (A3 Original)

Job No: B23067 | Dwg No: 3000 | Rev: 5

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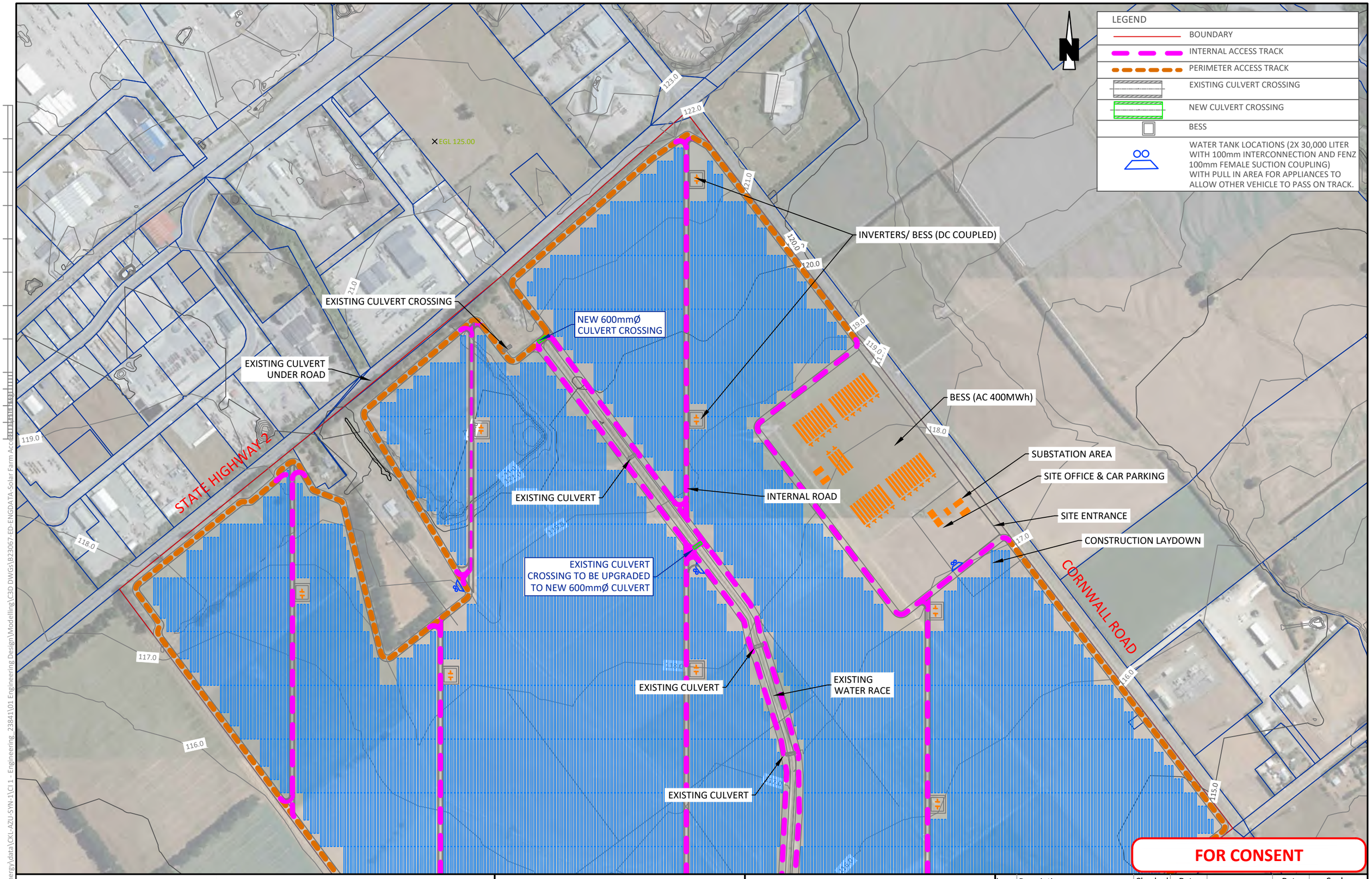

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SITE LAYOUT SHEET 1
ACCESS ROUTES

Issue	Description	Checked	Date
1	Culverts amended	GCW	13.10.23
2	Revised Layout	GCW	06.11.23
3	Revised Layout	GCW	08.11.23
4	Culverts amended	GCW	15.11.23

		Date
Designed:	RRC	09.10.23
Drawn:	RRC	09.10.23
Checked:	GCW	09.10.23

Scale: 1:5000 (A3 Original)

Job No: B23067 | Dwg No: 3001 | Rev: 4

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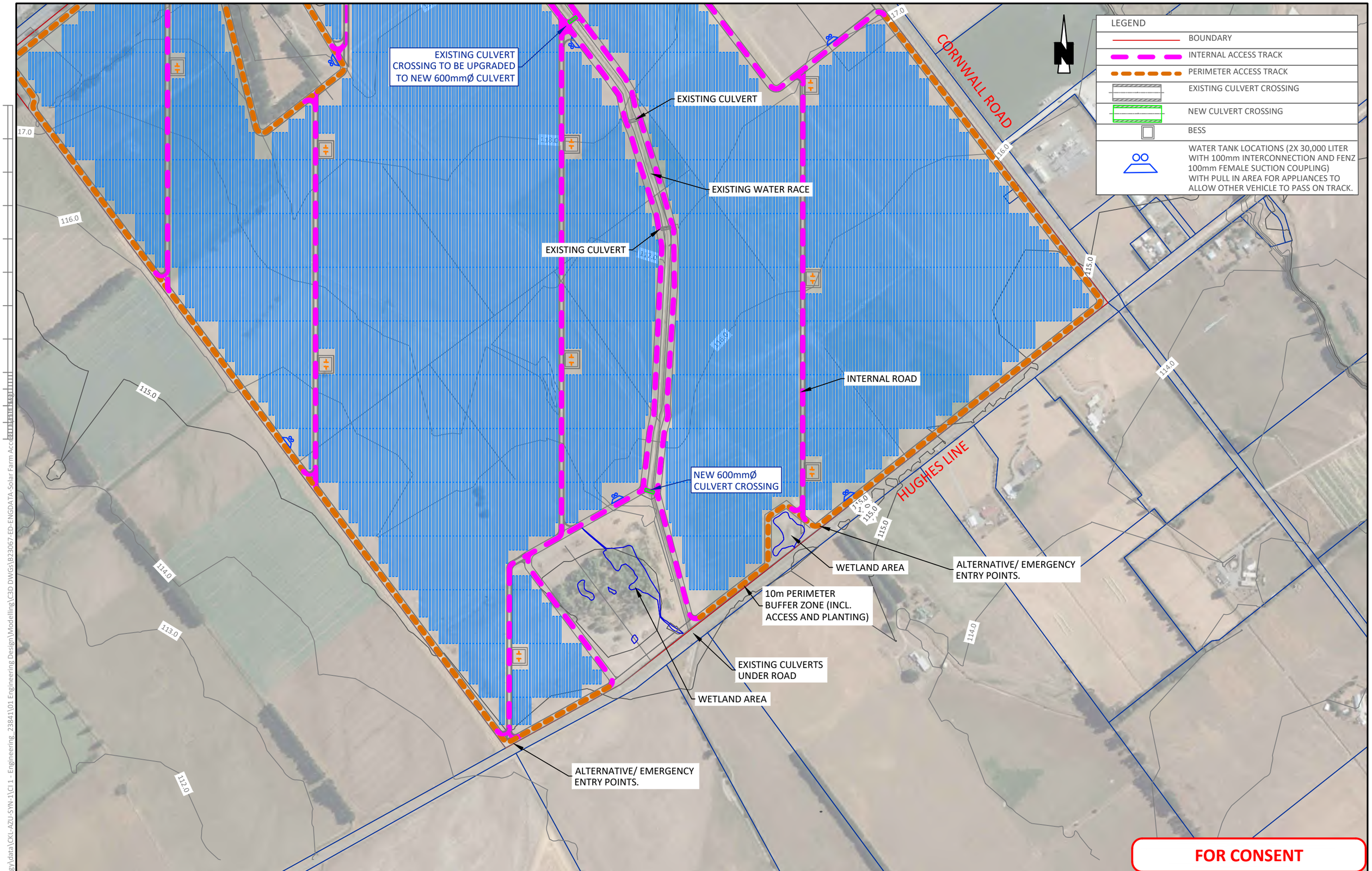

