BYRON BAY SOLAR FARM

Landscape Character, Visual Impact and Solar Glare Assessment

LANDSCAPE ARCHITECTS

November 2020

Figure 01. Proposed Solar Farm Aerial View.

CLIENT

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Cover Image. Proposed Solar Farm, Site View West.

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GLOSSARY OF DEFINITIONS

Viewpoint. *A point within a viewing situation where panoramic or scenic views are particularly visible, as identified through field survey for the purposes for viewshed mapping.*

Field of View. *The extent to which what is seen and how it is seen as expressed as an angle horizontally and vertically.*

Viewing Situation. *Locations from which people experience and enjoy views.*

Viewshed. *The entire area that is visible from a particular viewing situation. It is the combination of all available lines of sight along which an observer has an unobstructed view, and is directly related to terrain, elevation and obstructions, including vegetation or structures.*

Scenic Quality. *The combination of natural and cultural elements within the landscape and level of satisfaction or appreciation it creates.*

Scenic Landscape. *A landscape that displays aesthetic qualities or values that an observer finds appealing. The combination of Landscape Character and Scenic Quality.*

Dynamic Viewing Situations. *May include roads, cycleways, walking trails, navigable waterways and any other route along which an observer appreciates a sequence of views from a series of locations over time as they move through the landscape.*

Static Viewing Situations. *Locations from which a single unchanging view or scene is appreciated where the viewer is for the most part stationary. May include lookouts, public parks and reserves, beaches, headlands and places of interest such as Cape Byron Lighthouse, St Helena Lookout and Byron Bay Surf Club foreshore.*

Key Landscape Feature. *A distinguishing, visually prominent or valued visual attribute regarded as characteristic of the landscape. May include recognisable natural landforms, vegetation or cultural elements.*

Landscape Character. *The combined quality of built, natural and cultural aspects which make up an area and provide its unique sense of place.*

Landscape Character Unit. *An area of landscape with similar properties or strongly defined spatial qualities, distinct from areas immediately nearby.*

Visual Impact. *The impact on the views from public places, workplaces and residences.*

Visual Sensitivity. *Capacity of a landscape or view to accommodate change without losing valued attributes. Includes the value placed on a landscape or view by the community through planning scheme protection, and the type and number of receivers (Viewers).*

Visual Amenity. *The attractiveness of a scene or view.*

Scenic Amenity. *A measure of the relative contribution of each place to the collective appreciation of the landscape.*

Modification. *The Project, Deveopment, Action that alters the existing Landscape condition.*

Magnitude of Change. *The extent of modification that will be experienced by viewers.*

Mitigation Measures *The management of Visual Impacts through planning and design solutions (Site, Location, Scale, Materiality) that reduce and alleviate the magnitude of change. Through actions that compensate for visual impact , usually through screening.*

Zone of Theoretical Visual Influence. *The extent to which when undertaking a viewshed analysis the proposed modification can be seen limited only by topography.*

Glint and Glare. *Glint is typically defined as a momentary flash of bright light, often caused by a reflection off a moving source. A typical example of glint is a momentary solar reflection from a moving car. Glare is defined as a continuous source of bright light. Glare is generally associated with stationary objects, which, due to the slow relative movement of the sun, reflect sunlight for a longer duration*

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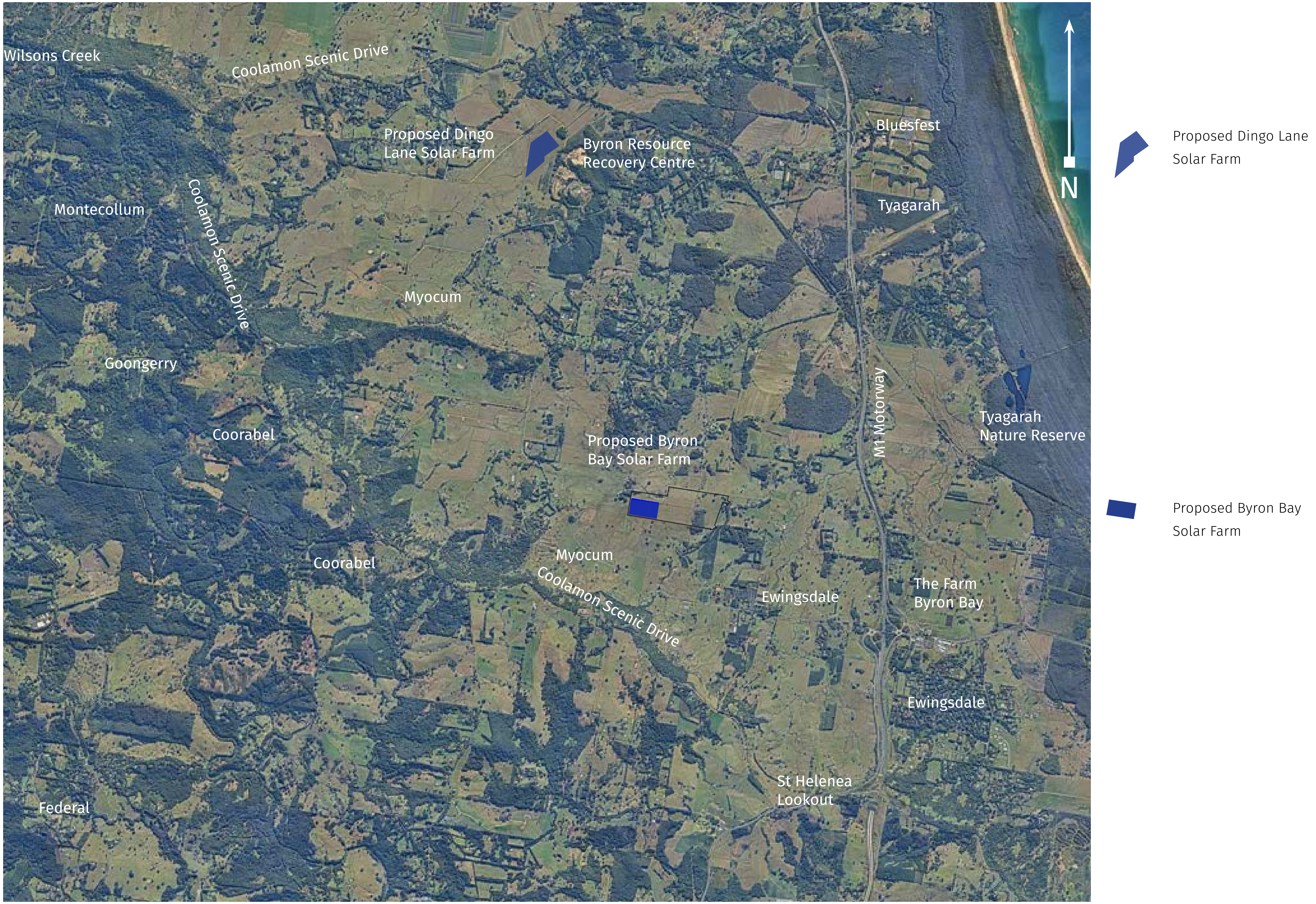


Figure 02. Locality and Vicinal Proposed Development Type.

EXECUTIVE SUMMARY

This Landscape Character, Visual Impact and Solar Glare Assessment, has been undertaken on behalf of Byron Bay Solar Farm Holdings Pty Ltd, to evaluate the existing landscape character, determine the extent to which the Project may impact Scenic Quality and how any impacts may be managed and or mitigated.

The Scenic Quality of the Byron Shire is defined by the visual drama of the transition from the perceived naturalness of coastal beaches and wetlands, through a pattern of gently undulating rural hills and valleys to a backdrop of dramatic ridgelines and escarpments. The rural hills and valleys within the assessment area are delineated by roads and lanes that follow ridgelines and rises. These rural vistas are patterned by rural settlements on landscaped and forested allotments on elevated rises; grazing lands with paddock trees and remnant vegetation on the valley floor; and farms, small holdings, plantations and horticultural industries on undulating hills and rises.
Recognition of potential visual impact is implicit in the site selection for the Project, The site on which the Solar Farm being proposed is a drainage plain of low elevation in a valley of westerly aspect, separate from urban development and large viewing populations. The proposed site has limited landuse options.

Byron Bay Solar Farm Holdings proposes to construct, install and operate a 5MW Solar Farm comprising 25056 (PV) Modules, and ancillary structures at 196 Kennedys Lane, Ewingsdale, covering an area of approximately 7 Hectares.
Recognition of visual impact is implicit in the selection of a (PV) Solar Array system that minimises height and therefore visibility at low elevations, maintaining the existing landscape topography and vegetation.

Viewed at low elevations the project within the valley floor becomes a thin line in the landscape. As elevation increases the visibility increases due to the angle of view. With distance visibility decreases. Public views are mainly limited to local roads and lanes. The roads and lanes have limited opportunity for stopping. Viewing situations are dynamic, intermittent and limited. There are no views from public buildings, reserves or parks that would provide an opportunity for viewers to experience extended viewing times. Tourist roads (Coolamon Scenic Drive) and lookouts (St Helena Lookout) within the viewshed have limited opportunity for views due to existing offsite vegetation screening and the effect of distance from the Project.

To mitigate visual impact, planting is proposed along the southern boundary of the Project to screen the ancillary structures. Planting along the boundary in the south west corner is proposed to screen and embed the Project from views at low elevations. Planting to the northern boundary will embed the Project within the landscape by increasing the footprint of adjacent vegetaion communities mitigating the impact from views at higher elevations.

The Project site is visible within the landscape and is discernable with focused viewing at discrete locations in excess of 2km but is unlikely to be distinguised from other elements in the landscape such as shadow, agricultural netting or bodies of water when viewed from a passing vehicle.

The Project is visible within the landscape and is discernable as a Solar Farm with focused viewing at locations within 2km. It is a new element in the landscape. An open area of pasture used for grazing is replaced with a low lying (PV) Solar array. There is no modification to existing paddock trees, forested areas or horizon lines. Ancillary structures have visual parity in the landscape in the short term and will be screened in the long term. The security fencing, which is rural in character becomes increasingly disceranable within 1km. The Project is screened in part by existing stands of Bamboo, Camphor Laurel and native regrowth at low elevations with increased density proposed.

In the winter months before 9am there is the potential for glare at discrete locations on Possum Shoot Road and Myocum Road. In the late Summer and early Autumn months and late Winter and early Spring months before 8am there is the potential for glare at the western extent of Myocum Road.
At observation point 4 on Possum Shoot Road vegetation does not impede the potential for glare. Potential for glare is further reduced at lower elevations due to interceding vegetation and the low profile of the array.
The proposed Solar Farm at Dingo Lane is not visible within the viewshed assessed precluding the assessment at this stage of the effect of cumulative development.

Mark Perkins RLA AILA
24/11/2020

1.0 INTRODUCTION

This report has been prepared by Ennismore Field Pty Ltd; Author, Mark Perkins, Landscape Architect (AILA), to assess the potential visual impact of the proposed Byron Bay Solar Farm at Ewingsdale within Byron Shire, NSW.

The Landscape Character, Visual Impact and Solar Glare Assessment, has been undertaken on behalf of Byron Bay Solar Farm Holdings Pty Ltd, to evaluate the existing landscape character, determine the viewshed (all points from which the project could possibly be seen), identify viewing situations and establish viewpoints for assessment.

THE REPORT COMPRISES THREE ASSESSMENTS.

The Landscape and Visual Impact Assessment (LVIA) comprises a Landscape Character Assessment and Visual Impact Assessment that are interrelated, providing an assessment of visual sensitivity leading to a consideration of the likely effect of the modification on the existing landscape and the subsequent effect on visual amenity.

It assesses the sensitivity of the viewshed from impacted viewpoints and provides guidance on mitigation measures to address scenic amenity.

The Solar Glare Assessment (Addenda 1 to this report) provides guidance on glare throughout the year for the photovoltaic (PV) Solar Array proposed and potential effects on the human eye at locations identified in the LVIA.

The assessments are undertaken specifically with regard to the objectives of Byron LEP, RU2, Rural Landscape Zone, and informed by the provisions, Byron Shire Council, Chapter C3 of Byron Development Control Plan (BDCP) 2014.

The objectives are.

"1. To retain and enhance the unique character of Byron Shire and its towns, villages, rural, coastal and natural areas.
2. To ensure that development does not adversely impact on the Shire's scenic character and visual quality.
3. To ensure that where possible new development contributes to enhancement of the Shire's scenic character and visual quality.
4. To ensure adequate information is available to properly assess visual impact."

The report describes how site selection and project design has been considered, identifying significant views in planning documents, minimising height and scale of the (PV) Solar Array and ancillary structures, embedding materiality within the existing landscape character and managing viewsheds through vegetation screening.

It identifies viewing populations, establishes landscape and visual receptor sensitivity, providing a qualitative and quantitative assessment of Visual Impact.

Figure 03. Solar Farm Site Plan.

2.0 SCOPE

2.1 PROJECT DESCRIPTION

Byron Bay Solar Farm Holdings proposes to construct, install and operate a 5MW Solar Farm (The Project), comprising 25056 (PV) Modules, and ancillary structures at 196 Kennedys Lane, Ewingsdale, 2481, New South Wales, being (LOT: 5 DP: 776609), covering an area of approximately 7 Hectares.

The property has an area of 35.54 Hectares with an area of approximately 7 Hectares proposed for the Solar Farm. A gravel access road will connect the (PV) Solar Array and ancillary structures to an existing access road to Kennedys lane for the installation and ongoing operation of the Solar Farm. An easement is proposed within Lot 1/1138652, to the South West of the Solar Farm, for connection to the existing power grid.

The project proposes a (PV) Solar Array utilising a proprietary Peg System developed by Jurgen Technology. The (PV) Solar Array has a maximum height of 950mm and a minimum height of 800mm with panels running east-west, fixed tilt at 8°. The ground below the (PV) Solar Array is maintained as pasture.

Recognition of visual impact is implicit in the selection of a (PV) Solar Array system that minimises height and therefore visibility at low elevations, maintaining the existing landscape topography and vegetation.

The (PV) Solar Array system utilises a peg and plate system, precluding the need for concrete foundations and the excavation required.

Recognition of visual impact is implicit in the selection of the (PV) Solar Array system limiting visual impact in the short term by minimising the requirement for trenching and heavy machinery during construction.

The exclusion security fencing proposed allows beneficial small animals and pollinators through while deterring larger animals and people. Utilising high tensile wire requiring fewer posts, that are driven, rather than systems requiring poured concrete foundations. The fence design allows for overland water flow in times of excessive inundation. Security systems will include visual surveillance.

Recognition of visual impact is implicit in the design of and material specification for security fencing; being visually not dissimilar to stock fencing.

Ancillary structures include five, white shipping containers (12.2m in length, 2.4 m wide and 2.59m high) set on 600mm stands and two shade structures (8m in length, 4 m in width and 2.4 m high) to house batteries and inverters.

Recognition of visual impact is implicit in the selection of the shade structures with equine structures proposed that are typical of rural outbuildings. The number and scale of containers is not dissimilar to containers on nearby farms.

2.2 SHORT TERM PROJECT DESCRIPTION

The construction of a gravel access road from the farm entry to the fenced (PV) Solar Array area involves the removal of grass sod and the laying of compacted road base to allow for truck deliveries to the project site for construction and ongoing light truck and small vehicle access for operation and maintenance. Trenching and the erection of a power pole is required for connection to the grid. Landscape and revegetation works will be undertaken to embed and screen the development.

2.3 LONG TERM PROJECT DESCRIPTION.

Operation of a Solar Farm, maintenance of pasture, maintenance of modules, batteries and inverters, maintenance of fence lines and maintenance of screening and revegetation planting.

2.4 SITE AND LOCALITY

The site is located approximately 9 km west of Byron Bay CBD and 2.5 km west of the M1 Pacific Motorway.

The property is zoned RU1 Primary Production and RU2 Rural Landscape under the Byron Local Environmental Plan 2014 (BLEP 2014); and (a) General Rural and 1(b1) Agricultural Protection under the Byron Local Environmental Plan 1988 (BLEP1988).

The area of the site proposed for the solar farm is RU2 Rural Landscape and accessed through land zoned RU1 Primary Production. To the north are undulating wooded hills and rises on land zoned R5, Large Lot Residential. Small holdings and farms predominately on lands zoned RU1 are to the east, south and west.

The project site occupies land currently used for grazing with historical cropping having been undertaken.

Recognition of potential visual impact is implicit in site selection, the solar farm being proposed for a site on a drainage plain of low elevation in a valley of westerly aspect, separate from urban development and large viewing populations. The proposed site has limited landuse options.

GIS mapping undertaken to determine the Zone of Theoretical Visual Influence (ZTVI) confirms a limited viewshed.

2.5 POLICY CONTEXT

THIS ASSESSMENT HAS BEEN UNDERTAKEN WITHIN THE REGULATORY CONTEXT OF

Byron Local Environmental Plan, 2014 (BLEP 2014). The property is zoned, RU1 Primary Production and RU2 Rural Landscape.

The LVIA has been undertaken with specific regard to the objectives of the RU2 Zone.

"Zone RU2 Rural Landscape.
1 Objectives of zone
- *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.*
- *To maintain the rural landscape character of the land.*
- *To provide for a range of compatible land uses, including extensive agriculture.*
- *To enable the provision of tourist accommodation, facilities and other small-scale rural tourism uses associated with primary production and environmental conservation consistent with the rural character of the locality.*
- *To protect significant scenic landscapes and to minimise impacts on the scenic quality of the locality."*

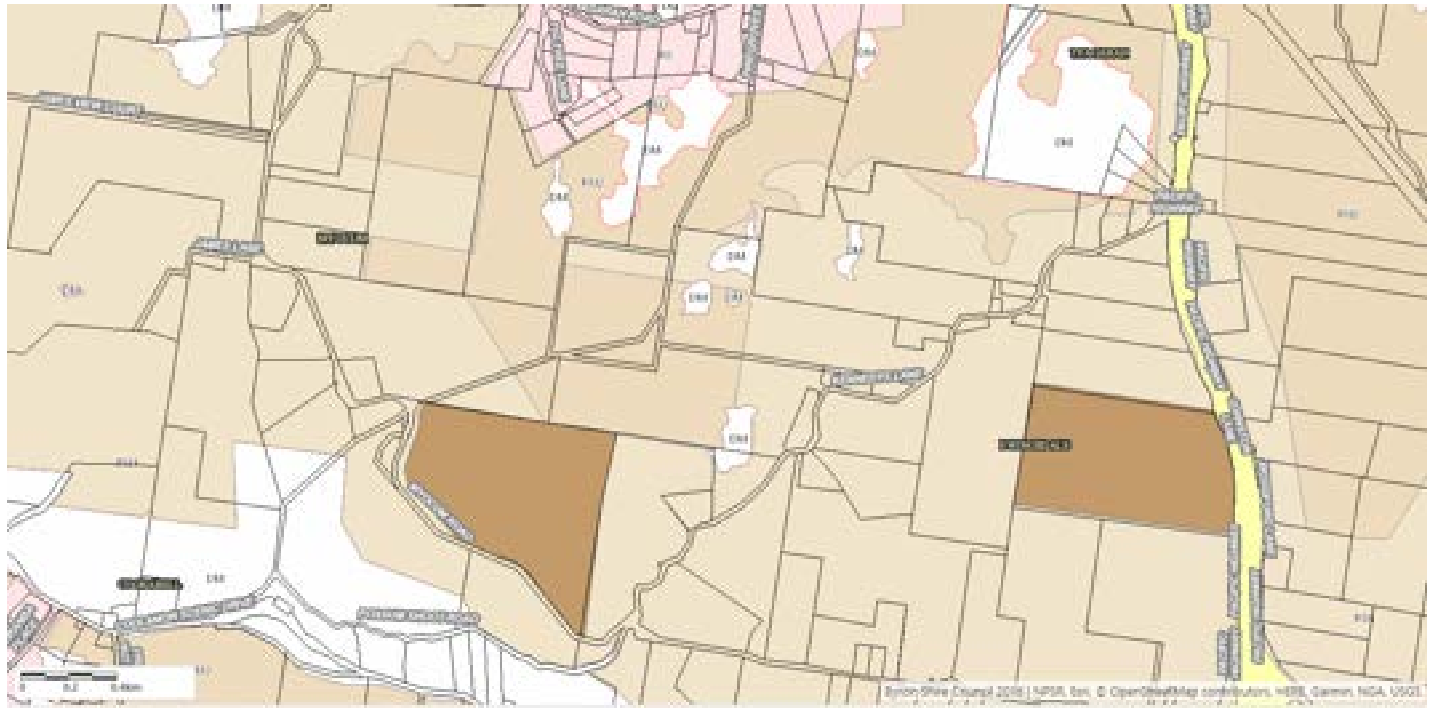


Figure 04 Byron LEP 2014 Land Zoning and Heritage

Figure 05 Vegetation Commnities 2017

The property is zoned (a) General Rural and 1(b1) Agricultural Protection, Byron Local Environmental Plan 1988 (BLEP1988).

This assessment has been undertaken with regard to

- Byron Shire, Development Control Plan 2014, Chapter C3, Visually Prominent Sites, Visually Prominent Development and View Sharing.

"C3.2 General Provisions
C3.2.1 Visual Impact Assessment
Objectives,
". 1. To retain and enhance the unique character of Byron Shire and its towns, villages, rural, coastal and natural areas.
2. To ensure that development does not adversely impact on the Shire's scenic character and visual quality.
3. To ensure that where possible new development contributes to enhancement of the Shire's scenic character and visual quality.
4. To ensure adequate information is available to properly assess visual impact."

This assessment has been undertaken with the guidance of

- A development advisory Panel Meeting was held on the 30 September 2020, with the Client and Council Staff and the following advice was given by Council.
-

"Visual Impact Assessment

Although the development is not expected to be "visually prominent development", a visual impact assessment should be provided that includes details to how any visual impacts will be ameliorated or mitigated. Regard should be had to the objectives of the RU2 Zone and the provision of Chapter C3 of BDCP 2014 should be used to inform the visual impact assessment which should include details including, but not limited to, the height of the solar panels above current ground level, visual screening, glint and glare management. The visual impact assessment should be prepared by a qualified and experience practitioner due to the rural location of the proposed development and position below Coolamon Scenic Drive (i.e., an elevated and established view point for the Shire)."

- Large-Scale Solar Energy Guideline for State Significant Development, (LSSEG) December 2018. NSW Government.

The development of a solar farm such as the proposed project is considered non-designated development and a regionally significant development. It does not qualify as State Significant Development. However (LSSEG) provides guidance for minimising negative impacts of development and addressing landscape values and the scenic amenity of landholders and communities.

- Byron Shire Council Biodiversity Conservation Strategy, 2020 - 2030.
- North Coast Regional Plan, 2036, March 2017, 2017 NSW Government.

Historical, project relevant and projects that may contribute to cumulative impact reviewed.

- Dingo Lane Solar Farm Landscape and Visual Impact Assessment. Environmental Ethos, For Byron Shire Council, October 2020.

Figure 06. Land Zoning Perspective Proposed Site.

Figure 07 Land Zoning Perspective

3.0 METHODOLOGY

3.1 BEST PRACTICE

As of the date of issue of this report there is no formalised standard for visual assessment methodology at Federal, State or Local Government levels.

This report methodology has been undertaken with the guidance of,

AILA, Guidance Note for Visual Impact Assessment, June 2018.

Guideline for Landscape Character and Visual Impact Assessment, Version2.2, Centre for Urban Design, Transport NSW, 21/08/2020.

Landscape Institute and Institute of Environmental Management and Assessment, (2013), The Guidelines for Landscape and Visual Impact.

Scenic Management System (1996) as described in the publication Landscape Aesthetics: A Handbook of Scenery Management prepared by the US Forestry Service. Assessment, Third Edition.

Linking ecology and aesthetics in sustainable agricultural landscapes: Lessons from the Palouse region of Washington, U.S.A. Linda R. Kleina,, School of the Environment – College of Arts and Sciences, Washington State University, Pullman, WA 99164-2812, USA.

Solar Glare Hazard Analysis Tool (SGHAT), Technical Reference Manual US Department of Energy March 2015.

3.2 Approach

The approach used for the LVIA is to firstly establish the landscape quality and significant landscape features of the project site and the surrounding areas to establish a baseline for an analysis of scenic amenity sensitivity.

Secondly to establish the extent to which the project and therefor the modification of the landscape character would be visible. Then to establish viewing situations (Viewpoints) from where viewing populations will experience the effect of modification.

Thirdly to undertake a quantitative analysis of the effects of scale and materiality of the modification, proximity of the viewer to the modification and the extent to which the modification occupies the field of view of viewing populations at viewing situations (Viewpoints).

The completed assessments evaluate the magnitude of change to landscape character, the sensitivity of Landscape Character to change and the extent to which viewing populations are affected by changes in landscape character.

3.3 FIELD STUDY AND LANDSCAPE CHARACTER AND PHOTOPOINT DOCUMENTATION

A site meeting on 29/09/2020 established property and project site extents in the field. Views from the project site were documented. Camera position coordinates were recorded. Site suitability was discussed in reference to potential Visual Impact.

Initial site documentation confirmed, built form on the ridgeline along Coolamon Scenic Drive and Possum Shoot Road is visible, built form on Myocum road is visible, built form to the north on Tyagarah Road and side roads is not visible.

Recognition of potential visual impact is implicit in site selection with potential viewing populations identified, confirming low population densities for elevated settlements.

Documentation of the project site confirmed that construction and installation did not require the removal of vegetation, leveling of the site or the import of fill.

Recognition of potential visual impact is implicit in site selection. The removal of vegetation especially in landscapes where naturalness and biodiversity are present, implicit and or valued has a high sensitivity for scenic amenity.

Documentation of the project site confirmed importing and compacting of gravel to construct an unsealed access road was required.

A desktop study was undertaken to establish The Zone of Theoretical Visual Influence (ZTVI) through Geographic Information System (GIS) mapping. A viewshed analysis determined all possible locations based on topography that any part of the project could be seen from.

From this analysis all publicly accessible spaces and roads within the (ZTVI) were ground truthed for visibility.

Two approaches were maintained in selecting Viewpoints.

- Where the project was most visible in whole or part due to uninterrupted viewlines from vegetation or built form and therefore the most potentially visually impacted; viewing situations were established and documented.
- Viewing situations from regionally significant roads and public spaces were established and documented.

All publicly accessible local roads and lanes were investigated for project visibility.

Landscape Character and the field of view (FOV) from viewpoints was documented on the 13/10/2020 and 05/11/2020 with a Nikon D90, digital Single Lens Reflex camera with an 18-105mm Lens set at a 35 mm focal length.

The viewshed was documented as a focused view towards the project at 38° field of view and as a panorama created by stitching together images taken at 35mm focal length throughout the entire 200° field of vision that is available to the human eye.

3.4 DESKTOP ASSESSMENT AND GIS

To establish the (ZTVI) a high resolution DTM (Digital Terrain Model) was created based on 1m LiDAR for an area in excess of 5km radius from the centre of the project. The DTM has a vertical accuracy of +/- 30cm, and a horizontal accuracy of +/- 80cm. Spatial analysis, including contours at 500mm and viewshed analysis was performed using ESRI ArcMap software.

Byron Shire Council online mapping tool was utilised to identify Items of Heritage Value under the Byron LEP 2014 and areas of High Environmental Value that were mapped for Byron Shire Council in 2017.

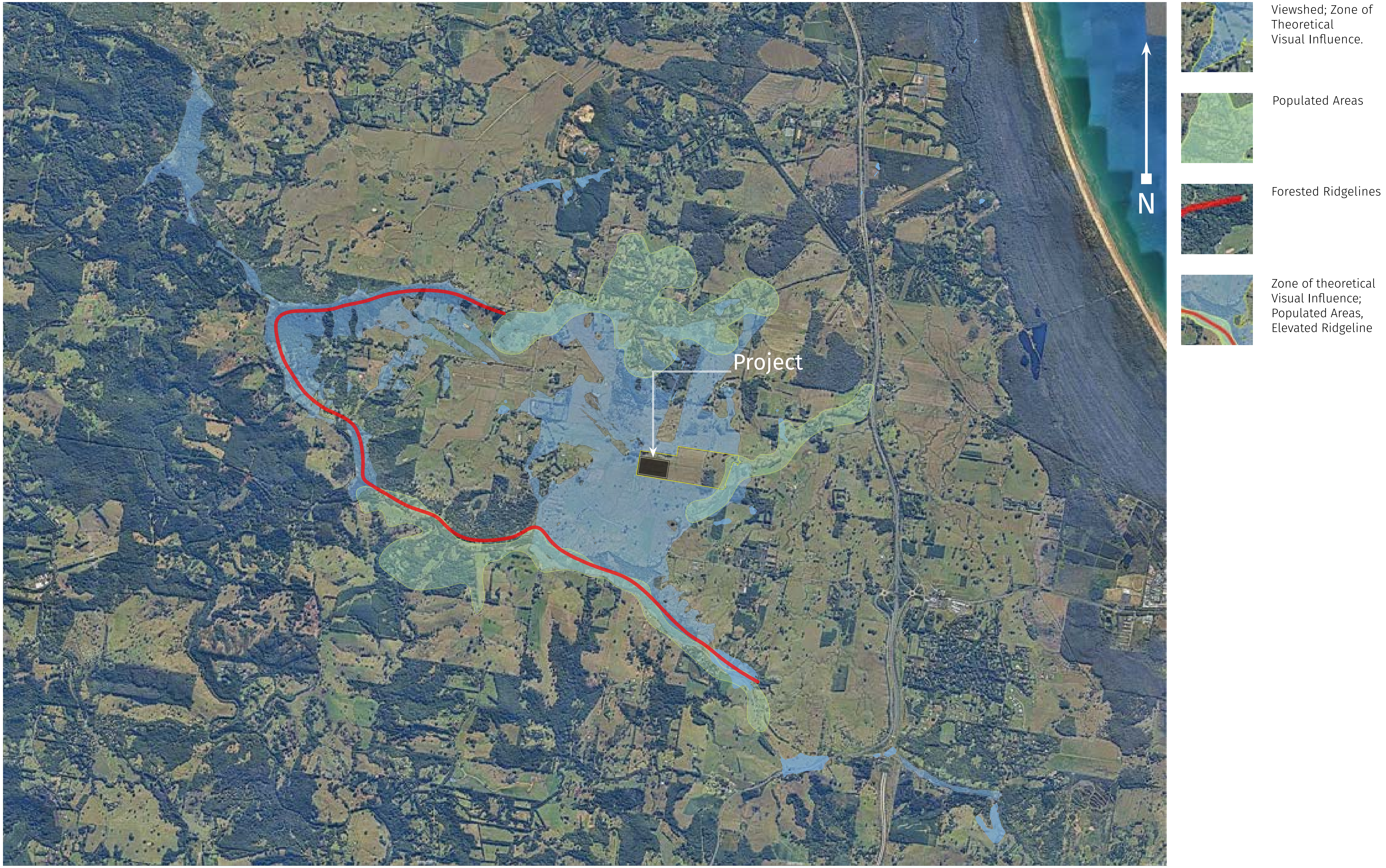


Figure 08. Viewshed; Zone of Theoretical Visual Influence; Populated Areas, Elevated Ridgeline.

To establish base data and inform an infield documentation of landscape character

a review of,

"Soil Landscapes of the Lismore Ballina 1:100 000 Sheet Report and Map Series DT Morand 1994. Department of Conservation and Land Management", was undertaken to establish Geology, Topography, Vegetation Type, Landuse, Existing Erosion, Dominant Soil Materials, Occurrence and Relationships, Landscape Limitations, Soil Limitations, Fertility, Erodibility, Erosion Hazard, Foundation Hazard and Urban and Rural Capability.

The landscape Character Units determined by this report were developed from an underlying appreciation of the geomorphology within the viewshed and surrounding locale.

There are four distinct landscape types that have given rise to landuse and subsequently informed land use planning zones that correlate to landscape within the viewshed.

The valley floor which contains the project site is described as a Transferral Landscape, corresponding to (BLEP 2014) RU2 Zoning.

The low to undulating hills and rises, rising from the valley floor is described as a Residual Landscape, corresponding to (BLEP 2014) RU1 Zoning.

The undulating hills and steeper rises to the north of the project site is described as an Erosional Landscape, corresponding to (BLEP 2014) RU5 Zoning.

The very steep slopes to the south and south west, cresting along Coolamon Scenic Drive are described as a Colluvial Landscape corresponding to the Scenic Escarpment 7(d) Zone Byron LEP 2008, and Deferred Matter (BLEP 2014) 2014.

3.4.1 DATA ANALYSIS AND PRESENTATION

Nine photopoints were selected that allow for a representative assessment of viewing situations.

A topographic model was created from 500mm contours for an area in excess of a 5km radius from the centre of the project and combined with a 3d model of the (PV) Solar Array and ancillary structures in 3D modeling software. The nine photopoints were placed in the model at real world coordinates.

The photographic image describes a 38° field of view which approximates the 40° field of view in which humans can distinguish with clarity, colour, shapes and symbols.

Four panoramas were created from viewpoints that illustrate the full 200°Field of View available to the human eye. See Figures 28,29,30 and 31.

The (FOV) of depth perception (Binocular Vision of the human eye, being between 100° and 120° is described on the illustrated panoramas.

Calculations for horizontal and vertical visual effect were undertaken within CAD software.

Images from the photo points in the 3d model were captured within the 3d environment corresponding to the real-world coordinates, camera elevation and focal length of the infield photographic documentation.

For each of the 9 photopoints the model was overlaid with the in field documented image to describe the visibility of the project limited only by topography.

The model when overlaid with the site infield photograph forms the basis for the photomontage where built form and vegetation can be allowed for.

Possible mitigation measures that may involve vegetation screening at the project site or offsite can also be described.

4.0 VISIBILITY

4.1 VIEWSHED ANALYSIS.

The project site sits within a low-profile drainage plain at an elevation of 4.5 to 5m. The site is potentially visible throughout the valley floor and on slopes and rises facing the project within a 1 km radius to the east, two kilometres to the north and 1.5 km to the west. The viewshed is interrupted by variations in topography and vegetation.

Along ridgelines to the south the project is potentially visible within a 2 km radius and to the west and south-east potentially visible within a six km radius.

Viewed at low elevations the project within the valley floor becomes a thin line in the landscape. As elevation increases the visibility increases due to the angle of view. With distance visibility decreases.

Public views are mainly limited to local roads and lanes. The roads and lanes have limited opportunity for stopping. Viewing situations are dynamic, intermittent and limited. There are no views from public buildings, reserves or parks that would provide an opportunity for viewers to experience extended viewing times.

Tourist roads (Coolamon Scenic Drive) and lookouts (St Helena Lookout) within the viewshed have limited opportunity for views due to vegetation screening and distance from the project site.

Views from Myocum Road are dynamic (viewers in vehicles or cyclists) and disrupted by paddock trees and bamboo stands.

Views from Possum Shoot Road are dynamic and intermittent, disrupted by vegetation along the road verge and the orientation of the viewer, as vehicles negotiate a tightly cornering descent (descending traffic is intermittently orientated towards the project site and ascending traffic orientating away from the project site).