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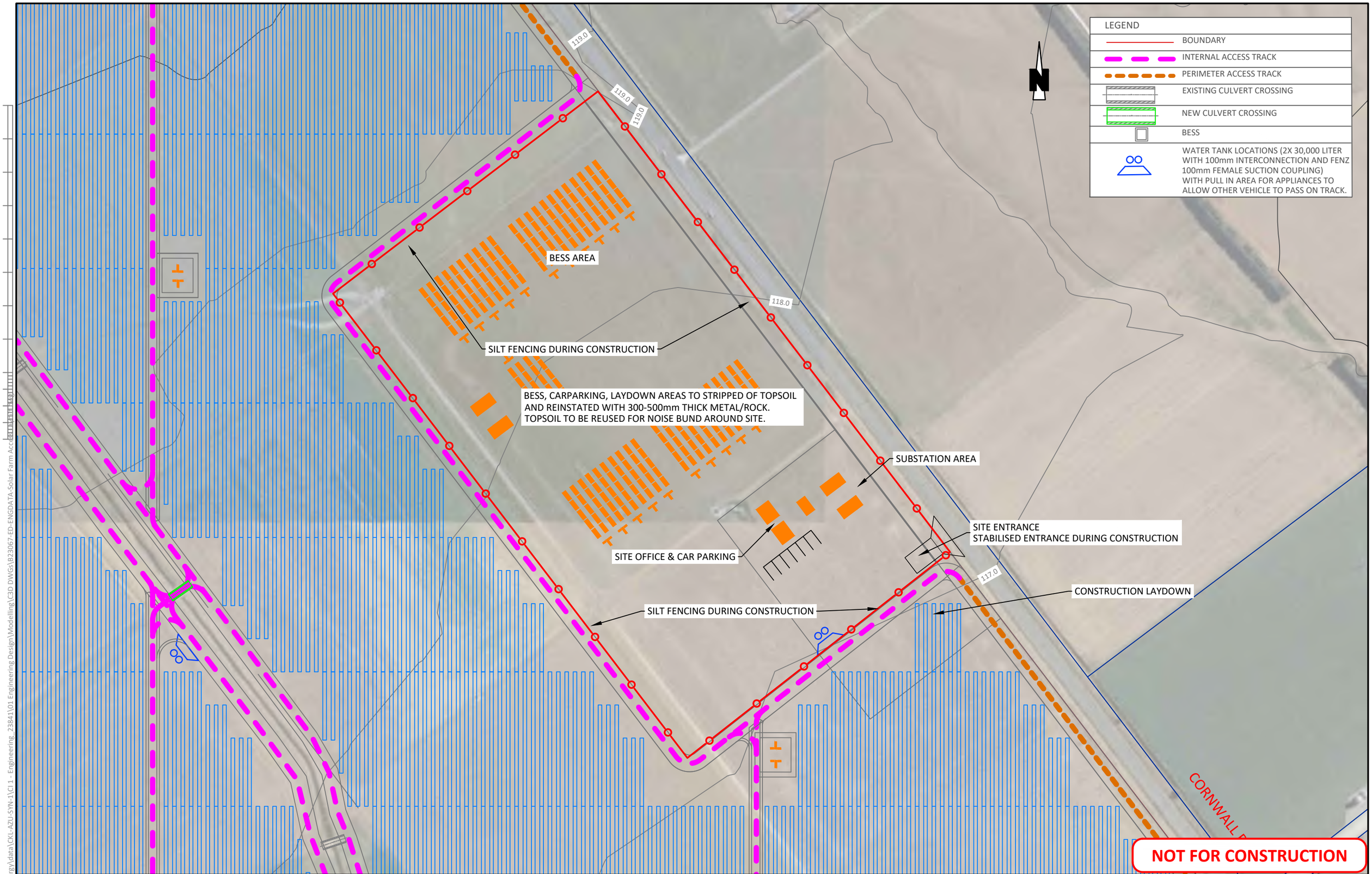
SITE LAYOUT SHEET 2
ACCESS ROUTES

Issue	Description	Checked	Date
1	Culverts amended	GCW	13.10.23
2	Revised Layout	GCW	06.11.23
3	Revised Layouts	GCW	18.11.2023
4	Culverts amended	GCW	15.11.23
5	Track amended around wetland	GCW	29.11.23

		Date
Designed:	RRC	09.10.23
Drawn:	RRC	09.10.23
Checked:	GCW	09.10.23

Scale: 1:5000 (A3 Original)

Job No: B23067 | Dwg No: 3002 | Rev: 5



NOT FOR CONSTRUCTION

CKL
Planning | Surveying | Engineering | Environmental

OFFICE
Auckland
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P: 09 524 7029
E: Auckland@ckl.co.nz

SOLAR FARM
NZ CLEAN ENERGY
CORNWALL ROAD, MASTERTON

SITE LAYOUT SHEET 3
ACCESS ROUTES
OFFICE/ CAR PARK AREA

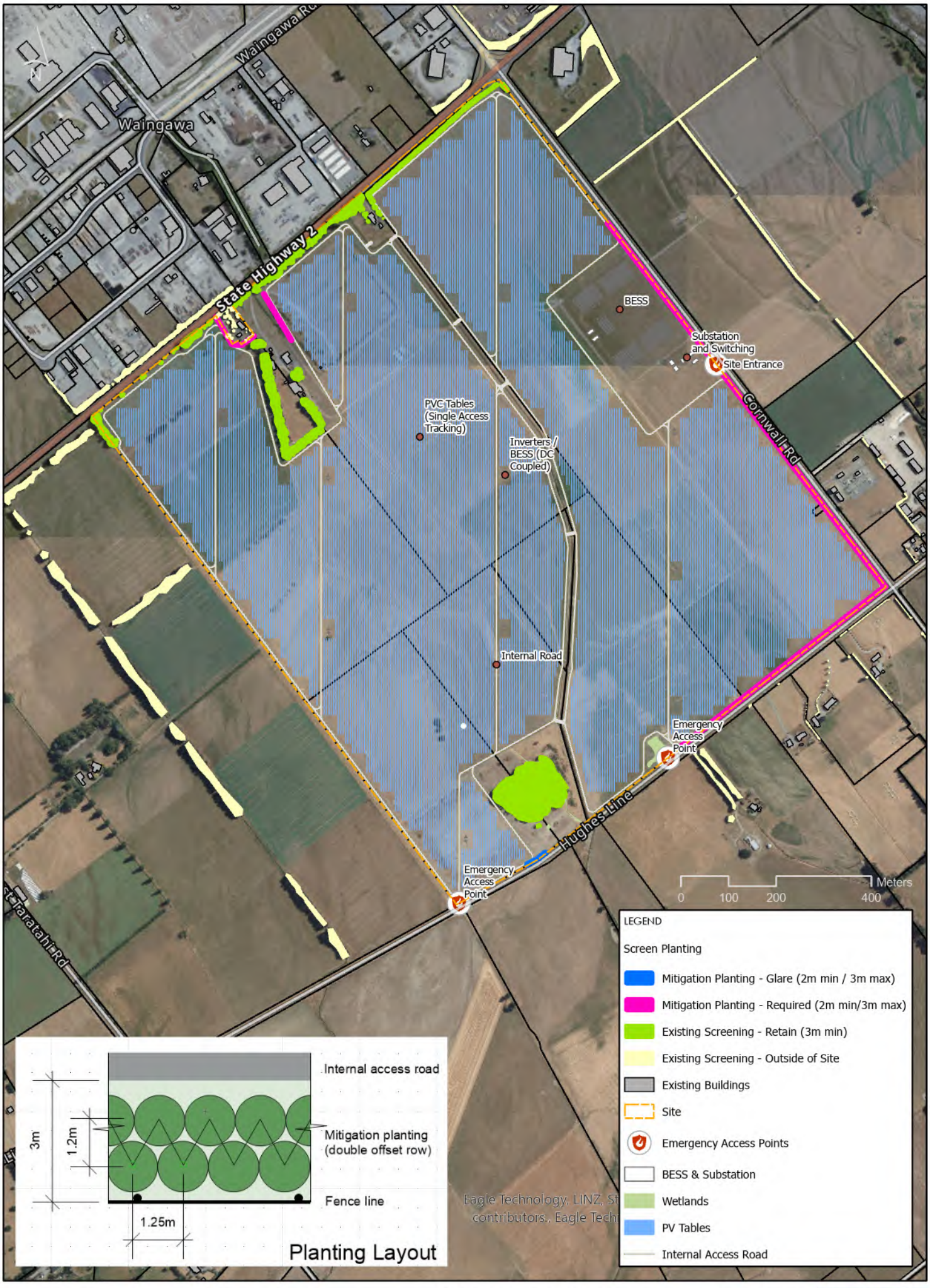
Issue	Description	Checked	Date
1	Revised Layout	GCW	06.11.23
2	Revised Layout	GCW	08.11.23
3	Culverts amended	GCW	15.11.23

		Date
Designed:	RRC	09.10.23
Drawn:	RRC	09.10.23
Checked:	GCW	09.10.23

Scale: 1:2000 (A3 Original)

Job No: B23067 | Dwg No: 3003 | Rev: 3

APPENDIX FIVE: MITIGATION PLAN



MASTERTON SOLAR & ENERGY STORAGE

MITIGATION PLANTING PLAN

SCALE 1:10,000 AT A4 | DECEMBER 2023 | MAP NO-04 | R3

mansergh graham LANDSCAPE ARCHITECTS

Botanical Name	Common Name	Mature size (ht x wth)	Yrs to 3m	Flammability [1]	Min size at planting	Plant spacing
Exotic - Single species border						
Cupressus macrocarpa	Macrocarpa	25m x 7m	4yr	x	20-30cm	2
Cupressus x ovensii	Ovens Cypress	30m x 4m	4yr	x	20-30cm	2
Native - Single species border						
*Pittosporum eugenioides	Tarata	9m x 3m	5yr	Low/mod	20-30cm	1m
Griselinia littoralis	Kapuka	6m x 2.5m	5yr	Low	20-30cm	1m
Native - Mixed species border						
Coprosma crassifolia	Mingimingi	4m x 2m	3yr	Low	20-30cm	1
**Coprosma lucida	Karanga/Shining karamu	6m x 3m	7yr	x	20-30cm	1m
Coprosma repens	Taupata	5m x 3m	5yr	Low	20-30cm	1m
Coprosma robusta	Karamu	5m x 4m	5yr	Low	20-30cm	1
Coprosma virescens	Mikimiki	5m x 3m	5-7yr	x	20-30cm	1
Corokia cotoneaster	Korokio	3m x 2m	7yr	x	20-30cm	1m
Corokia x virgata	C buddleioides x c cononeaster		10	x	20-30cm	0.75m
Griselinia littoralis	Kapuka	6m x 2.5m	5yr	Low	20-30cm	1m
Veronica stricta	Koromiko	2m x 1.5m		Low/mod	20-30cm	1
Olearia paniculata	Akiraho/Golden Ake Ake	4m x 2.5m	5yr	x	20-30cm	1m
Olearia solandri	Coastal Shrub Daisy	4m x 2m	5yr	x	20-30cm	1m
*Pittosporum eugenioides	Tarata	9m x 3m	5yr	Low/mod	20-30cm	1m
Pittosporum ralphii	Ralph's karo	4m x 3m	5yr	x	20-30cm	1m

x = flammability not listed in the Fire Emergency New Zealand Low Flammability Plant List (unknown)

* Tips can be frosted when young but will recover after 2 yrs.

**Presumed this plant will be same as the other plants of the same species listed

[1] As identified in *The Fire Emergency New Zealand Low Flammability Plant List.* https://www.checkitsalright.nz/reduce-your-risk/low-flammability-plants.

Plant Species Palette

Exotic - Single species border

Cupressus macrocarpa
Macrocarpa

Cupressus x ovensii
Ovens Cypress

Native - Single species border

Pittosporum eugenioides
Tarata

Griselinia littoralis
Kapuka

Native - Mixed species border

Coprosma crassifolia
Mingimingi

Coprosma lucida
Karanga/
Shining karamu

Coprosma repens
Taupata

Coprosma robusta
Karamu

Native - Mixed species border (continued)

Coprosma virescens
Mikimiki

Corokia cotoneaster
Korokio

Corokia x virgata
C buddleioides x c cononeaster

Griselinia littoralis
Kapuka

Veronica stricta
Koromiko

Olearia paniculata
Akiraho/
Golden Ake Ake

Olearia solandri
Coastal Shrub Daisy

Pittosporum eugenioides
Tarata

Pittosporum ralphii
Ralph's karo

Schedule
Growth limit zones

r 4(1)

Table 1

Distances for spans less than and equal to 150 metres in length

Voltage of conductors other than aerial bundled conductors or conductors insulated by other means	Distance in any direction from any point on conductor (metres)
66 kV or greater	4
50 kV to 66 kV	3
33 kV	2.5
11 kV	l.6
400/230 v	0.5
Voltage of aerial bundled conductors or conductors insulated by other means	**Distance in any direction from any point on conductor (metres)**
Any voltage where the conductor is an aerial bundled conductor or is otherwise insulated	0.5