Views along Coolamaon Scenic Drive are limited to a 150 m stretch of road, 2.35 km from the project site, where views to the north, to the coastal plain, are possible. The remaining length of Coolamon Scenic Drive does not offer views north due to dense vegetation between the road verge and settlements on the ridgeline.

Views from St Helena Lookout and St Helena Road though theoretically possible are not in evidence due to vegetation and distance.

No public views from R5 Large Lot Residential areas along Tyagarah Road, Figtree Lane, Benloro Lane and Pingroves Road could be established.

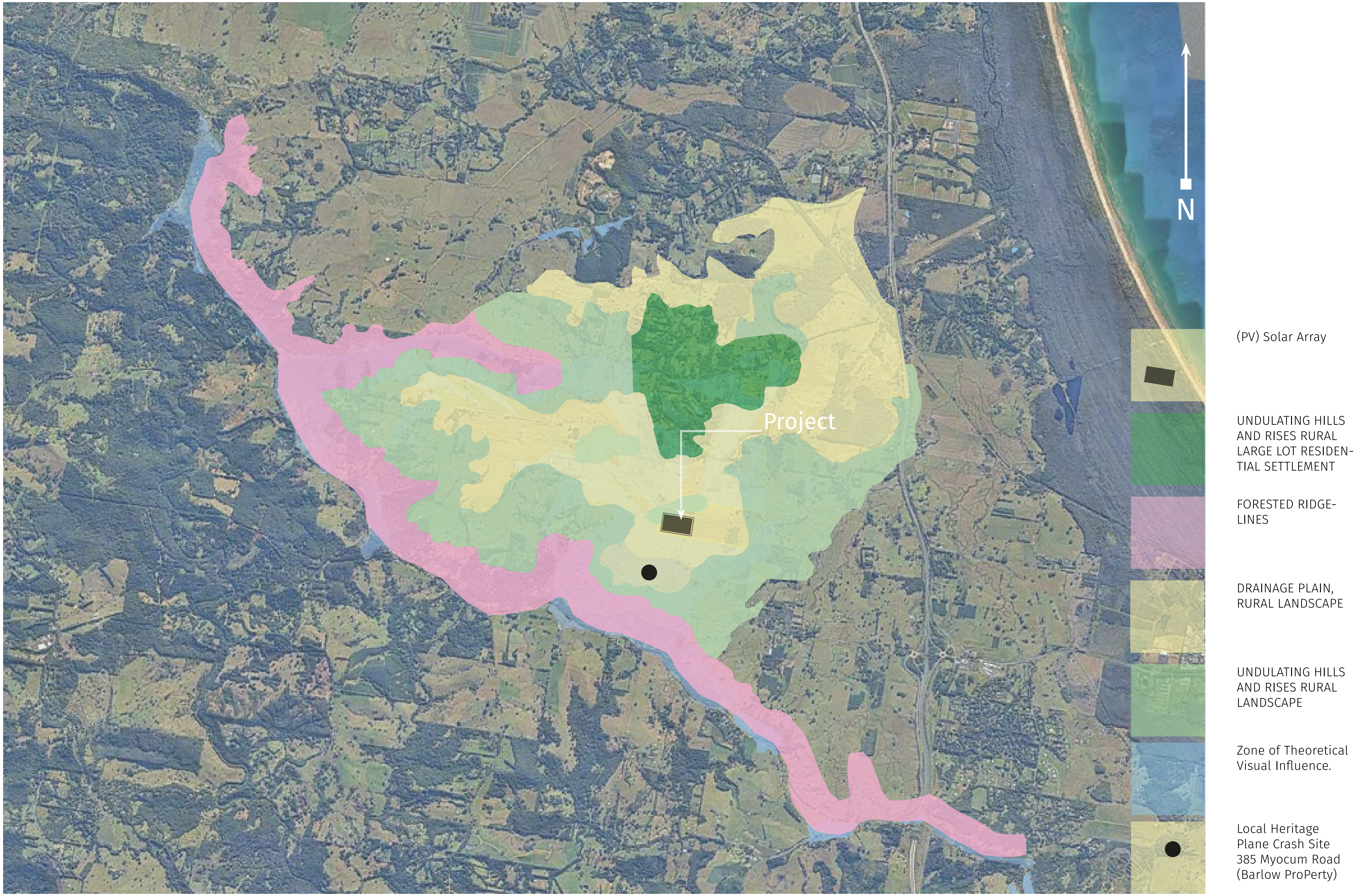


Figure 09. Landscape Character Units.

Figure 10. Drainage Plain Rural Landscape.

Figure 11. Undulating Hills and Rises, Rural Landscape.

Figure 12. Undulating Hills and Rises, Rural Large Lot Residential Landscape.

Figure 13.Forested Ridgelines.

Figure 14, Landscape Features, Remnant Vegetation and Regrowth.

Figure 15. Landscape Features, Rural Structures.

4.2 SCENIC QUALITY

The scenic quality of the Byron Shire is defined by the visual drama of the transition from the perceived naturalness of coastal beaches and wetlands, through a pattern of gently undulating rural hills and valleys to a backdrop of dramatic ridgelines and escarpments.

The rural hills and valleys within the assessment area are delineated by roads and lanes that follow ridgelines. The rural vistas are patterned by rural settlements on landscaped and forested allotments on elevated rises; grazing lands with paddock trees and remnant vegetation on the valley floor; and farms, small holdings, plantations and horticultural industries on undulating hills and rises.

5.0 LANDSCAPE CHARACTER

5.1 APPROACH

Landscape character is what makes a region or location visually unique. It will have recognizable patterns of topography, vegetation and land use.

We value landscapes for their naturalness, (as perceived by communities), their coherence and stability over time and cultural and community associations developed through landuse.

The Landscape Character Units defined in this report are determined by geomorphology, vegetation, landuse, built form and formal aesthetic values. See Figure. 09.

5.2 KEY LANDSCAPE FEATURES AND CULTURAL ELEMENTS

Landscape Features include undulating hills and rises in the foreground and forested ridgelines in the background. These large scale features establish a sense of place, as these elements are recognisable from multiple locations and appreciated as unique by residents and visitors to the region.

Landscape features include remnant vegetation and regrowth that reference pre European settlement. Usually experienced as naturalness in a rural setting.

Recognition of visual impact is implicit in site selection with the project area not containing vegetation of high environmental value.

Landscape features include established farm buildings, outbuildings and infrastructure which are strongly associated with rural settings. Usually experienced as having cultural significance to populations reflecting on stability of landuse over time.

There is mapped subtropical rainforest stands outside the site on lot 2/746096 to the north and on the property to the east.

Within a kilometre of the project there is a heritage item that is not visible in the landscape. There is an historical plane crash site at on Part of Lot 11, DP 878735 385 Myocum Road (Barlow Property Plane Crash Site Myocum

Recognition of visual impact is implicit in site selection and project specification; landscape character features are not removed, modified, or views to them impeded.

5.3 LANDSCAPE CHARACTER UNITS

5.3.1 DRAINAGE PLAIN, RURAL LANDSCAPE. See Figure.10.

The project site occupies an area of extremely low, level to very gently inclined drainage plain. Slopes rarely exceed 2%. Views are limited and range from 500 metres to a kilometre.

The landscape is rural in character. Streams are incipient and reticulated, forming a pattern of meandering tributaries. The landscape is prone to flooding and waterlogging. Vegetation is both planned and opportunistic following creek and fence lines.

Paddock trees, including large clumps of Bamboo and isolated Ficus are dispersed. Remnant vegetation communities of Subtropical Rainforest, Coastal Flood Plain Wetlands and Coastal Flood Plain Forests are concentrated within open areas of closed sod grassland of predominately kikuyu and couch with open rushlands of juncus species.

Two stands of Subtropical Rainforest of high environmental value are within 500m of the project site.

Landuse is predominately beef grazing. Built form consists of dispersed farmhouses, outbuildings, fencing, livestock pens, shipping containers and power lines.

This landscape is sensitive to modification that cuts across viewlines or redefines the pattern of fenced rectangular paddocks. Its openess contrasts with vegetation on adjacent hills and slopes. Paddock trees in open grassland can be interpreted as a park like setting reflecting an historical appreciation of the picturesque.

5.3.2 UNDULATING HILLS AND RISES RURAL LANDSCAPE See Figure.11.

This landscape is rural in character. The drainage plain gives way to low undulating hills to the east and west. View lines increase and an appreciation develops of the interplay of drainage plain and the undulating low hills and extended drainage plain beyond the viewshed. Landuse though still predominately grazing also includes plantations, orchards, nurseries and small holdings.

Built form is concentrated on elevated sections of rural roads and lanes. Vegetation and built form on elevated rises interact with the horizon line. With an increase in landuse type the landscape becomes more complex and textured.

Remnants of Wet Sclerophyll Forest and Subtropical Rainforest are dominated by stands of Camphor Laurel Closed Forest.

This landscape is sensitive to modification that cuts across the horizon line, involves the loss of vegetation (primarily large trees), involves cut and fill resulting in a changed topography and the development of built form at a scale that dominates vegetation.

5.3.3 UNDULATING HILLS AND RISES RURAL LARGE LOT RESIDENTIAL SETTLEMENT See Figure.12.

To the north the drainage plain gives way to undulating hills to 100m. Predominantly Zoned R5 Large Lot Residential the area on upper slopes is heavily forested and landscaped predominately with Eucalyptus species and Subtropical Rainforest species. Views are constrained by heavily vegetated lots screened to local roads and lanes. At elevation viewing situations, ornamental lawns, driveways, outbuildings and pools are somewhat visible.

This landscape is sensitive to modification that cuts across the horizon line, involves the loss of vegetation (primarily large trees), involves cut and fill resulting in a changed topography and the development of built form at a scale that dominates vegetatiion.

5.3.4 FORESTED RIDGELINES See Figure.13.

This landscape is natural in character when viewed from a distance. To the south and further west the low undulating hills transition to, at times rapidly, steep to very steep slopes and ridge slopes. These slopes are often boulder strewn and occur with springs and seepages.

These areas formed the edge of the extensively cleared Big Scrub Subtropical Rainforest. Views, where not constrained by vegetation along roads are extensive. These vistas primarily from rural settlements capture an extensive northerly aspect extending from south of Cape Byron Lighthouse to the Scenic Escarpment of Nightcap National Park.

Vegetation consists of Camphor Laurel, Subtropical Rainforest and planted Sclerophyll Closed Forest and landscaped gardens. This land is not suitable for cultivation due to stony soils, mass movement and steepness. Built form consists of residential buildings in elevated positions.

This landscape unit is identified as a significant Scenic Landscape, being visible from most locations in the northern region of Byron Shire. This landscape is highly sensitive to any modification that is visible.

6.0 ASSESSMENT OF IMPACTS

Visual sensitivity is a measure of how critically a change to the existing landscape will be viewed from various use areas (Brush and Shafer, 1975). This Visual Impact Assessment evaluates prominent viewpoints to determine a visual effect value for each viewing position and a value for degree of sensitivity.

It's this rating that determines the ability of the modification to the existing landscape to be absorbed and as a starting point for an evaluation of the type of and suitability for, mitigation measures to protect and enhance scenic amenity.

To quantify the visual sensitivity of viewing situations an analysis of the degree of effect was undertaken. These are expressed as evaluation tables and a quantifiable rating for visual sensitivity arrived at. See Pages 34 through 55.

Visual sensitivity ratings are based on Landscape Character, the type of modification proposed and the ability of the Landscape Character Unit to absorb the modification; and the degree to which a viewer is sensitive to that change based on distance from the modification and the amount of the field of view that is impacted; See Pages 54 through 56

A detailed narrative that ground-truths visibility determines the duration and focus of viewing and the effect of mitigation measures is provided for each Photopoint.

Figure 16. Built form within the Locality that Correlates with The Project Elements.

Figure 17. (PV) Solar Array Proposed.

Figure 18. (PV) Solar Array Proposed.

Figure 19. Ancillary Structure Shipping Container Type Proposed.

Figure 20. Ancillary structure Shipping Container Type Proposed.

Figure 21. Security Fencing Proposed.

Figure 22. Ancillary structure Shade Structure Type Proposed.

7.0 MITIGATION MEASURES

Potential Visual Impact can be managed and mitigated to reduce sensitivity to modification of landscape character to protect Scenic Quality and maintain the Scenic Amenity of viewing populations.

Where visual modification is of a type and scale that is visible and introduces new visual elements consideration is given to site selection and Project design to enhance the landscape character and or embed the modification within the landscape character; and where this is not possible minimise visibility through limiting visibility to viewing populations through site selection and on and off site screening.

Recognition of potential visual impact is implicit in site selection, the solar farm being proposed for a site on a drainage plain of low elevation in a horseshoe valley of westerly aspect, separate from urban development and large viewing populations. The proposed site has limited landuse options.

Recognition of potential visual impact is implicit in site selection with potential viewing populations identified, confirming low population densities for elevated settlements.

Byron Bay Solar Farm site selection limits visibility to large viewing populations. Public views experienced by community and visitors are mainly limited to dynamic and intermittent views while transiting

Recognition of potential visual impact is implicit in site selection. The removal of vegetation especially in landscapes where naturalness and biodiversity are present, implicit and or valued has a high sensitivity for scenic amenity.

Recognition of visual impact is implicit in site selection and project specification; landscape character features are not removed, modified, or views to them impeded.

Recognition of visual impact is implicit in the selection of a (PV) Solar Array system that minimises height and therefore visibility at low elevations, maintaining the existing landscape topography and vegetation.

Project design minimises the height of the (PV) Solar Array, allows for no existing vegetation loss, and proposes ancillary structures including security fencing that are consistent with existing rural elements.

Recognition of visual impact is implicit in the selection of the (PV) Solar Array system limiting visual impact in the short term by minimising the requirement for trenching and heavy machinery during construction

Recognition of visual impact is implicit in the design of and material specification for security fencing; being visually not dissimilar to stock fencing.

Recognition of visual impact is implicit in the selection of the shade structures with equine structures proposed that are typical of rural outbuildings. The number and scale of containers is not dissimilar to containers on nearby farms.

To mitigate visual impact, planting is proposed along the southern boundary of the Project to screen the ancillary structures. Planting along the boundary in the south west corner is proposed to screen and embed the Project from views at low elevations.

Planting to the northern boundary will embed the Project within the landscape by increasing the footprint of adjacent vegetation communities mitigating the impact from views at higher elevations. See Figure 23 and Photomontages on double page spreads on pages 26 through 33. And on pages 35,37,39,41,43,45,47,49 and 51.

Figure 23 Vegetation Screening and Embedding

Figure 24. Viewshed Analysis Zone of Theorectical Visual Influence.

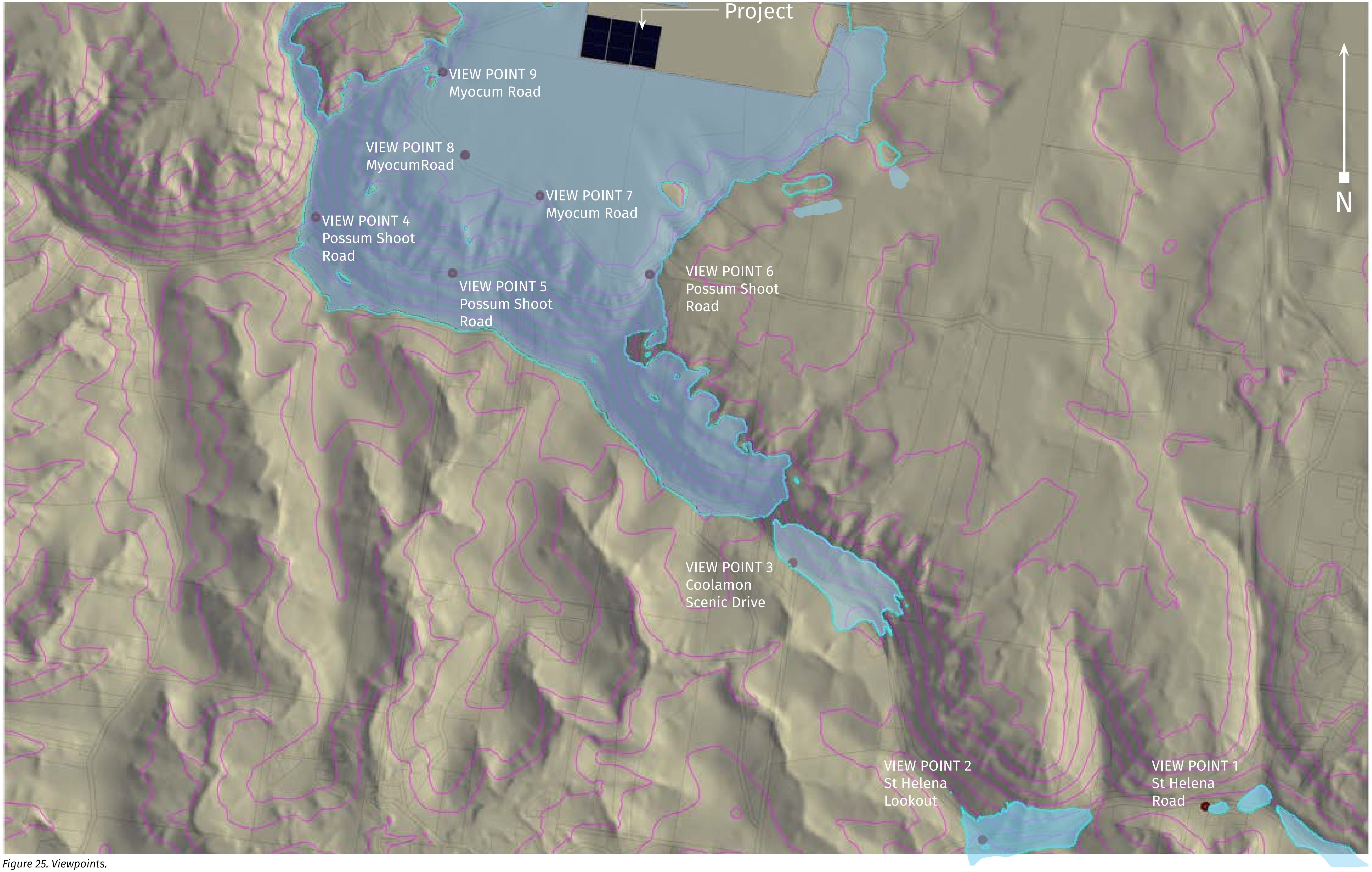
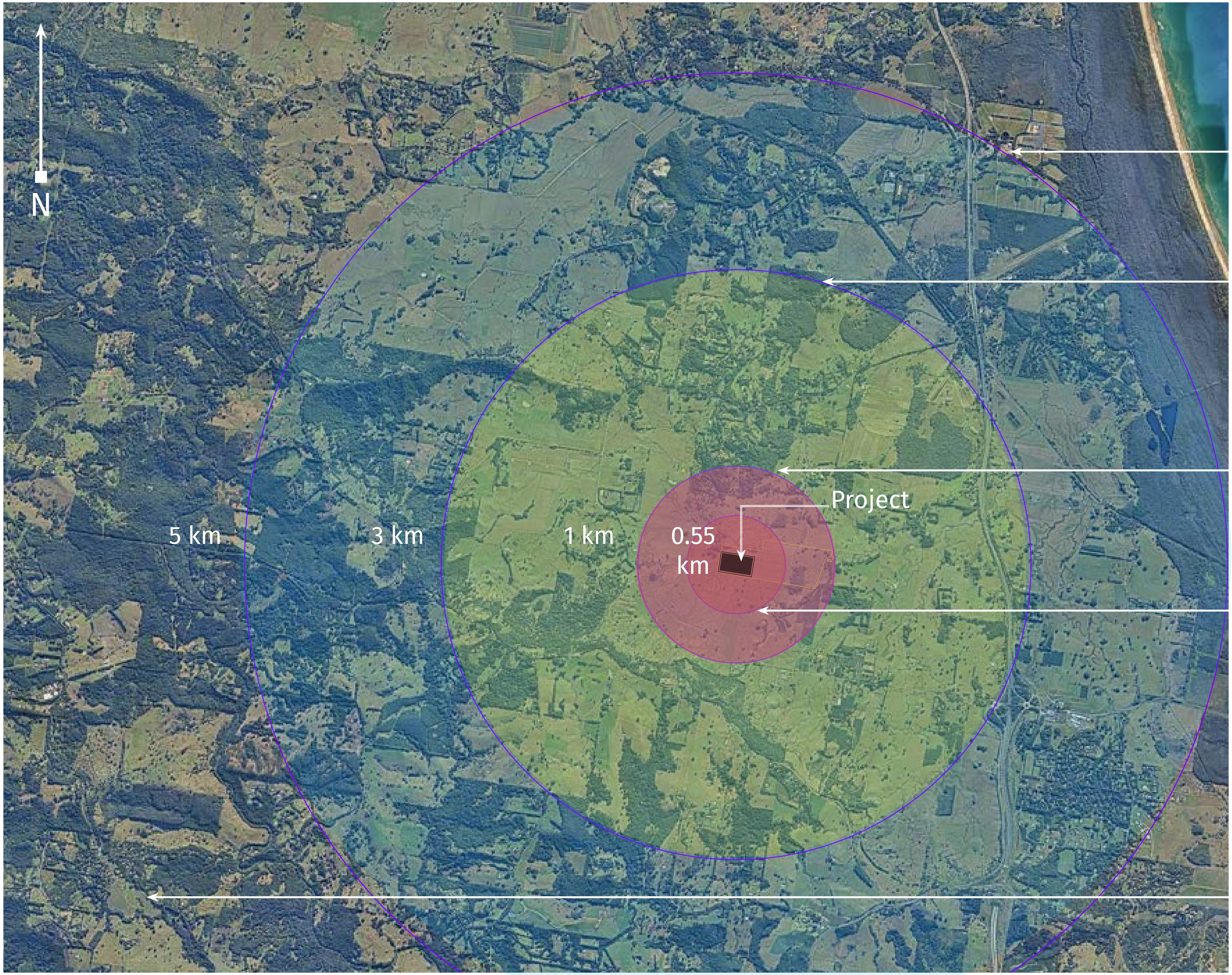


Figure 25. Viewpoints.



3 to 5 km: Distant middle ground_Sub Regional, Limited visual impact

1 to 3 km: Middle ground _Sub Regional, Moderate visual im-pactvisual impact

0.5 to 1 km: Foreground_Local, Increasing visual impact

0 to 0.5 km: Adjacent_Local, Substantial visual impact

5 km and greater:background regional, no or minor visual impact within the landscape

Figure 26. Distance Zones.

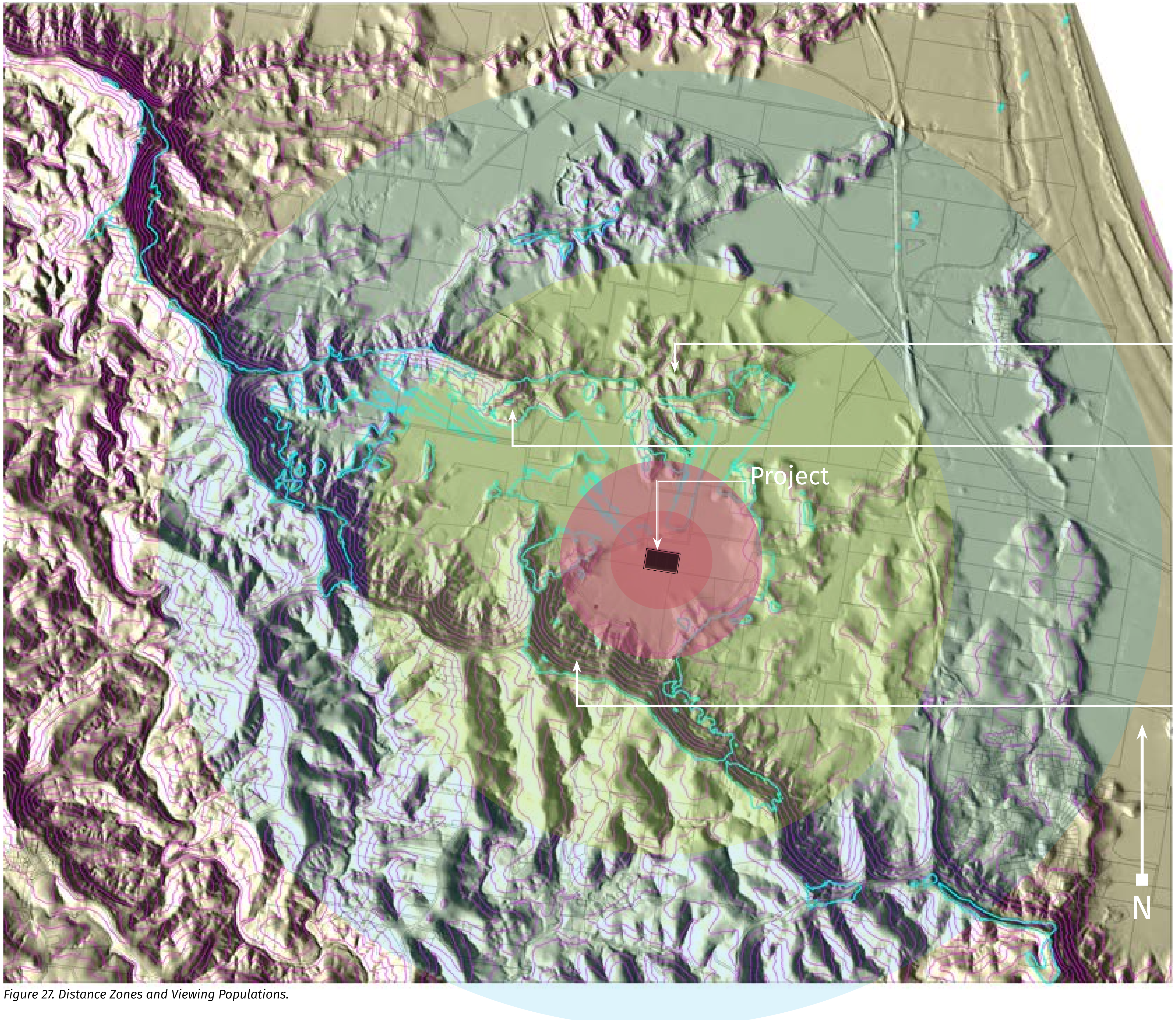


Figure 27. Distance Zones and Viewing Populations.

R5 Large Lot Residential between 25 and 65 m elevation

Small Holdings between 30 and 90 m elevation

Small Holdings between 165 and 180 m elevation

Ref ef2016
BYRON BAY SOLAR FARM
LANDSCAPE CHARACTER VISUAL IMPACT AND SOLAR GLARE ASSESSMENT

40° Discernment Colours and Symbols

100° Binocular Vision

Figure 28. VIEWPOINT TWO: NORTH NORTH WEST FROM ST HELENA LOOKOUT_STATIC VIEWING SITUATION @ 3.75 KM FROM CENTRE OF SOLAR ARRAY 100°

PHOTOMONTAGE WITH MITIGATION MEASURES (FOV) 100°

Ref ef2016
BYRON BAY SOLAR FARM
LANDSCAPE CHARACTER VISUAL IMPACT AND SOLAR GLARE ASSESSMENT

40° Discernment Colours and Symbols

100° Binocular Vision

Figure 29. VIEWPOINT FOUR: NORTH EAST FROM POSSUM SHOOT ROAD_DYNAMIC VIEWING SITUATION @ 1.51 KM FROM CENTRE OF SOLAR ARRAY 100°.

PHOTOMONTAGE WITH MITIGATION MEASURES (FOV) 200°

Ref ef2016
BYRON BAY SOLAR FARM
LANDSCAPE CHARACTER VISUAL IMPACT AND SOLAR GLARE ASSESSMENT

40° Discernment Colours and Symbols

100° Binocular Vision

Figure 30. VIEWPOINT EIGHT: NORTH EAST FROM MYOCUM ROAD_DYNAMIC VIEWING SITUATION @ 0.82 KM FROM CENTRE OF SOLAR ARRAY 100°.

PHOTOMONTAGE WITH MITIGATION MEASURES (FOV) 200°

Ref ef2016
BYRON BAY SOLAR FARM
LANDSCAPE CHARACTER VISUAL IMPACT AND SOLAR GLARE ASSESSMENT

40° Discernment Colours and Symbols

100° Binocular Vision

Figure 31. VIEWPOINT NINE: EAST NORTH EAST FROM MYOCUM ROAD_DYNAMIC VIEWING SITUATION @ 0.77 KM FROM CENTRE OF SOLAR ARRAY 100°.

PHOTOMONTAGE WITH MITIGATION MEASURES (FOV) 200°

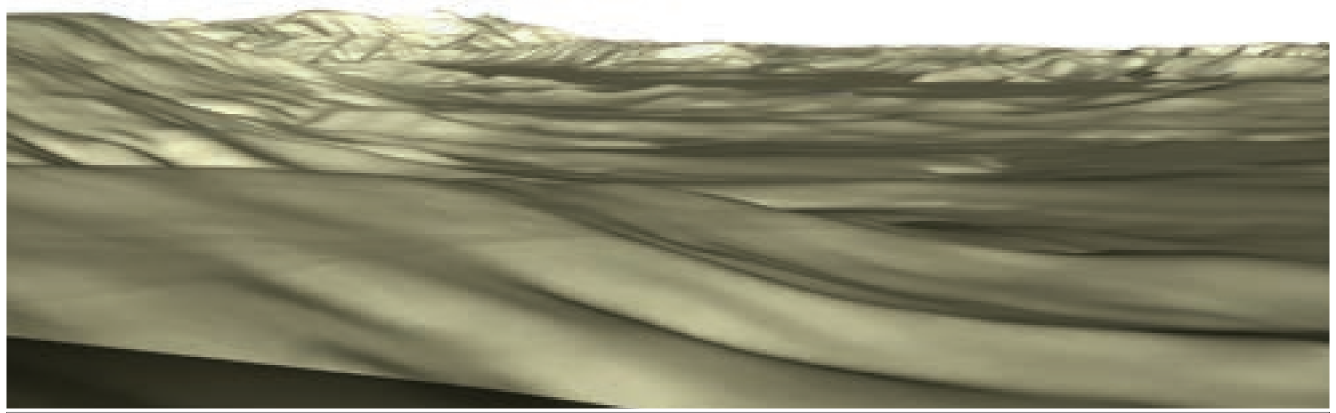
VIEWPOINT ONE: WEST NORTH WEST FROM ST HELENA ROAD_DYNAMIC VIEWING SITUATION @ 4.1KM FROM CENTRE OF SOLAR ARRAY

VIEW (FOV) 38°

Viewpoint One
Horizontal Field of View..... 3.23˚
Vertical Field of View.......... 0.19˚
Distance Photopoint from centre of Solar Array........... 4.1 km

Landscape Architect................................ Mark Perkins RLA 002060
GIS.. GEOVIEW Pty Ltd
Camera.. Nikon D90: S/N: 3290438
Camera Lens and focal length............ 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position....................................... lat: 28˚ 39'10.11"S lon: 153˚ 32'46.18"E
Camera elevation.................................... rl: 135.6
Date image taken.................................... 13/10/2020

VIEWPOINT ONE: NORTH NORTH WEST FROM ST HELENA ROAD_DYNAMIC VIEWING SITUATION @ 4.1KM FROM CENTRE OF SOLAR ARRAY



TERRAIN MODEL (FOV) 38°

Viewpoint One
Horizontal Field of View..... 3.23˚
Vertical Field of View.......... 0.19˚
Distance Photopoint from centre of Solar Array........... 4.1 km

Landscape Architect................................ Mark Perkins RLA 002060
GIS.. GEOVIEW Pty Ltd
Camera.. Nikon D90: S/N: 3290438
Camera Lens and focal length............ 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position....................................... lat: 28˚ 39'10.11"S lon: 153˚ 32'46.18"E
Camera elevation.................................... rl: 135.6
Date image taken.................................... 13/10/2020

VIEWPOINT ONE ST HELENA ROAD		
VISUAL EFFECT	VISUAL SENSITIVITY	DESCRIPTION OF VISUAL EFFECT
LANDSCAPE CHARACTER VALUE	MODERATE	Typical character is a rural landscape, defined by field patterns, forestry plantations, agricultural areas and associated small-scale roads and buildings
DEGREE OF MODIFICATION OF THE EXISTING LANDSCAPE CHARACTER	MODERATE	Moderate visual impact. Medium level of change to the landscape character. The landscape is able to or absorb change due to the scale and extent of the development.
HORIZONTAL VISUAL EFFECT	VERY LOW	None to minor impact of the field of view.
VERTICAL VISUAL EFFECT	VERY LOW	None to minor impact of the field of view.
DISTANCE VISUAL EFFECT	LOW	Distant middle ground_Sub Regional, Limited visual impact
VISUAL SENSITIVITY		Low sensitivity to changes to the existing landscape character

VIEWPOINT ONE ST HELENA ROAD LANDSCAPE CHARACTER AND VISUAL SENSITIVITY EVALUATION
Viewpoint one takes in scenic vistas across the Coastal Plain to the Scenic Escarpment. Landscape character is predominatley undulating hills and rises (treed' and cleared) and forested ridgelines. The viewing situation is dynamic with some opportunity to stop on the road verge. Nearby residences have similar vistas. Although theoretically visible (refer viewpoint 1 terrain model), existing vegetation on rises between the viewer and Project totally screen modification. There is a low sensitivity to changes to the existing landscape character given the ground truthed visibility and distance. There is a non existent to a potentially negligable Visual Impact.
Refer; Visual Sensitivity Evaluation Tables, Pages 54 and 55 for rating analysis.