Key:

kV = kilovolts

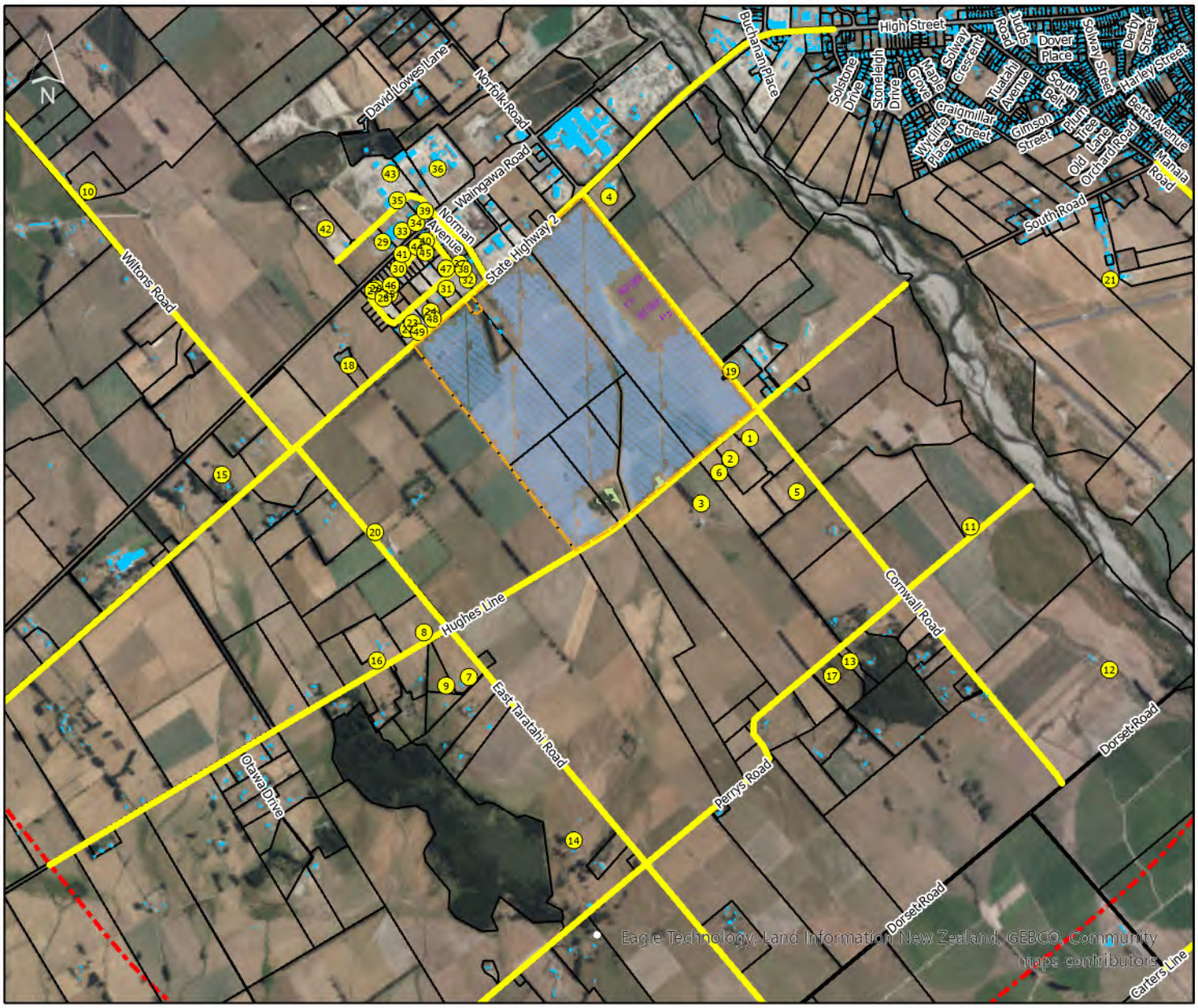
v = volts

Table 2

Distances for spans more than 150 metres in length

Length of span (metres)	Vertical distance from a horizontal plane drawn from any point on conductor (metres)	Horizontal distance from a vertical plane drawn from any point on conductor (metres)
150 to 300	4	D1 = 4 D2 = 8
301 to 500	4	D1 = 7.5 D2 = 15
501 to 700	4	D1 = 15 D2 = 30
Greater than or equal to 701	4	D1 = 25 D2 = 50

APPENDIX SIX: FORGESOLAR ANALYSIS REPORT & GLARE RATING CRITERIA



OP	Type	Address
1	House	558 Hughes Line, East Taratahi, Carterton
2	House	542 Hughes Line, East Taratahi, Carterton
3	House	
4	Commercial	4022 State Highway 2, East Taratahi, Carterton
5	House	178 Cornwall Road, East Taratahi, Carterton
6	House	532 Hughes Line, East Taratahi, Carterton
7	House	142 East Taratahi Road, West Taratahi, Carterton
8	House	353 Hughes Line, West Taratahi, Carterton
9	House	144B East Taratahi Road, West Taratahi, Carterton
10	House	164 Wiltons Road, West Taratahi, Carterton
11	House	251 Cornwall Road, East Taratahi, Carterton
12	House	329 Cornwall Road, East Taratahi, Carterton
13	House	524 Perrys Road, East Taratahi, Carterton
14	House	250 East Taratahi Road, East Taratahi, Carterton
15	House	3787 State Highway 2, West Taratahi, Carterton
16	House	345 Hughes Line, West Taratahi, Carterton
17	House	518 Perrys Road, East Taratahi, Carterton
18	House	3865 State Highway 2, West Taratahi, Carterton
19	Commercial	113 Cornwall Road, East Taratahi, Carterton
20	Commercial	61 East Taratahi Road, West Taratahi, Carterton
21	Commercial	210 South Road, Solway, Masterton
22	Commercial	11A Pakihi Road, Waingawa, Carterton
23	Commercial	9 Pakihi Road, Waingawa, Carterton
24	Commercial	7 Pakihi Road, Waingawa, Carterton
25	Commercial	21 Ahumahi Road, Waingawa, Carterton

OP	Type	Address
26	Commercial	28 Ahumahi Road, Waingawa, Carterton
27	Commercial	30 Ahumahi Road, Waingawa, Carterton
28	Commercial	23 Ahumahi Road, Waingawa, Carterton
29	Commercial	
30	Commercial	16 Ahumahi Road, Waingawa, Carterton
31	Commercial	3 Pakihi Road, Waingawa, Carterton
32	Commercial	11 Norman Avenue, Waingawa, Carterton
33	Commercial	
34	Commercial	
35	Commercial	124 Norman Avenue, Waingawa, Carterton
36	Commercial	
37	Commercial	11 Norman Avenue, Waingawa, Carterton
38	Commercial	11 Norman Avenue, Waingawa, Carterton
39	Commercial	43 Norman Avenue, Waingawa, Carterton
40	Commercial	2 Ahumahi Road, Waingawa, Carterton
41	Commercial	12 Ahumahi Road, Waingawa, Carterton
42	Commercial	134 Norman Avenue, Waingawa, Carterton
43	Commercial	124 Norman Avenue, Waingawa, Carterton
44	Commercial	6 Ahumahi Road, Waingawa, Carterton
45	Commercial	3 Ahumahi Road, Waingawa, Carterton
46	Commercial	19 Ahumahi Road, Waingawa, Carterton
47	Commercial	4 Pakihi Road, Waingawa, Carterton
48	Commercial	7 Pakihi Road, Waingawa, Carterton
49	Commercial	9 Pakihi Road, Waingawa, Carterton