VIEWPOINT ONE: NORTH NORTH WEST FROM ST HELENA ROAD_DYNAMIC VIEWING SITUATION @ 4.1KM FROM CENTRE OF SOLAR ARRAY

PHOTOMONTAGE WITH MITIGATION MEASURES (FOV) 38°

Viewpoint One
Horizontal Field of View..... 3.23°
Vertical Field of View.......... 0.19°
Distance Photopoint from centre of Solar Array........... 4.1 km

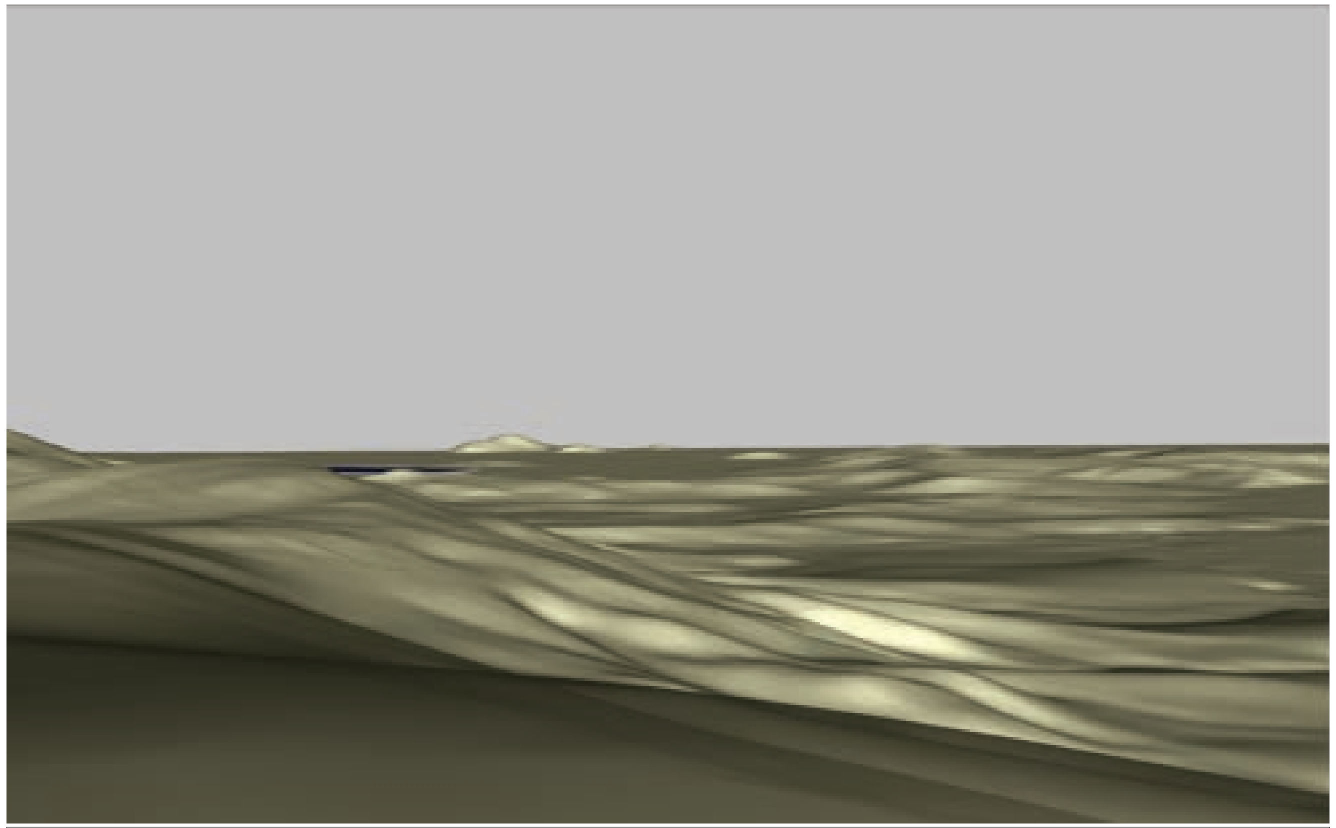
Landscape Architect................................ Mark Perkins RLA 002060
GIS.. GEOVIEW Pty Ltd
Camera.. Nikon D90: S/N: 3290438
Camera Lens and focal length............ 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position...................................... lat: 28° 39’10.11”S lon: 153° 32’25.18”E
Camera elevation..................................... rl: 135.6
Date image taken..................................... 13/10/2020

VIEWPOINT TWO: NORTH NORTH WEST FROM ST HELENA LOOKOUT_STATIC VIEWING SITUATION @ 3.75 KM FROM CENTRE OF SOLAR ARRAY

VIEW (FOV) 38°

Viewpoint Two		Landscape Architect......................	Mark Perkins RLA 002060
Horizontal Field of View.....	4.25˚	GIS..	GEOVIEW Pty Ltd
Vertical Field of View..........	0.28˚	Camera..	Nikon D90: S/N: 3290438
Distance Photopoint from centre of Solar Array...........	3.75 km	Camera Lens and focal length..............	18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
		Camera position..................................	lat: 28˚ 39’14.99”S lon: 153˚ 32’11.26”E
		Camera elevation................................	rl: 183.6
		Date image taken................................	13/10/2020

VIEWPOINT TWO: NORTH NORTH WEST FROM ST HELENA LOOKOUT_STATIC VIEWING SITUATION @ 3.75 KM FROM CENTRE OF SOLAR ARRAY



TERRAIN MODEL (FOV) 38°

Viewpoint Two		Landscape Architect......................	Mark Perkins RLA 002060
Horizontal Field of View.....	4.25˚	GIS..	GEOVIEW Pty Ltd
Vertical Field of View..........	0.28˚	Camera..	Nikon D90: S/N: 3290438
Distance Photopoint from centre of Solar Array...........	3.75 km	Camera Lens and focal length..............	18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
		Camera position..................................	lat: 28˚ 39’14.99”S lon: 153˚ 32’11.26”E
		Camera elevation................................	rl: 183.6
		Date image taken................................	13/10/2020

VIEWPOINT TWO ST HELENA LOOKOUT		
VISUAL EFFECT	VISUAL SENSITIVITY	DESCRIPTION OF VISUAL EFFECT
LANDSCAPE CHARACTER VALUE	MODERATE	Typical character is a rural landscape, defined by field patterns, forestry plantations, agricultural areas and associated small-scale roads and buildings
DEGREE OF MODIFICATION OF THE EXISTING LANDSCAPE CHARACTER	MODERATE	Moderate visual impact. Medium level of change to the landscape character. The landscape is able to or absorb change due to the scale and extent of the development.
HORIZONTAL VISUAL EFFECT	VERY LOW	No or minor visual impact within the landscape
VERTICAL VISUAL EFFECT	VERY LOW	No or minor visual impact within the landscape
DISTANCE VISUAL EFFECT	LOW	Distant middle ground_Sub Regional, Limited visual impact
VISUAL SENSITIVITY		Low sensitivity to changes to the existing landscape character

VIEWPOINT TWO ST HELENA LOOKOUT LANDSCAPE CHARACTER AND VISUAL SENSITIVITY EVALUATION
Viewpoint two takes in scenic vistas across the Coastal Plain to the Scenic escarpment and The Coral sea. Landscape character is predominatley undulating hills and rises (treed’ and cleared) and forested ridgelines. The viewing situation is static with parking available. It is situated on a well advertised and prominent tourist Drive (Hinterland Way). This is an iconic viewing situation within the Byron Shire with strong cultural connection for residents and tourists. Although theoretically visible (refer viewpoint 2 terrain model), existing vegetation on rises between the viewer and Project totally screen visibility. There is a low sensitivity to changes to the existing landscape character from the proposed modification. There is a non existent to a potentially negligable Visual Impact.
Refer; Visual Sensitivity Evaluation Tables, Pages 54 and 55 for rating analysis.

VIEWPOINT TWO: NORTH NORTH WEST FROM ST HELENA LOOKOUT_STATIC VIEWING SITUATION @ 3.75 KM FROM CENTRE OF SOLAR ARRAY

Viewpoint Two		Landscape Architect	Mark Perkins RLA 002060
Horizontal Field of View	4.25˚	GIS	GEOVIEW Pty Ltd
Vertical Field of View	0.28˚	Camera	Nikon D90: S/N: 3290438
Distance Photopoint from centre of Solar Array	3.75 km	Camera Lens and focal length	18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
		Camera position	lat: 28˚ 39'14.99"S lon: 153˚ 32'11.26"E
		Camera elevation	rl: 183.6
		Date image taken	13/10/2020

PHOTOMONTAGE WITH MITIGATION MEASURES (FOV) 38°

VIEWPOINT THREE: NORTH BY WEST FROM COOLAMON SCENIC DRIVE_DYNAMIC VIEWING SITUATION @ 2.35 KM FROM CENTRE OF SOLAR ARRAY

VIEW (FOV) 38°

Viewpoint Three
Horizontal Field of View..... 10˚
Vertical Field of View.......... 0.49˚
Distance Photopoint from centre of Solar Array........... 2.35 km

Landscape Architect.............................. Mark Perkins RLA 002060
GIS.. GEOVIEW Pty Ltd
Camera.. Nikon D90: S/N: 3290438
Camera Lens and focal length.............. 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position....................................... lat: 28˚ 38'37.06"S lon: 153˚ 31'40.21"E
Camera elevation...................................... rl: 136.6
Date image taken....................................... 13/10/2020

VIEWPOINT THREE: NORTH BY WEST FROM COOLAMON SCENIC DRIVE_DYNAMIC VIEWING SITUATION @ 2.35 KM FROM CENTRE OF SOLAR ARRAY

TERRAIN MODEL (FOV) 38°

Viewpoint Three
Horizontal Field of View..... 10˚
Vertical Field of View.......... 0.49˚
Distance Photopoint from centre of Solar Array........... 2.35 km

Landscape Architect.............................. Mark Perkins RLA 002060
GIS.. GEOVIEW Pty Ltd
Camera.. Nikon D90: S/N: 3290438
Camera Lens and focal length.............. 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position....................................... lat: 28˚ 38'37.06"S lon: 153˚ 31'40.21"E
Camera elevation...................................... rl: 136.6
Date image taken....................................... 13/10/2020

VIEWPOINT THREE COOLAMON SCENIC DRIVE		
VISUAL EFFECT	VISUAL SENSITIVITY	DESCRIPTION OF VISUAL EFFECT
LANDSCAPE CHARACTER VALUE	MODERATE	Typical character is a rural landscape, defined by field patterns, forestry plantations, agricultural areas and associated small-scale roads and buildings
DEGREE OF MODIFICATION OF THE EXISTING LANDSCAPE CHARACTER	MODERATE	Moderate visual impact. Medium level of change to the landscape character. The landscape is able to or absorb change due to the scale and extent of the development.
HORIZONTAL VISUAL EFFECT	VERY LOW	No or minor visual impact within the landscape
VERTICAL VISUAL EFFECT	VERY LOW	No or minor visual impact within the landscape
DISTANCE VISUAL EFFECT	LOW	Middle ground _Sub Regional, Moderate visual impact
VISUAL SENSITIVITY		Low sensitivity to changes to the existing landscape character

VIEWPOINT THREE COOLAMON SCENIC DRIVE LANDSCAPE CHARACTER AND VISUAL SENSITIVITY EVALUATION
Viewpoint three takes in scenic vistas across the Coastal Plain to the Scenic Escarpment. Landscape character is predominatley undulating hills and rises (treed' and cleared) and forested ridgelines. The viewing situation is dynamic. The Drainage plain on the valley floor is park like at a distance and describes a rural farming character. It is situated on a well advertised and prominent tourist Drive (Coolamon Scenic Drive). This is an iconic drive with occasional and limited vistas to the north. On Coolamon Scenic Drive between The Old Pacific Highway and Possum shoot road (4500m), there is a 150 metre section of road where the project may be momentarily visible. There is 500 metres of road where there are public views north with vegetation screening the remaining 4000m. The Project Site is visible within the landscape and is discernable with focused viewing but is unlikely to be distinguised from other elements in the landscape such as shadow, agricultural netting or shading or bodies of water when viewed from a passing vehicle. There is a low sensitivity to changes to the existing landscape character from the proposed modification. There is a negligable visual impact.
Refer; Visual Sensitivity Evaluation Tables, Pages 54 and 55 for rating analysis.

VIEWPOINT THREE: NORTH NORTH WEST FROM COOLAMON SCENIC DRIVE_DYNAMIC VIEWING SITUATION @ 2.35 KM FROM CENTRE OF SOLAR ARRAY

Viewpoint Three
Horizontal Field of View..... 10°
Vertical Field of View........... 0.49°
Distance Photopoint from centre of Solar Array........... 2.35 km

Landscape Architect................................ Mark Perkins RLA 002060
GIS.. GEOVIEW Pty Ltd
Camera.. Nikon D90: S/N: 3290438
Camera Lens and focal length............... 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position.. lat: 28° 38’37.06”S lon: 153° 31’40.21”E
Camera elevation...................................... rl: 136.6
Date image taken....................................... 13/10/2020

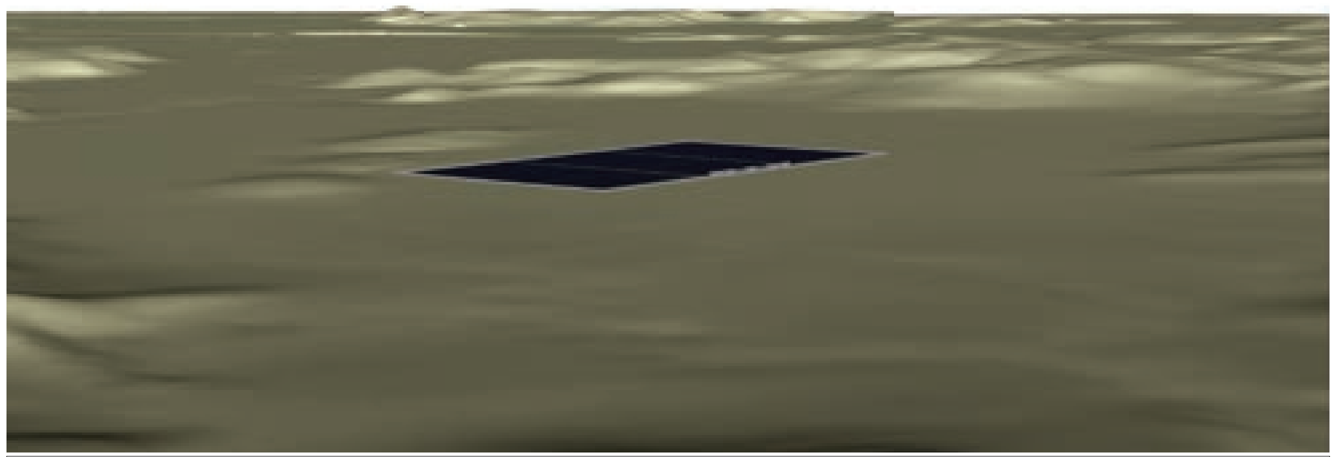
PHOTOMONTAGE WITH MITIGATION MEASURES (FOV) 38°

VIEWPOINT FOUR: NORTH EAST FROM POSSUM SHOOT ROAD_DYNAMIC VIEWING SITUATION @ 1.51 KM FROM CENTRE OF SOLAR ARRAY

VIEW (FOV) 38°

Viewpoint Four		Landscape Architect	Mark Perkins RLA 002060
Horizontal Field of View	14˚	GIS	
Vertical Field of View	1.41˚	Camera	Nikon D90: S/N: 3290438
Distance Photopoint from centre of Solar Array	1.51 km	Camera Lens and focal length	18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
		Camera position	lat: 28˚ 37’48.76”S lon: 153˚ 30’25.67”E
		Camera elevation	rl: 149.6
		Date image taken	13/10/2020

VIEWPOINT FOUR: NORTH EAST FROM POSSUM SHOOT ROAD_DYNAMIC VIEWING SITUATION @ 1.51 KM FROM CENTRE OF SOLAR ARRAY



TERRAIN MODEL (FOV) 38°

Viewpoint Four		Landscape Architect	Mark Perkins RLA 002060
Horizontal Field of View	14˚	GIS	
Vertical Field of View	1.41˚	Camera	Nikon D90: S/N: 3290438
Distance Photopoint from centre of Solar Array	1.51 km	Camera Lens and focal length	18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
		Camera position	lat: 28˚ 37’48.76”S lon: 153˚ 30’25.67”E
		Camera elevation	rl: 149.6
		Date image taken	13/10/2020

VIEWPOINT FOUR POSSUM SHOOT ROAD		
VISUAL EFFECT	VISUAL SENSITIVITY	DESCRIPTION OF VISUAL EFFECT
LANDSCAPE CHARACTER VALUE	MODERATE	Typical character is a rural landscape, defined by field patterns, forestry plantations, agricultural areas and associated small-scale roads and buildings
DEGREE OF MODIFICATION OF THE EXISTING LANDSCAPE CHARACTER	MODERATE	Moderate visual impact. Medium level of change to the landscape character. The landscape is able to or absorb change due to the scale and extent of the development.
HORIZONTAL VISUAL EFFECT	VERY LOW	No or minor visual impact within the landscape
VERTICAL VISUAL EFFECT	LOW	Limited visual impact of the field of view.
DISTANCE VISUAL EFFECT	MODERATE	Middle ground _Sub Regional, Moderate visual impact
VISUAL SENSITIVITY		Low sensitivity to changes to the existing landscape character

VIEWPOINT FOUR POSSUM SHOOT ROAD LANDSCAPE CHARACTER AND VISUAL SENSITIVITY EVALUATION
Viewpoint four takes in views across the coastal plain to the ocean. The viewing situation is dynamic and limited, with no opportunity for a vehicle to stop. It is situated on a local road connecting Coolamon Scenic Drive with Myocum Road. Traffic is local. Landscape Character is predominatley drainage plain, undulating hills and rises (treed’ and cleared) and rural settlement. The Project is visible within the landscape and is discernable as a Solar Farm. It is a new element in the landscape. An open area of pasture used for grazing is replaced with a low lying (PV) Solar array. There is no modification to paddock trees or forested areas. Ancillary structures have visual parity in the landscape. The security fencing is indisceranable at this distance. Mitigation measures to screen ancillary structures, increase vegetation on the north property boundary and south western aspect, will embed the project within the drainage plain. There is a low sensitivity to changes to the existing landscape character from the proposed modification. There is a slight to limited visual impact.
Refer; Visual Sensitivity Evaluation Tables, Pages 54 and 55 for rating analysis.

VIEWPOINT FOUR: NORTH EAST FROM POSSUM SHOOT ROAD_DYNAMIC VIEWING SITUATION @ 1.51 KM FROM CENTRE OF SOLAR ARRAY

Viewpoint Four
Horizontal Field of View..... 14˚
Vertical Field of View.......... 1.41˚
Distance Photopoint from
centre of Solar Array........... 1.51 km

Landscape Architect................................ Mark Perkins RLA 002060
GIS...
Camera.. Nikon D90: S/N: 3290438
Camera Lens and focal length.............. 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position.......................................lat: 28˚ 37’48.76”S lon: 153˚ 30’25.67”E
Camera elevation..................................... rl: 149.6
Date image taken...................................... 13/10/2020

PHOTOMONTAGE WITH MITIGATION MEASURES (FOV) 38°

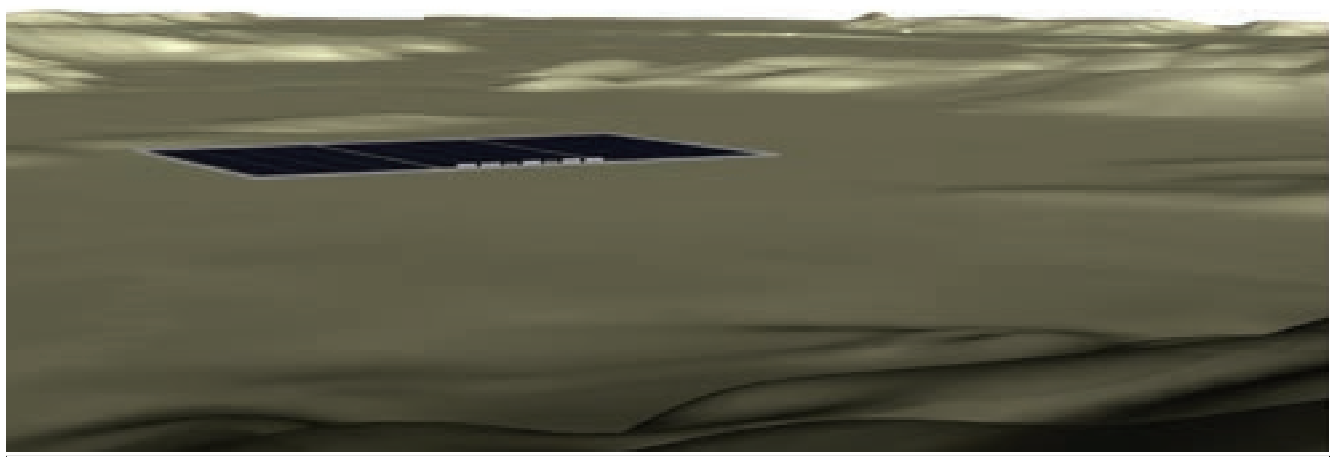
VIEWPOINT FIVE: NORTH NORTH EAST FROM POSSUM SHOOT ROAD_DYNAMIC VIEWING SITUATION @ 1.22 KM FROM CENTRE OF SOLAR ARRAY

VIEW (FOV) 38°

Viewpoint Five
Horizontal Field of View..... 18°
Vertical Field of View.......... 1.25°
Distance Photopoint from centre of Solar Array........... 1.22 km

Landscape Architect................................ Mark Perkins RLA 002060
GIS... GEOVIEW Pty Ltd
Camera.. Nikon D90: S/N: 3290438
Camera Lens and focal length.............. 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position...................................... lat: 28° 37'56.49"S lon: 153° 30'46.97"E
Camera elevation..................................... rl: 104.6
Date image taken..................................... 13/10/2020

VIEWPOINT FIVE: NORTH NORTH EAST FROM POSSUM SHOOT ROAD_DYNAMIC VIEWING SITUATION @ 1.22 KM FROM CENTRE OF SOLAR ARRAY



TERRAIN MODEL (FOV) 38°

Viewpoint Five
Horizontal Field of View..... 18°
Vertical Field of View.......... 1.25°
Distance Photopoint from centre of Solar Array........... 1.22 km

Landscape Architect................................ Mark Perkins RLA 002060
GIS... GEOVIEW Pty Ltd
Camera.. Nikon D90: S/N: 3290438
Camera Lens and focal length.............. 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position...................................... lat: 28° 37'56.49"S lon: 153° 30'46.97"E
Camera elevation..................................... rl: 104.6
Date image taken..................................... 13/10/2020

VIEWPOINT FIVE POSSUM SHOOT ROAD		
VISUAL EFFECT	VISUAL SENSITIVITY	DESCRIPTION OF VISUAL EFFECT
LANDSCAPE CHARACTER VALUE	MODERATE	Typical character is a rural landscape, defined by field patterns, forestry plantations, agricultural areas and associated small-scale roads and buildings
DEGREE OF MODIFICATION OF THE EXISTING LANDSCAPE CHARACTER	MODERATE	Moderate visual impact. Medium level of change to the landscape character. The landscape is able to or absorb change due to the scale and extent of the development.
HORIZONTAL VISUAL EFFECT	VERY LOW	No or minor visual impact within the landscape
VERTICAL VISUAL EFFECT	LOW	Limited visual impact of the field of view.
DISTANCE VISUAL EFFECT	MODERATE	Middle ground _Sub Regional, Moderate visual impact
VISUAL SENSITIVITY		Low sensitivity to changes to the existing landscape character

VIEWPOINT FIVE POSSUM SHOOT ROAD LANDSCAPE CHARACTER AND VISUAL SENSITIVITY EVALUATION
Viewpoint five takes in views across the coastal plain to the ocean. The viewing situation is dynamic and limited, with no opportunity for a vehicle to stop. It is situated on a local road connecting Coolamon Scenic Drive with Myocum Road. Traffic is local. Landscape Character is predominatley drainage plain, undulating hills and rises (treed' and cleared) and rural settlement. The Project is visible within the landscape and is discernable as a Solar Farm. It is a new element in the landscape. An open area of pasture used for grazing is replaced with a low lying (PV) Solar array. There is no modification to paddock trees or forested areas. Ancillary structures have visual parity in the landscape. The security fencing is indisceranable at this distance. Mitigation measures to screen ancillary structures, increase vegetation on the north property boundary and south western aspect, will embed the project within the drainage plain. There is a low sensitivity to changes to the existing landscape character from the proposed modification. There is a slight to limited visual impact.
Refer; Visual Sensitivity Evaluation Tables, Pages 54 and 55 for rating analysis.

VIEWPOINT FIVE: NORTH NORTH EAST FROM POSSUM SHOOT ROAD_DYNAMIC VIEWING SITUATION @ 1.22 KM FROM CENTRE OF SOLAR ARRAY

PHOTOMONTAGE WITH MITIGATION MEASURES (FOV) 38°

Viewpoint Five

Horizontal Field of View.....	18°
Vertical Field of View...........	1.25°
Distance Photopoint from centre of Solar Array...........	1.22 km

Landscape Architect................................	Mark Perkins RLA 002060
GIS..	GEOVIEW Pty Ltd
Camera..	Nikon D90: S/N: 3290438
Camera Lens and focal length..............	18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position..	lat: 28° 37'56.49"S lon: 153° 30'46.97"E
Camera elevation.......................................	rl: 104.6
Date image taken.......................................	13/10/2020

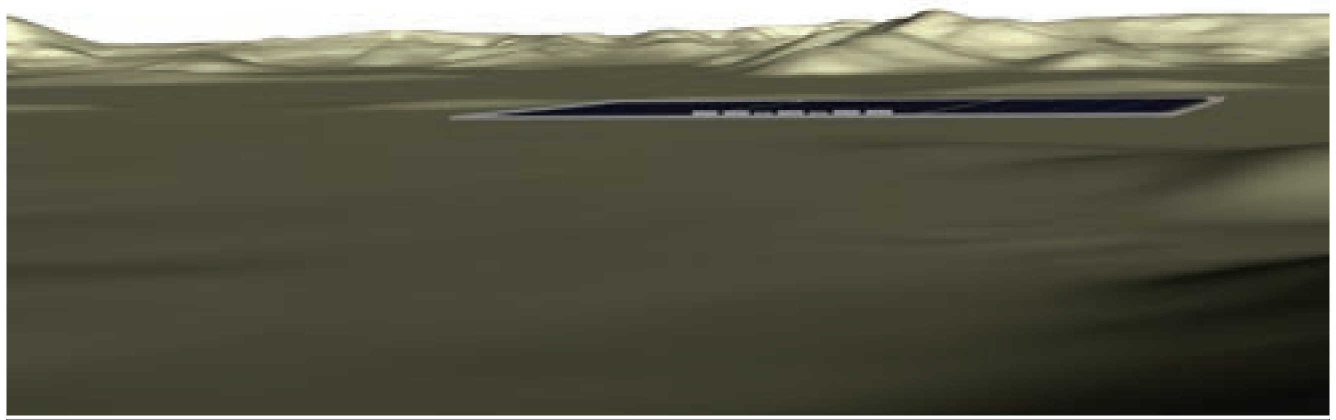
VIEWPOINT SIX: NORTH BY WEST FROM POSSUM SHOOT ROAD_DYNAMIC VIEWING SITUATION @ 1.00 KM FROM CENTRE OF SOLAR ARRAY

VIEW (FOV) 38°

Viewpoint Six
Horizontal Field of View..... 22°
Vertical Field of View.......... 0.67°
Distance Photopoint from centre of Solar Array........... 1.00 km

Landscape Architect.......... Mark Perkins RLA 002060
GIS.......... GEOVIEW Pty Ltd
Camera.......... Nikon D90: S/N: 3290438
Camera Lens and focal length.......... 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position.......... lat: 28° 37’56.47”S lon: 153° 31’18.44”E
Camera elevation.......... rl: 42.6
Date image taken.......... 13/10/2020

VIEWPOINT SIX: NORTH BY WEST FROM POSSUM SHOOT ROAD_DYNAMIC VIEWING SITUATION @ 1.00 KM FROM CENTRE OF SOLAR ARRAY



TERRAIN MODEL (FOV) 38°

Viewpoint Six
Horizontal Field of View..... 22°
Vertical Field of View.......... 0.67°
Distance Photopoint from centre of Solar Array........... 1.00 km

Landscape Architect.......... Mark Perkins RLA 002060
GIS.......... GEOVIEW Pty Ltd
Camera.......... Nikon D90: S/N: 3290438
Camera Lens and focal length.......... 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position.......... lat: 28° 37’56.47”S lon: 153° 31’18.44”E
Camera elevation.......... rl: 42.6
Date image taken.......... 13/10/2020

VIEWPOINT SIX POSSUM SHOOT ROAD		
VISUAL EFFECT	VISUAL SENSITIVITY	DESCRIPTION OF VISUAL EFFECT
LANDSCAPE CHARACTER VALUE	MODERATE	Typical character is a rural landscape, defined by field patterns, forestry plantations, agricultural areas and associated small-scale roads and buildings
DEGREE OF MODIFICATION OF THE EXISTING LANDSCAPE CHARACTER	MODERATE	Moderate visual impact. Medium level of change to the landscape character. The landscape is able to or absorb change due to the scale and extent of the development.
HORIZONTAL VISUAL EFFECT	VERY LOW	No or minor visual impact within the landscape
VERTICAL VISUAL EFFECT	LOW	Limited visual impact of the field of view.
DISTANCE VISUAL EFFECT	MODERATE	Middle ground _Sub Regional, Moderate visual impact
VISUAL SENSITIVITY		Low sensitivity to changes to the existing landscape character

VIEWPOINT SIX POSSUM SHOOT ROAD LANDSCAPE CHARACTER AND VISUAL SENSITIVITY EVALUATION
Viewpoint six takes in views across the drainage plain to forested settlement and the escarpment beyond. The viewing situation is dynamic and limited, with no opportunity for a vehicle to stop. It is situated on local road connecting Coolamon Scenic Drive with Myocum Road. Traffic is local. Landscape Character is predominatley drainage plain, undulating hills and rises (treed’ and cleared) and rural settlement. The Project is visible within the landscape and is discernable as a Solar Farm. It is a new element in the landscape. An open area of pasture used for grazing is replaced with A low lying (PV) Solar array. There is no modification to paddock trees or forested areas. Ancillary structures have visual parity in the landscape. The security fencing is potentially disceranable at this distance. The Project is screened in part by existing stands of Bamboo, Camphor Laurel and native regrowth. Mitigation measures to screen ancillary structures, increase vegetation on the north property boundary and south western aspect, will embed the project within the drainage plain. There is a low sensitivity to changes to the existing landscape character from the proposed modification. There is a imited visual impact.
Refer; Visual Sensitivity Evaluation Tables, Pages 54 and 55 for rating analysis.

VIEWPOINT SIX: NORTH BY WEST FROM POSSUM SHOOT ROAD_DYNAMIC VIEWING SITUATION @ 1.00 KM FROM CENTRE OF SOLAR ARRAY

Viewpoint Six	
Horizontal Field of View.....	22˚
Vertical Field of View..........	0.67˚
Distance Photopoint from centre of Solar Array...........	1.00 km

Landscape Architect................................	Mark Perkins RLA 002060
GIS..	GEOVIEW Pty Ltd
Camera..	Nikon D90: S/N: 3290438
Camera Lens and focal length..............	18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position...	lat: 28˚ 37'56.47"S lon: 153˚ 31'18.44"E
Camera elevation.......................................	rl: 42.6
Date image taken.......................................	13/10/2020

PHOTOMONTAGE WITH MITIGATION MEASURES (FOV) 38°

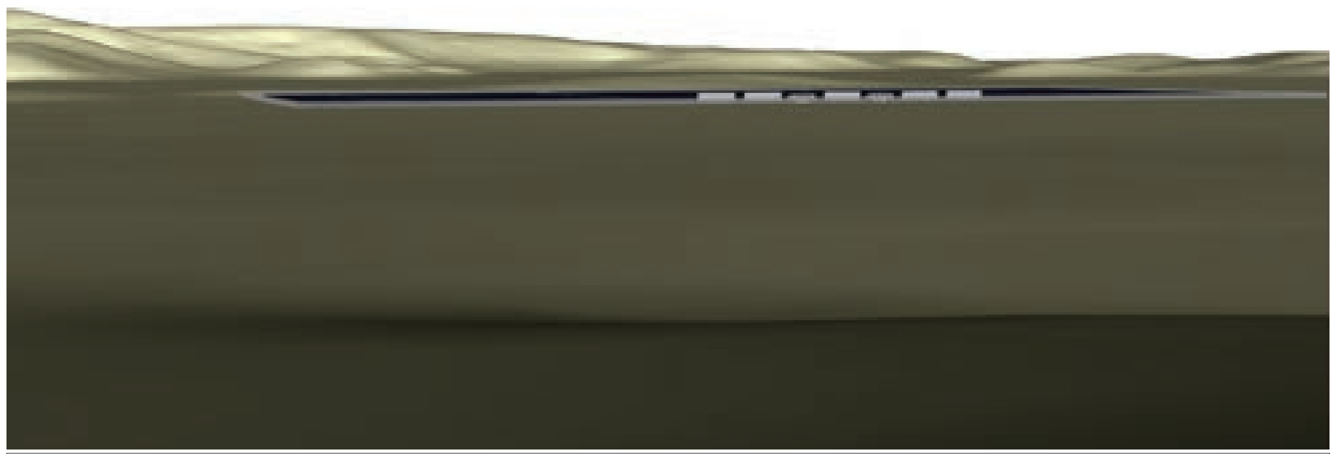
VIEWPOINT SEVEN: NORTH BY EAST FROM MYOCUM ROAD_DYNAMIC VIEWING SITUATION @ 0.74 KM FROM CENTRE OF SOLAR ARRAY

VIEW (FOV) 38°

Viewpoint Seven
Horizontal Field of View..... 29˚
Vertical Field of View.......... 0.41˚
Distance Photopoint from centre of Solar Array........... 0.74 km

Landscape Architect.............................. Mark Perkins RLA 002060
GIS.. GEOVIEW Pty Ltd
Camera... Nikon D90: S/N: 3290438
Camera Lens and focal length.............. 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position.................................... lat: 28˚ 37'45.42"S lon: 153˚ 31'1.13"E
Camera elevation.................................. rl: 19.1
Date image taken.................................. 13/10/2020

VIEWPOINT SEVEN: NORTH BY EAST FROM MYOCUM ROAD_DYNAMIC VIEWING SITUATION @ 0.74 KM FROM CENTRE OF SOLAR ARRAY



TERRAIN MODEL (FOV) 38°

Viewpoint Seven
Horizontal Field of View..... 29˚
Vertical Field of View.......... 0.41˚
Distance Photopoint from centre of Solar Array........... 0.74 km

Landscape Architect.............................. Mark Perkins RLA 002060
GIS.. GEOVIEW Pty Ltd
Camera... Nikon D90: S/N: 3290438
Camera Lens and focal length.............. 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position.................................... lat: 28˚ 37'45.42"S lon: 153˚ 31'1.13"E
Camera elevation.................................. rl: 19.1
Date image taken.................................. 13/10/2020

VIEWPOINT SEVEN MYOCUM ROAD		
VISUAL EFFECT	VISUAL SENSITIVITY	DESCRIPTION OF VISUAL EFFECT
LANDSCAPE CHARACTER VALUE	MODERATE	Typical character is a rural landscape, defined by field patterns, forestry plantations, agricultural areas and associated small-scale roads and buildings
DEGREE OF MODIFICATION OF THE EXISTING LANDSCAPE CHARACTER	MODERATE	Moderate visual impact. Medium level of change to the landscape character. The landscape is able to or absorb change due to the scale and extent of the development.
HORIZONTAL VISUAL EFFECT	VERY LOW	No or minor visual impact within the landscape
VERTICAL VISUAL EFFECT	VERY LOW	No or minor visual impact within the landscape
DISTANCE VISUAL EFFECT	HIGH	Foreground_Local, Increasing visual impact
VISUAL SENSITIVITY		Low sensitivity to changes to the existing landscape character

VIEWPOINT SEVEN MYOCUM ROAD LANDSCAPE CHARACTER AND VISUAL SENSITIVITY EVALUATION
Viewpoint seven takes in views across the drainage plain to low unulating hills of rural settlement. The viewing situation is dynamic and limited, with no opportunity for a vehicle to stop. It is situated on local road. Traffic is local. Landscape Character is predominatley drainage plain, undulating hills and rises (treed' and cleared) and rural settlement. The Project is visible within the landscape and is discernable as a Solar Farm. It is a new element in the landscape. An open area of pasture used for grazing is replaced with A low lying (PV) Solar array. There is no modification to paddock trees or forested areas. Ancillary structures have visual parity in the landscape. The security fencing is disceranable at this distance. The Project is screened in part by exist-ing stands of Bamboo, Camphor Laurel and native regrowth. Mitigation measures to screen ancillary structures, increase vegetation on the north property boundary and south western aspect, will embed the project within the drainage plain. There is a low sensitivity to changes to the existing landscape character from the proposed modification. There is a imited visual impact.
Refer; Visual Sensitivity Evaluation Tables, Pages 54 and 55 for rating analysis.