LEGEND

- Observer Points (Assessed)
- Existing Buildings
- Roads (Assessed)
- Analysis Area (3km)
- Site
- BESS & Substation
- PV Tables

Glare Analysis Points & Routes

Masterton Solar & Energy Storage | Scale 1:40,000 at A4 | November 2023 | Map No-03 | R0

mansergh graham LANDSCAPE ARCHITECTS

FORGESOLAR GLARE ANALYSIS

Project: **Masterton Solar**
Proposed 90MW Solar Farm SW of Masterton

Site configuration: **Masterton SAT 2939**

Site description: Masterton SAT Config Oct R2

Created 17 Oct, 2023
Updated 16 Nov, 2023
Time-step 1 minute
Timezone offset UTC12
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Category 10 MW to 100 MW
Site ID 103116.17313

Ocular transmission coefficient 0.5
Pupil diameter 0.002 m
Eye focal length 0.017 m
Sun subtended angle 9.3 mrad
PV analysis methodology V2

Summary of Results

Glare with potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy	Peak Luminance
	°	°	min	hr	min	hr	kWh	cd/m^2
Masterton	SA tracking	SA tracking	69	1.1	6	0.1	149,400.0	250,333

Total glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Carters Line	0	0.0	0	0.0
Cornwall Road A	0	0.0	0	0.0
Cornwall Road B	0	0.0	0	0.0
East Taratahi Road A	0	0.0	0	0.0
East Taratahi Road B	0	0.0	0	0.0
Hughes Line A	0	0.0	0	0.0
Hughes Line B	69	1.1	6	0.1
Hughs Line	0	0.0	0	0.0
Mania Road	0	0.0	0	0.0
Pakihi Road	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Perrys Road A	0	0.0	0	0.0
Perrys Road B	0	0.0	0	0.0
State Highway 2 A	0	0.0	0	0.0
State Highway 2 B	0	0.0	0	0.0
Wiltons Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
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OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 27	0	0.0	0	0.0
OP 28	0	0.0	0	0.0
OP 29	0	0.0	0	0.0
OP 30	0	0.0	0	0.0
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0
OP 35	0	0.0	0	0.0
OP 36	0	0.0	0	0.0
OP 37	0	0.0	0	0.0
OP 38	0	0.0	0	0.0

Obstruction Components

Name: Mitigation Screening
Top height: 3.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-40.972659	175.605086	120.00
2	-40.979307	175.612264	116.00
3	-40.982563	175.607082	116.00

Name: SH2 Northern Shelterbelt
Top height: 4.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-40.975163	175.594391	119.00
2	-40.972214	175.598876	124.00
3	-40.972157	175.599069	124.00
4	-40.970351	175.601623	124.00
5	-40.969987	175.602266	124.00
6	-40.970165	175.602460	124.00

Name: SH2 Western Shelterbelt
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-40.978444	175.589569	117.00
2	-40.978104	175.590095	117.00
3	-40.978176	175.590234	117.00
4	-40.976816	175.592315	118.00
5	-40.976492	175.592412	118.00
6	-40.977075	175.592852	118.00

Name: Southwestern Shelterbelt
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-40.986568	175.599250	114.00
2	-40.985078	175.597598	114.21

Name: Stockyards Shelterbelt
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-40.975033	175.596471	120.00
2	-40.977156	175.597287	120.00
3	-40.976589	175.598188	120.00
4	-40.976103	175.597630	120.00

Name: Western Shelterbelt
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-40.983928	175.596246	115.00
2	-40.979085	175.591182	117.00

Name: Wetland Willows
Top height: 15.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-40.983553	175.604486	116.00
2	-40.983342	175.604593	116.00
3	-40.982662	175.603820	116.00
4	-40.983132	175.603005	116.00
5	-40.983391	175.602662	116.00
6	-40.983699	175.602941	115.29
7	-40.983974	175.603520	115.00
8	-40.984055	175.603863	115.00
9	-40.983764	175.604014	116.00
10	-40.983553	175.604486	116.00

Glare Analysis Results

Summary of Results

Glare with potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy	Peak Luminance
	°	°	min	hr	min	hr	kWh	cd/m^2
Masterton	SA tracking	SA tracking	69	1.1	6	0.1	149,400.0	250,333

Total glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

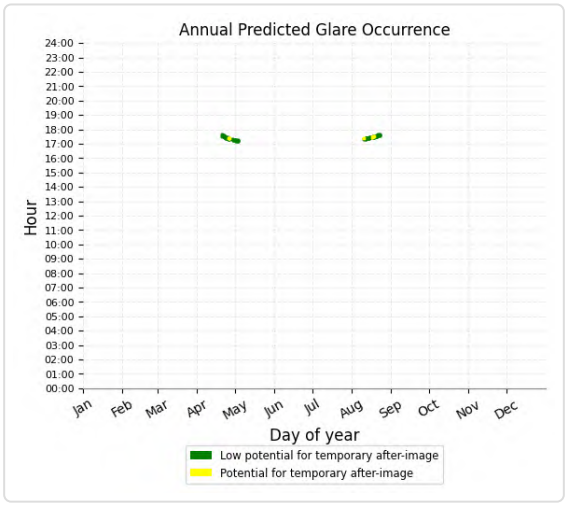
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Carters Line	0	0.0	0	0.0
Cornwall Road A	0	0.0	0	0.0
Cornwall Road B	0	0.0	0	0.0
East Taratahi Road A	0	0.0	0	0.0
East Taratahi Road B	0	0.0	0	0.0
Hughes Line A	0	0.0	0	0.0
Hughes Line B	69	1.1	6	0.1
Hughs Line	0	0.0	0	0.0
Mania Road	0	0.0	0	0.0
Pakihi Road	0	0.0	0	0.0
Perrys Road A	0	0.0	0	0.0
Perrys Road B	0	0.0	0	0.0
State Highway 2 A	0	0.0	0	0.0
State Highway 2 B	0	0.0	0	0.0
Wiltons Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0

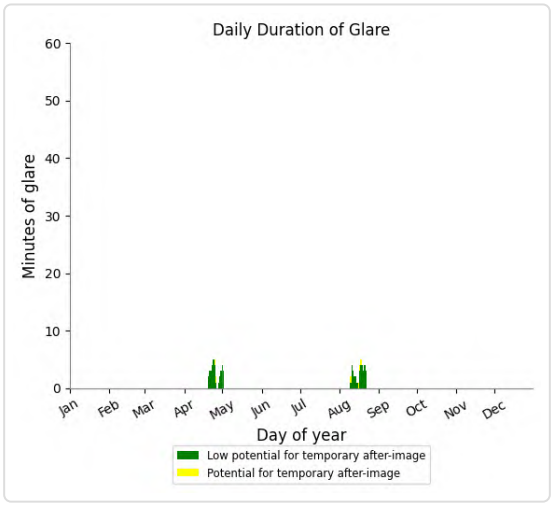
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 27	0	0.0	0	0.0
OP 28	0	0.0	0	0.0
OP 29	0	0.0	0	0.0
OP 30	0	0.0	0	0.0
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0
OP 35	0	0.0	0	0.0
OP 36	0	0.0	0	0.0
OP 37	0	0.0	0	0.0
OP 38	0	0.0	0	0.0
OP 39	0	0.0	0	0.0
OP 40	0	0.0	0	0.0

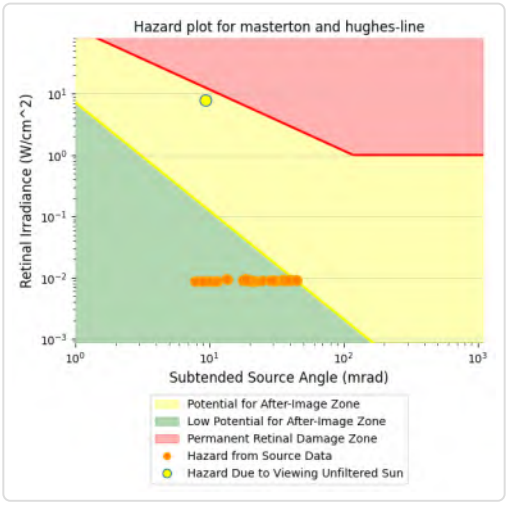
Masterton and Route: Hughes Line B

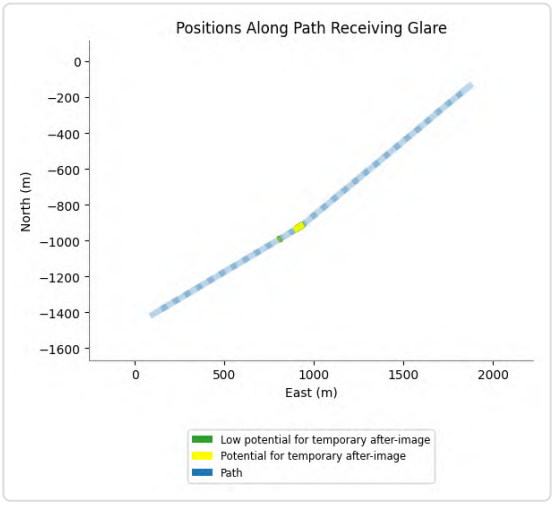
Yellow glare: 6 min.

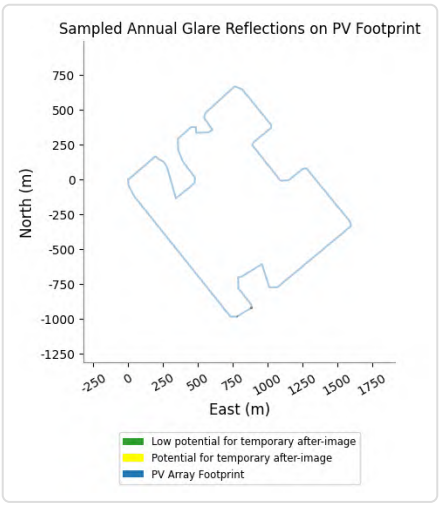
Green glare: 69 min.

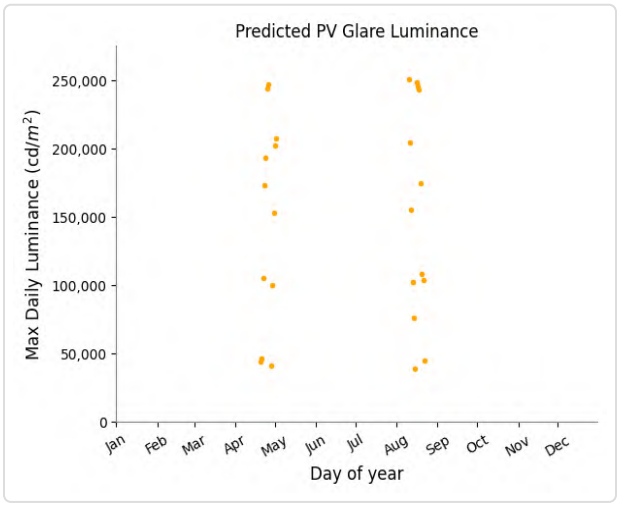












Masterton and Route: Carters Line

No glare found

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.
Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.
Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.
The analysis does not automatically consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.
The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.
The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

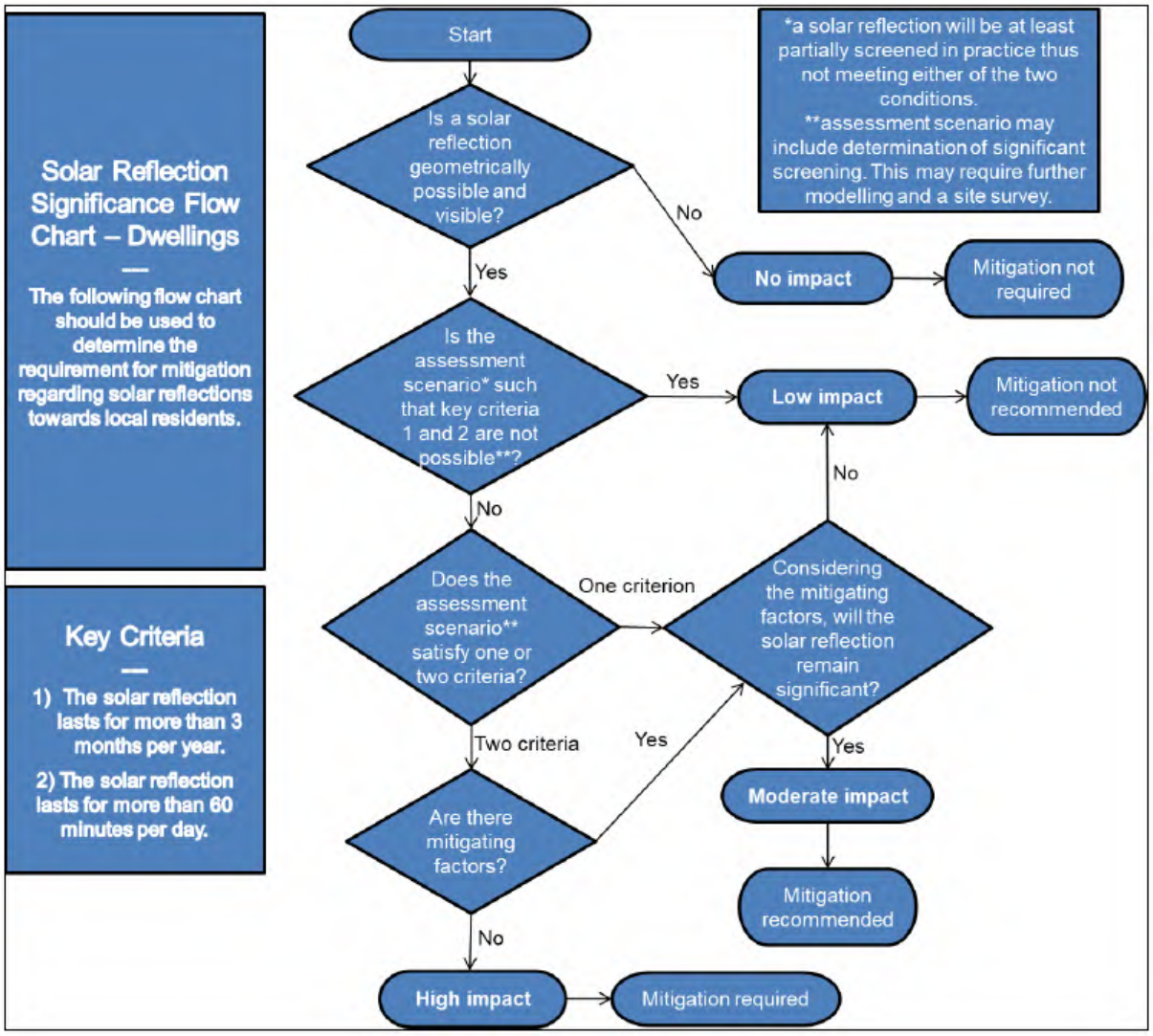
Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