VIEWPOINT SEVEN: NORTH FROM MYOCUM ROAD_DYNAMIC VIEWING SITUATION @ 0.74 KM FROM CENTRE OF SOLAR ARRAY

PHOTOMONTAGE WITH MITIGATION MEASURES (FOV) 38°

Viewpoint Seven	
Horizontal Field of View.....	29°
Vertical Field of View..........	0.41°
Distance Photopoint from centre of Solar Array...........	0.74 km

Landscape Architect................................	Mark Perkins RLA 002060
GIS..	GEOVIEW Pty Ltd
Camera..	Nikon D90: S/N: 3290438
Camera Lens and focal length..............	18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position..	lat: 28° 37’45.42”S lon: 153° 31’1.13”E
Camera elevation.......................................	rl: 19.1
Date image taken.......................................	13/10/2020

VIEWPOINT EIGHT: NORTH EAST FROM MYOCUM ROAD_DYNAMIC VIEWING SITUATION @ 0.82 KM FROM CENTRE OF SOLAR ARRAY

VIEW (FOV) 38°

Viewpoint Eight
Horizontal Field of View..... 26˚
Vertical Field of View.......... 0.37˚
Distance Photopoint from centre of Solar Array........... 0.82 km

Landscape Architect.............................. Mark Perkins RLA 002060
GIS.. GEOVIEW Pty Ltd
Camera.. Nikon D90: S/N: 3290438
Camera Lens and focal length.............. 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position.......................................lat: 28˚ 37'39.85"S lon: 153˚ 30'48.70"E
Camera elevation...................................... rl: 15.6
Date image taken...................................... 13/10/2020

VIEWPOINT EIGHT: NORTH EAST FROM MYOCUM ROAD_DYNAMIC VIEWING SITUATION @ 0.82 KM FROM CENTRE OF SOLAR ARRAY

TERRAIN MODEL (FOV) 38°

Viewpoint Eight
Horizontal Field of View..... 26˚
Vertical Field of View.......... 0.37˚
Distance Photopoint from centre of Solar Array........... 0.82 km

Landscape Architect.............................. Mark Perkins RLA 002060
GIS.. GEOVIEW Pty Ltd
Camera.. Nikon D90: S/N: 3290438
Camera Lens and focal length.............. 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position.......................................lat: 28˚ 37'39.85"S lon: 153˚ 30'48.70"E
Camera elevation...................................... rl: 15.6
Date image taken...................................... 13/10/2020

VIEWPOINT EIGHT MYOCUM ROAD		
VISUAL EFFECT	VISUAL SENSITIVITY	DESCRIPTION OF VISUAL EFFECT
LANDSCAPE CHARACTER VALUE	MODERATE	Typical character is a rural landscape, defined by field patterns, forestry plantations, agricultural areas and associated small-scale roads and buildings
DEGREE OF MODIFICATION OF THE EXISTING LANDSCAPE CHARACTER	MODERATE	Moderate visual impact. Medium level of change to the landscape character. The landscape is able to or absorb change due to the scale and extent of the development.
HORIZONTAL VISUAL EFFECT	VERY LOW	None to minor impact of the field of view.
VERTICAL VISUAL EFFECT	VERY LOW	None to minor impact of the field of view.
DISTANCE VISUAL EFFECT	HIGH	Foreground_Local, Increasing visual impact
VISUAL SENSITIVITY		Low sensitivity to changes to the existing landscape character

VIEWPOINT EIGHT MYOCUM ROAD LANDSCAPE CHARACTER AND VISUAL SENSITIVITY EVALUATION
Viewpoint eight takes in views across the drainage plain to low unulating hills of rural settlement. The viewing situation is dynamic and limited, there is opportunity for a vehicle to stop. It is situated on local road. Traffic is local. Landscape Character is predominatley drainage plain, undulating hills and rises (treed' and cleared) and rural settlement. The Project is visible within the landscape and is discernable as a Solar Farm. It is a new element in the landscape. An open area of pasture used for grazing is replaced with a low lying (PV) Solar array. There is no modification to paddock trees or forested areas. Ancillary structures have visual parity in the landscape. The security fencing is disceranable at this distance. The Project is screened in part by existing stands of Bamboo, Camphor Laurel and native regrowth. Mitigation measures to screen ancillary structures, increase vegetation on the north property boundary and south western aspect, will embed the project within the drainage plain. There is a low sensitivity to changes to the existing landscape character from the proposed modification. There is a limited visual impact.
Refer; Visual Sensitivity Evaluation Tables, Pages 54 and 55 for rating analysis.

VIEWPOINT EIGHT: NORTH EAST FROM MYOCUM ROAD_DYNAMIC VIEWING SITUATION @ 0.82 KM FROM CENTRE OF SOLAR ARRAY

PHOTOMONTAGE WITH MITIGATION MEASURES (FOV) 38°

Viewpoint Eight
Horizontal Field of View..... 26°
Vertical Field of View.......... 0.37°
Distance Photopoint from centre of Solar Array........... 0.82 km

Landscape Architect................................ Mark Perkins RLA 002060
GIS.. GEOVIEW Pty Ltd
Camera.. Nikon D90: S/N: 3290438
Camera Lens and focal length.............. 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position... lat: 28° 37'39.85"S lon: 153° 30'48.70"E
Camera elevation...................................... rl: 15.6
Date image taken...................................... 13/10/2020

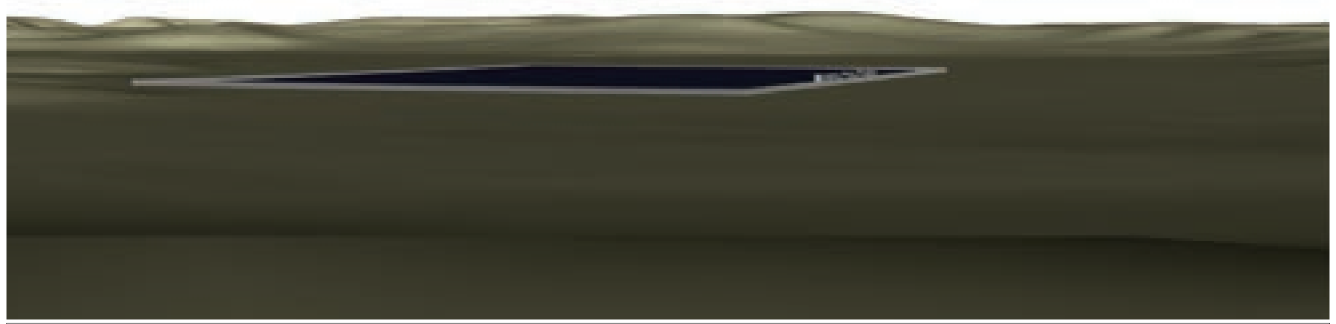
VIEWPOINT NINE: EAST NORTH EAST FROM MYOCUM ROAD_DYNAMIC VIEWING SITUATION @ 0.77 KM FROM CENTRE OF SOLAR ARRAY

VIEW (FOV) 38°

Viewpoint Nine
Horizontal Field of View..... 23˚
Vertical Field of View........... 0.75˚
Distance Photopoint from centre of Solar Array........... 0.77 km

Landscape Architect................................ Mark Perkins RLA 002060
GIS.. GEOVIEW Pty Ltd
Camera.. Nikon D90: S/N: 3290438
Camera Lens and focal length.............. 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position.. lat: 28˚ 37'28.43"S lon: 153˚ 30'45.71"E
Camera elevation...................................... rl: 25.1
Date image taken...................................... 13/10/2020

VIEWPOINT NINE: EAST NORTH EAST FROM MYOCUM ROAD_DYNAMIC VIEWING SITUATION @ 0.77 KM FROM CENTRE OF SOLAR ARRAY



TERRAIN MODEL (FOV) 38°

Viewpoint Nine
Horizontal Field of View..... 23˚
Vertical Field of View........... 0.75˚
Distance Photopoint from centre of Solar Array........... 0.77 km

Landscape Architect................................ Mark Perkins RLA 002060
GIS.. GEOVIEW Pty Ltd
Camera.. Nikon D90: S/N: 3290438
Camera Lens and focal length.............. 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position.. lat: 28˚ 37'28.43"S lon: 153˚ 30'45.71"E
Camera elevation...................................... rl: 25.1
Date image taken...................................... 13/10/2020

VIEWPOINT NINE MYOCUM ROAD		
VISUAL EFFECT	VISUAL SENSITIVITY	DESCRIPTION OF VISUAL EFFECT
LANDSCAPE CHARACTER VALUE	MODERATE	Typical character is a rural landscape, defined by field patterns, forestry plantations, agricultural areas and associated small-scale roads and buildings
DEGREE OF MODIFICATION OF THE EXISTING LANDSCAPE CHARACTER	MODERATE	Moderate visual impact. Medium level of change to the landscape character. The landscape is able to or absorb change due to the scale and extent of the development.
HORIZONTAL VISUAL EFFECT	VERY LOW	No or minor visual impact within the landscape
VERTICAL VISUAL EFFECT	LOW	Limited visual impact of the field of view.
DISTANCE VISUAL EFFECT	HIGH	Foreground_Local, Increasing visual impact
VISUAL SENSITIVITY		Moderate sensitivity to changes to the existing landscape character

VIEWPOINT NINE MYOCUM ROAD LANDSCAPE CHARACTER AND VISUAL SENSITIVITY EVALUATION
Viewpoint nine takes in views across the drainage plain to low unulating hills of rural settlement and small holdings. The viewing situation is dynamic and limited, there is opportunity for a vehicle to stop. It is situated on a local road. Traffic is local. Landscape Character is predominatley drainage plain, undulating hills and rises (treed' and cleared) and rural settlement. The Project is visible within the landscape and is discernable as a Solar Farm. It is a new element in the landscape. An open area of pasture used for grazing is replaced with a low lying (PV) Solar array. There is no modification to paddock trees or forested areas. Ancillary structures have visual parity in the landscape. The security fencing is disceranable at this distance. Mitigation measures to screen ancillary structures, increase vegetation on the north property boundary and south western aspect, will embed the project within the drainage plain. There is a moderate sensitivity to changes to the existing landscape character from the proposed modification. There is a moderate visual impact.
Refer; Visual Sensitivity Evaluation Tables, Pages 54 and 55 for rating analysis.

VIEWPOINT NINE: EAST FROM MYOCUM ROAD_DYNAMIC VIEWING SITUATION @ 0.77 KM FROM CENTRE OF SOLAR ARRAY

PHOTOMONTAGE WITH MITIGATION MEASURES (FOV) 38°

Viewpoint Nine
Horizontal Field of View..... 23˚
Vertical Field of View.......... 0.75˚
Distance Photopoint from centre of Solar Array........... 0.77 km

Landscape Architect................................ Mark Perkins RLA 002060
GIS.. GEOVIEW Pty Ltd
Camera.. Nikon D90: S/N: 3290438
Camera Lens and focal length.............. 18.0-105.0 mm f3.5-5.6_35.00mm (in 35mm: 52mm)
Camera position... lat: 28˚ 37'28.43"S lon: 153˚ 30'45.71"E
Camera elevation....................................... rl: 25.1
Date image taken....................................... 13/10/2020

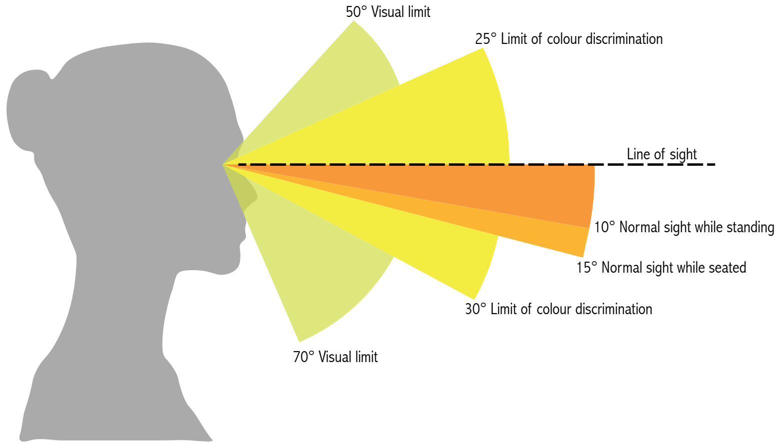
VISUAL SENSITIVITY EVALUATION TABLES		
LANDSCAPE TYPE	VALUE RATING	TYPICAL CHARACTERISTICS
Unmodified and or scenic landscapes identified at a national or regional level.	5	Natural habitats, iconic landscapes including identified areas such as scenic escarpments, headlands, foreshores and coastal plains often containing National Parks and Reserves.
Natural transition landscapes.	4	A changing landscape character associated with the interface between natural areas and modified rural, pastoral or agricultural zones.
Modified rural landscapes, agricultural and pastoral areas.	3	Typical character is a rural landscape, defined by field patterns, forestry plantations, agricultural areas and associated small-scale roads and buildings
Rural transition landscapes_Periurban.	2	Transitional landscape associated with the interface between rural, agricultural areas and more developed suburban and urban zones
Highly modified landscapes, urban and industrial, often un-planned.	1	Substantially developed landscape. Associated with buildings, factories, roads and other related infrastructure not identified as iconic or of heritage value.
LANDSCAPE CHARACTER UNIT VALUE RATING	#	This is an assessment of the visual character of the existing landscape- where value is ascribed on a descending scale with pristine natural landscapes higher on a value scale than man made landscapes. Value hierarchies can be ascribed to different subsets i.e. A highly modified landscape could be assessed -where higher value is ascribed to the importance of its role as a visual unit that combines with other units contributing to landscape identity or structure.

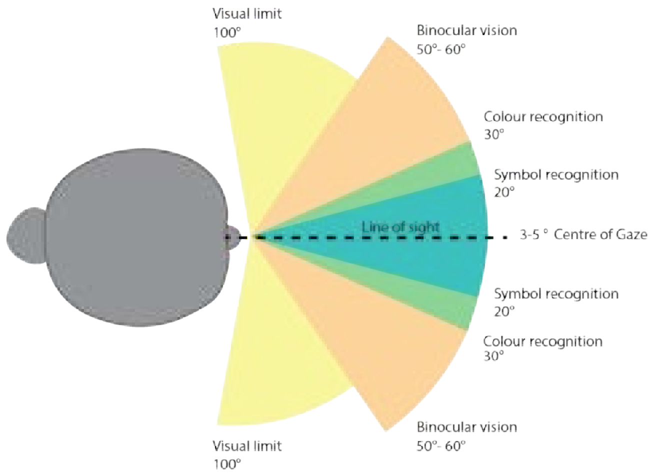
EFFECT OF VISUAL MODIFICATION (EXPRESSED AS A PERCENTAGE OF CHANGE	VALUE RATING	DESCRIPTION OF VISUAL MODIFICATION
80-100%	5	Substantial Visual impact. The existing landscape character is completely changed or modified to accommodate the development.
60-79%	4	Increasing Visual impact. The landscape is seen as changed permanently with the development dominating the existing landscape.
40-59%	3	Moderate visual impact. Medium level of change to the landscape character. The landscape is able to or absorb change due to the scale and extent of the development.
20-39%	2	Limited impact. The development is noticeable within the landscape,
0-19%	1	No or minor visual impact within the landscape. The development is considered in keeping with the existing landscapes character.
MODIFICATION VALUE RATING	#	This is an assessment of the degree of visual change that will occur within the context of the existing landscape due to the proposed development, and the existing landscapes ability to absorb or mitigate visual effect and change.

VISUAL SENSITIVITY EVALUATION TABLES		
HORIZONTAL VISUAL EFFECT (EXPRESSED AS A PERCENTAGE OF MODIFICATION WITHIN THE FIELD OF VIEW)	VALUE RATING	DESCRIPTION OF VISUAL EFFECT
80-100%	5	Substantial visual impact of the field of view.
60-80%	4	Extensive visual impact of the field of view.
40-60%	3	Moderate visual impact of the field of view.
20-40%	2	Limited impact of the field of view.
0-20%	1	None to minor impact of the field of view.
HORIZONTAL VISUAL EFFECT VALUE RATING	#	This is an assessment of ther degree of visual change within the horizontal plane of the field of view. The field of vision experienced by the human eye is described by an angle of 200° horizontally. The area of focus is 120° with discrimination of structures and colours being focused viewing between 40° and 60°. This measurement of effect is then described as a percentage of the panorama. This enables a calculation of the degree of modification depending on the angle of view.