The Pager Power Solar Photovoltaic and Building Development – Glint and Glare Guidance Report makes the following recommendations for the categorisation of the magnitude of glint and glare analysis effects:

> *6.16 If visible glint and glare is predicted for a surrounding dwelling for longer than 60 minutes per day, for three or more months of the year, then the impact should be considered significant with respect to residential amenity. In this scenario, mitigation should be implemented[19].*

> *6.20 Consultation is recommended where there is a requirement for mitigation[20].*



Roads

> *7.2 Where the solar reflection originates from relative to a road user is a key criterion. Pager Power considers a solar reflection to be potentially significant if it originates within 50 degrees of the direction of travel38;*

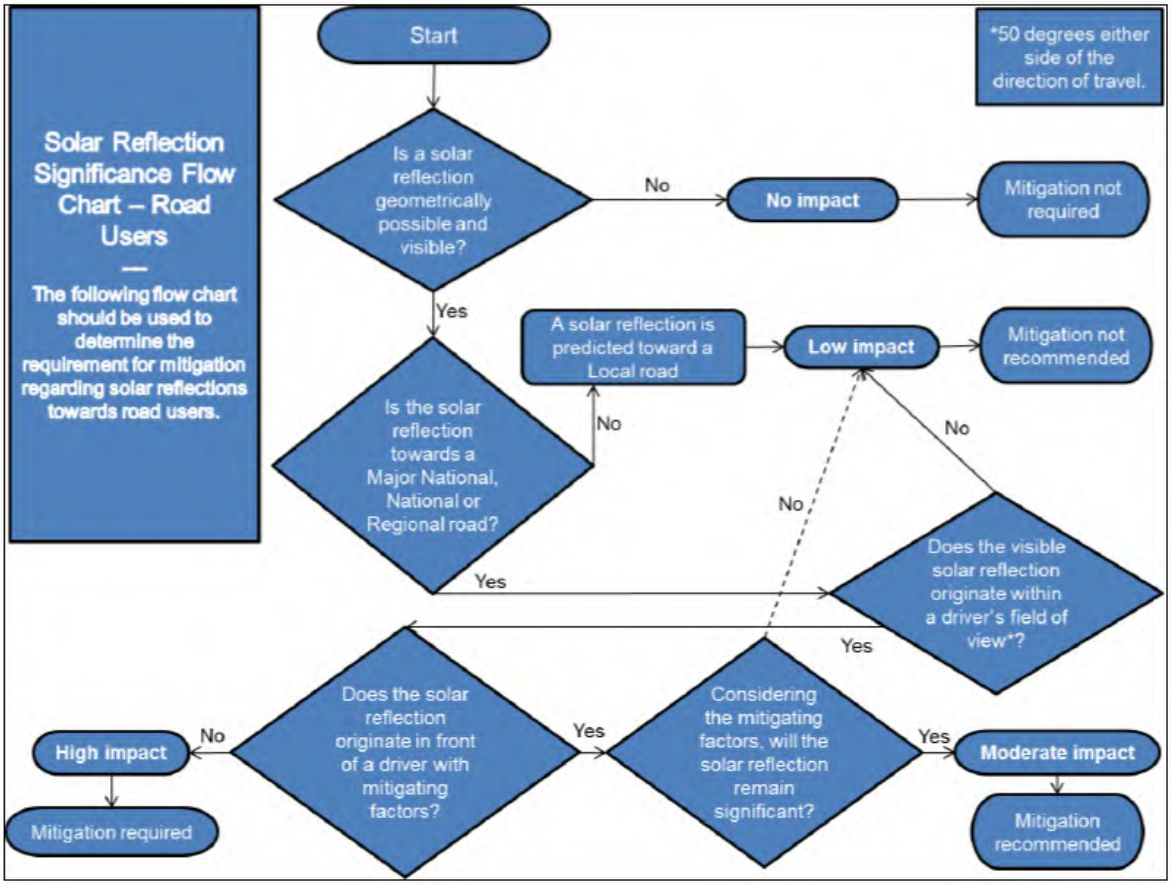
> *7.6 A road user travelling on surrounding roads where a solar reflection is geometrically possible would experience a solar reflection that is fleeting in nature. This is because the road user is typically moving at speeds anywhere up to 70mph or 120kph. This means that the duration of a predicted solar reflection is mostly dependent on the speed of the road user travelling past the solar farm at the time when a solar reflection is geometrically possible. Therefore, the location of origin of the solar reflection is more significant than its duration because the receptor is moving.*

[19] Page 55. *Solar Photovoltaic and Building Development Glint and Glare Guidance.*

[20] Page 57. *Solar Photovoltaic and Building Development Glint and Glare Guidance.*

7.9 Because the length of time a solar reflection can last is mostly dependent on the road user's speed rather than the solar PV development, the length of time that a solar reflection is not considered when determining its significance. Instead, the location of origination of the solar reflection and road type are considered.

7.14 The visibility and size of the reflecting solar panel area from an assessed road will in part, determine the duration of a solar reflection. In most scenarios, the speed of the vehicle will be the overall determining factor which determines the duration of the solar reflection. The type of road affected and location of origin of the solar reflection with respect to the direction of road travel will determine the requirement for mitigation. Consultation with the local highway authority is recommended where mitigation is required.



The Ridge Clean Energy Glint and Glare Assessment Report categorised the magnitude of glint and glare analysis effects into the following 4 rating criteria:

Although there is no specific guidance set out to identify the magnitude of impact from glare, the following criteria has been set out for the purposes of this report:

- *High - Glare impacts of over 30 hours per year or over 30 minutes per day*
- *Medium - Glare impacts between 20 and 30 hours per year or between 20 minutes and 30 minutes per day*
- *Low - Glare impacts up to 20 hours per year or up to 20 minutes per day*
- *None - Effects not geometrically possible or no visibility of reflective surfaces likely due to high levels of intervening screening*

APPENDIX SEVEN: VIEW LOCATION PHOTOGRAPHS

View Location Data

NZTM Easting:	1,819,030E
NZTM Northing:	5,461,415N
Focal length:	50mm
Photographer:	D. Mansergh
Camera:	Canon EOS D5 MK.4 Full Frame Digital with EF 50mm F/1.4 USM (Prime)
Date:	19th October 2023
Viewing Distance:	A3 image should be 500mm to approximate actual scale.

VL 1 - Photograph From SH2 (Looking South Towards the Site)

View Location Data

NZTM Easting:	1,818,224E
NZTM Northing:	5,460,711N
Focal length:	50mm
Photographer:	D. Mansergh
Camera:	Canon EOS D5 MK.4 Full Frame Digital with EF 50mm F/1.4 USM (Prime)
Date:	19th October 2023
Viewing Distance:	A3 image should be 500mm to approximate actual scale.

VL 2 - Photograph From SH2 (Looking Southeast Towards the Site)

View Location Data

NZTM Easting: 1,818,224E
NZTM Northing: 5,460,711N
Focal length: 50mm
Photographer: D. Mansergh
Camera: Canon EOS D5 MK.4 Full Frame Digital with EF 50mm F/1.4 USM (Prime)
Date: 19th October 2023
Viewing Distance: A3 image should be 500mm to approximate actual scale.

A 3D digital model of the proposed development was produced and accurately superimposed into each image using a combination of Adobe Photoshop, City Engine 2023 and ArcGIS Pro, in accordance with NZILA best practice guidelines. Photo montaging by MGLA.

VL 2 - Photomontage From SH2 (Looking Southeast Towards the Site)

View Location Data

NZTM Easting:	1,818,403E
NZTM Northing:	5,460,765N
Focal length:	50mm
Photographer:	D. Mansergh
Camera:	Canon EOS D5 MK.4 Full Frame Digital with EF 50mm F/1.4 USM (Prime)
Date:	19th October 2023
Viewing Distance:	A3 image should be 500mm to approximate actual scale.

VL 3 - Photograph From Adjacent to the Residence at 3920 SH2 (Looking South From Within the Site)

View Location Data

NZTM Easting: 1,819,405E
NZTM Northing: 5,460,766N
Focal length: 50mm
Photographer: D. Mansergh
Camera: Canon EOS D5 MK.4 Full Frame Digital with EF 50mm F/1.4 USM (Prime)
Date: 19th October 2023
Viewing Distance: A3 image should be 500mm to approximate actual scale.

VL 4 - Photograph From Cornwall Road (Looking Northwest Towards the Site)

View Location Data

NZTM Easting: 1,819,405E
NZTM Northing: 5,460,766N
Focal length: 50mm
Photographer: D. Mansergh
Camera: Canon EOS D5 MK.4 Full Frame Digital with EF 50mm F/1.4 USM (Prime)
Date: 19th October 2023
Viewing Distance: A3 image should be 500mm to approximate actual scale.

A 3D digital model of the proposed development was produced and accurately superimposed into each image using a combination of Adobe Photoshop, City Engine 2023 and ArcGIS Pro, in accordance with NZILA best practice guidelines. Photo montaging by MGLA.

VL 4 - Photomontage From Cornwall Road (Looking Northwest Towards the Site)

View Location Data

NZTM Easting: 1,819,405E
NZTM Northing: 5,460,766N
Focal length: 50mm
Photographer: D. Mansergh
Camera: Canon EOS D5 MK.4 Full Frame Digital with EF 50mm F/1.4 USM (Prime)
Date: 19th October 2023
Viewing Distance: A3 image should be 500mm to approximate actual scale.

A 3D digital model of the proposed development was produced and accurately superimposed into each image using a combination of Adobe Photoshop, City Engine 2023 and ArcGIS Pro, in accordance with NZILA best practice guidelines. Photo montaging by MGLA.

VL 4 - Photomontage From Cornwall Road with Screening (Looking Northwest Towards the Site)

View Location Data

NZTM Easting: 1,819,715E
NZTM Northing: 5,460,369N
Focal length: 50mm
Photographer: D. Mansergh
Camera: Canon EOS D5 MK.4 Full Frame Digital with EF 50mm F/1.4 USM (Prime)
Date: 19th October 2023
Viewing Distance: A3 image should be 500mm to approximate actual scale.

VL 5 - Photograph From Cornwall Road (Looking Northwest Towards the Site)

View Location Data

NZTM Easting:	1,819,639E
NZTM Northing:	5,460,131N
Focal length:	50mm
Photographer:	D. Mansergh
Camera:	Canon EOS D5 MK.4 Full Frame Digital with EF 50mm F/1.4 USM (Prime)
Date:	19th October 2023
Viewing Distance:	A3 image should be 500mm to approximate actual scale.

VL 6 - Photograph From Hughes Line (Looking Northwest Towards the Site)

View Location Data

NZTM Easting: 1,819,639E
NZTM Northing: 5,460,131N
Focal length: 50mm
Photographer: D. Mansergh
Camera: Canon EOS D5 MK.4 Full Frame Digital with EF 50mm F/1.4 USM (Prime)
Date: 19th October 2023
Viewing Distance: A3 image should be 500mm to approximate actual scale.

A 3D digital model of the proposed development was produced and accurately superimposed into each image using a combination of Adobe Photoshop, City Engine 2023 and ArcGIS Pro, in accordance with NZILA best practice guidelines. Photo montaging by MGLA.

VL 6 - Photomontage From Hughes Line (Looking Northwest Towards the Site)

View Location Data

NZTM Easting: 1,819,639E
NZTM Northing: 5,460,131N
Focal length: 50mm
Photographer: D. Mansergh
Camera: Canon EOS D5 MK.4 Full Frame Digital with EF 50mm F/1.4 USM (Prime)
Date: 19th October 2023
Viewing Distance: A3 image should be 500mm to approximate actual scale.

A 3D digital model of the proposed development was produced and accurately superimposed into each image using a combination of Adobe Photoshop, City Engine 2023 and ArcGIS Pro, in accordance with NZILA best practice guidelines. Photo montaging by MGLA.

VL 6 - Photomontage From Hughes Line with Screening (Looking Northwest Towards the Site)

View Location Data

NZTM Easting:	1,819,421E
NZTM Northing:	5,459,961N
Focal length:	50mm
Photographer:	D. Mansergh
Camera:	Canon EOS D5 MK.4 Full Frame Digital with EF 50mm F/1.4 USM (Prime)
Date:	19th October 2023
Viewing Distance:	A3 image should be 500mm to approximate actual scale.

VL 7 - Photograph From Hughes Line (Looking Northwest Towards the Site)

View Location Data

NZTM Easting:	1,820,146E
NZTM Northing:	5,459,058N
Focal length:	50mm
Photographer:	D. Mansergh
Camera:	Canon EOS D5 MK.4 Full Frame Digital with EF 50mm F/1.4 USM (Prime)
Date:	19th October 2023
Viewing Distance:	A3 image should be 500mm to approximate actual scale.

VL 8 - Photograph From Perrys Road (Looking Nothwest Towards the Site)

Masterton Solar & Energy Storage. December 2023. R1

mansergh graham
LANDSCAPE ARCHITECTS

View Location Data

NZTM Easting: 1,819,032E
NZTM Northing: 5,458,215N
Focal length: 50mm
Photographer: D. Mansergh
Camera: Canon EOS D5 MK.4 Full Frame Digital with EF 50mm F/1.4 USM (Prime)
Date: 19th October 2023
Viewing Distance: A3 image should be 500mm to approximate actual scale.

VL 9 - Photograph From East Taratahi Road (Looking North Towards the Site)

Masterton Solar & Energy Storage. December 2023. R1

mansergh graham LANDSCAPE ARCHITECTS

View Location Data

NZTM Easting: 1,818,175E
NZTM Northing: 5,459,297N
Focal length: 50mm
Photographer: D. Mansergh
Camera: Canon EOS D5 MK.4 Full Frame Digital with EF 50mm F/1.4 USM (Prime)
Date: 19th October 2023
Viewing Distance: A3 image should be 500mm to approximate actual scale.

VL 10 - Photograph From East Taratahi Road (Looking Northeast Towards the Site)