VERTICAL VISUAL EFFECT (EXPRESSED AS DEGREES OF VIEW OCCUPIED BY MODIFICATION WITHIN THE FIELD OF VIEW)	VALUE RATING	DESCRIPTION OF VISUAL EFFECT
Greater than 3.5°	5	Substantial visual impact of the field of view.
2.5° to 3.5°	4	Extensive visual impact of the field of view.
1.5° to 2.5°	3	Moderate visual impact of the field of view.
0.5° to 1.5°	2	Limited visual impact of the field of view.
Less than 0.5°	1	None to minor impact of the field of view.
VERTICAL VISUAL EFFECT VALUE RATING	#	This is an assessment of the degree of visual change within the vertical plane of the field of view The vertical visual effect measures in a similar way to the assessment of horizontal visual effect, but where the visual limit of the eye is 120°. The typical line of sight for a standing person at ground level is approximately 10° below the horizon line. This assessment ensures that the visual effect in relation to proximity is considered by measuring the degree of vertical modification.

VISUAL SENSITIVITY EVALUATION TABLES		
EFFECT OF DISTANCE	VALUE RATING	TYPICAL CHARACTERISTICS
0 to 0.5 km	5	Adjacent_Local, Substantial visual impact
0.5 to 1 km	4	Foreground_Local, Increasing visual impact
1 to 3 km	3	Middle ground _Sub Regional, Moderate visual impact
3 to 5 km	2	Distant middle ground_Sub Regional, Limited visual impact
5 km and greater	1	Background _Regional, No or minor visual impact within the landscape
DISTANCE UNIT VALUE RATING	#	This is an assessment of the visual character of the existing landscape- where value is ascribed on a descending scale with pristine natural landscapes higher on a value scale than man made landscapes. Value hierarchies can be ascribed to different subsets i.e. A highly modified landscape could be assessed -where higher value is ascribed to the importance of its role as a visual unit that combines with other units contributing to landscape identity or structure.





Vertical Field of View

The Vertical Field of Vision of the human eye is described by an angle of 120°. If we give the horizon a value of 0° then the eye clearly discerns colours, objects and has image sharpness for an angle of approximately 25° upwards and 30°downwards. The standard line of sight for a person at ground level is approximately 10° to 15° below the horizon line. It's within this limited field of vision that a quantification of perception of modification can be assessed.

Horizontal Field of View.

The Horizontal Field of Vision of the human eye is described by an angle of 200° horizontally. The area of focus (Binocular Vision) is 60° either side of the line of sight with discrimination of symbols, structures and colours being focused viewing 30° either side of the line of sight. It's within this field of vision that a quantification of perception of modification can be assessed.

EXAMPLE: VIEWPOINT VISUAL SENSITIVITY EVALUATION TABLE VIEWPOINT ONE		
VISUAL EFFECT	VALUE	VISUAL SENSITIVITY RATING
Landscape Character	3	Moderate
Effect of Visual Modification	3	Moderate
Horizontal Visual Effect	1	Very low
Vertical Visual Effect	1	Very low
Distance Visual Effect	2	Low
Visual Effect Value (provides a rating for visual sensitivity)	10	

VIEWPOINT VISUAL SENSITIVITY EVALUATION TABLE KEY		
DEGREE OF VISUAL EFFECT	VALUE TOTAL	VISUAL SENSITIVITY RATING
Extensive	21-25	Very high sensitivity to changes to the existing landscape character
Substantial	17-20	High sensitivity to changes to the existing landscape character
Moderate	13-16	Moderate sensitivity to changes to the existing landscape character
Slight	9-12	Low sensitivity to changes to the existing landscape character
Negligible	5-8	Very low sensitivity to changes to the existing landscape character

ADDENDA: SOLAR GLARE ASSESSMENT

1.0 INTRODUCTION

1.1 BACKGROUND

This report has been prepared by Ennismore Field Pty Ltd; Author, Mark Perkins, Landscape Architect (AILA), to assess the potential for solar glint and glare from the proposed Byron Bay Solar Farm (The Project), at Ewingsdale within Byron Shire, NSW.

This Solar Glare Assessment, has been undertaken on behalf of Byron Bay Solar Farm Holdings Pty Ltd, to provide guidance on glare throughout the year for the photo-voltaic (PV) Solar Array proposed and potential effects on the human eye at locations identified in the LVIA.

This Report utilises the Solar Glare Hazard Analysis Tool (SGHAT 2.0) developed by Sandi National Laboratory. The (SGHAT) was developed to evaluate glare resulting from solar farms at different viewpoints, based on the location, orientation and specifications of the PV modules. This tool is required by the United States FAA for glare hazard analysis near airports and is also recognised by the Australian Government Civil Aviation Safety Authority (CASA).

This report details the key inputs, methodology and results of the glare hazard assessment.

1.2 OBJECTIVES

- Conduct a glare potential analysis of the proposed Byron Bay Solar Farm based on a fixed panel system
- Identify potential glare impacts at viewing situations identified in the LVIA
- provide guidance on glint and glare management

2.O SOLAR GLARE HAZARD; BACK GROUND AND THEORY

2.1 GLINT AND GLARE FROM SOLAR PANELS

"Glint is typically defined as a momentary flash of bright light, often caused by a reflection off a moving source. A typical example of glint is a momentary solar reflection from a moving car. Glare is defined as a continuous source of bright light. Glare is generally associated with stationary objects, which, due to the slow relative movement of the sun, reflect sunlight for a longer duration.

The difference between glint and glare is duration. Industry-standard glare analysis tools evaluate the occurrence of glare on a minute-by minute basis; accordingly, they generally refer to solar hazards as glare."[1]

Solar panels are designed to absorb light, and accordingly reflect only reflect a small amount of the sunlight that falls on them when directly facing the sun compared to most other everyday objects. See Figure 1.

2.2 SPECULAR AND DIFFUSE REFLECTION

Smooth surfaces such as glass and still water exhibit 'specular reflection'. This is when light hits the surface at one angle and reflects in another direction. Specular reflection can be contrasted with 'diffuse reflection', which occurs when light reflects off of microscopically rough surfaces and scatters. Diffuse reflection is what happens when light hits virtually everything in our field of vision.

1 SGHAT Users and Technical Manuals

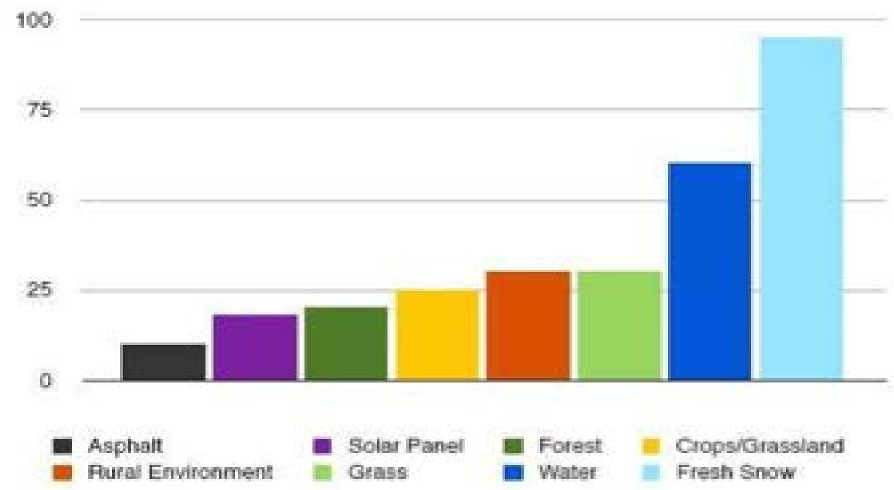


Figure 1. Graph illustrating a reflection analysis of a comparative range of materials

2.3 SOLAR GLARE HAZARD CATEGORISATION AND PLOTTING

When sun is reflected on a smooth surface it can result in glint (a quick reflection) or glare which is a longer reflection for those who are on the 'receiving' angle. In both cases the light reflected is diminished by having first hit the substrate that reflected it, unless that surface is a perfect mirror. When the sun is the original source of the light reflected off a reflective surface, the time and position at which glare or glint might occur depends on the original position of the sun in the sky in relation to the location of the viewer.

The ocular impact of solar glare is quantified into three categories (Ho,2011). See Figure 2.

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)

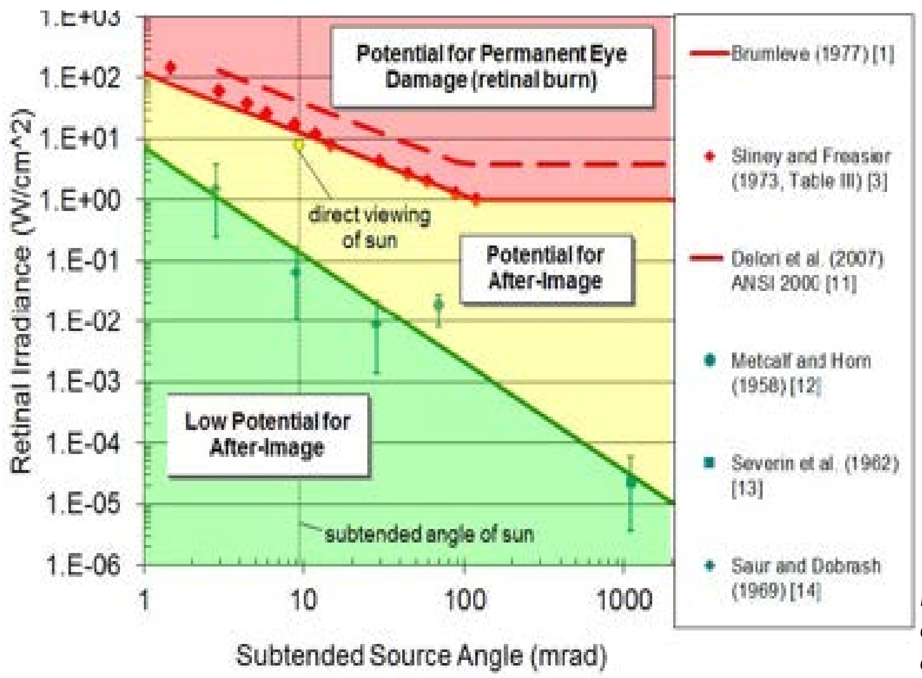


Figure 2. Sample glare hazard plot defining ocular impact as function of retinal irradiance and subtended source angle (Ho, 2011)

"These categories assume a typical blink response in the observer. Note that retinal burn is typically not possible for PV glare since PV modules do not focus reflected sunlight.

"The ocular impact of glare is visualized within the Glare Hazard Plot. This chart displays the ocular impact as a function of glare subtended source angle and retinal irradiance. Each minute of glare is displayed on the chart as a small circle in its respective hazard zone. For convenience, a reference point is provided which illustrates the hazard from viewing the sun without filtering, i.e. staring at the sun. Each plot includes predicted glare for one PV array and one receptor."[2] See Appendix 1

2.4 PANEL REFLECTIVITY TILT AND ANGLE OF INCIDENCE

"Refections from PV panels may impair observers. Studies have found that 7 W/m is enough to cause an after-image lasting 4 to 12 seconds (Ho,2009). This represents a refection of only 1-2% of typical solar irradiance (incoming sunlight) for a given location, which typically ranges between 800-1000 W/m .

A key factor of reflectance is the position of PV modules relative to the sun. A panel that absorbs 90% of direct sunlight may reflect up to 60% when not directly facing the sun. This situation is common for low-tilt panels during sunset and sunrise (Yellowhair, 2015). The oft-repeated claim that PV panels reflect less than 5% of sunlight only holds true when the panels directly face the sun. For fixed mount panels, this claim only applies during a few minutes of the day at most."[3]

2 SGHAT Users and Technical Manuals
3 SGHAT Users and Technical Manuals

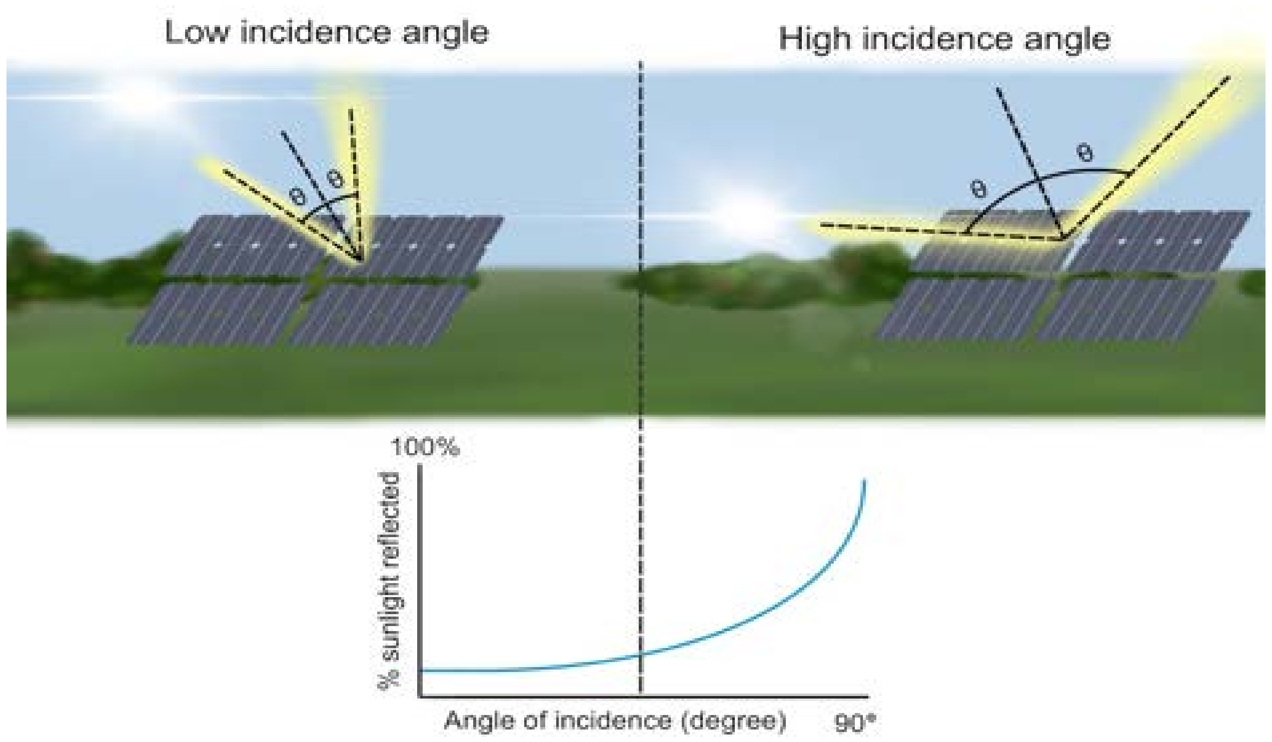


Figure 3 Comparative reflection analysis.

2.5 PV MODULE REFLECTANCE PROFILE

"Sandia National Laboratories developed five generic PV module material reflectance profiles by analyzing over twenty PV module samples. These profiles are available in ForgeSolar and allow for customizing the material properties of the PV array during analysis."

Figure 3 illustrates the reflectance of each material profile as a function of incidence angle, where an angle of 0° implies the panels are directly facing the sun. For example, a high glancing angle near 90° for panels with 0° tilt (lying flat) occurs daily at sunrise and sunset.

Anti-reflective coatings (ARC) and surface texturing can reduce panel reflectivity, but this reduction is typically less than 8% (Yellowhair, 2015). In addition, greater surface texturing can increase the size of the subtended source angle (i.e. glare spot)."[4]

3.0 PROJECT OVERVIEW

3.1 BYRON BAY SOLAR FARM (THE PROJECT)

Byron Bay Solar Farm Holdings proposes to construct, install and operate a 5MW Solar Farm(The Project), comprising 25056 (PV) Modules, and ancillary structures at 196 Kennedys Lane,Ewingsdale, 2481, New South Wales, being (LOT: 5 DP: 776609), covering an area of approximately 7 Hectares. See Fig 4.

Coordinates of the proposed solar farm development area are provided in the GlareGauge report attached in Appendix 1.

The proposed system for the project utilises JA Solar (PV) modules. They are laminated by high-transmission glass with an anti-reflective coating treatment. The reflectance of Mono PERC PV modules is less than 10%.

The model proposed has a silver frame and white back-sheet with a reflectance of 9.29%.

The proposed array is orientated east west on a tilt of 8°. See figure 4.

4.0 GLARE ANALYSIS SOFTWARE

4.1 ASSUMPTIONS

Glare hazard is difficult to define and is not the same for every person. It is dependent on a number of factors including reflectance parameters (light intensity, angle of reflectance etc.), the size of the glare source and the observer's distance from it, the orientation of the viewer, the effects of weather, duration and ocular/eye parameters (pupil diameter, distance from the pupil to the retina, etc). The following "assumptions and abstractions required by the SGHAT/ ForgeSolar analysis methodology"[5] have been made through the course of the analysis.

This analysis uses the GlareGauge tool - providing an annual glare hazard analysis of PV arrays and receptors.

4 SGHAT Users and Technical Manuals
5 SGHAT Users and Technical Manuals

"-The model assumes flat reflective surfaces and that light reflected by the solar panels is specular (i.e. the angle of incidence = the angle of reflection).

-The average subtended angle[6] of the sun as viewed from earth is ~9.3 mrad or 0.5°.

-The ocular transmission coefficient accounts for radiation that is absorbed in the eye before reaching the retina. A value of 0.5 is typical (Ho, 2011; Sliney, 1973).

-Diameter of the pupil – the size impacts the amount of light entering the eye and reaching the retina. The typical value is 0.002m for daylight-adjusted eyes (Ho, 2011; Sliney, 1973).

-Eye focal length: This value is used to determine the projected image size on the retina for a given subtended angle of the glare source. A typical value of 0.017 m is used (Ho, 2011; Sliney, 1973).

4.2 LIMITATIONS

GlareGauge has the following limitations:

"-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.

-Several 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 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[7]. 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 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 algorithm assumes that the PV array is aligned with a plane defined by the total heights of the coordinates outlined. For more 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.

-The algorithm does not 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 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. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.

-Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.

-Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ."[8]

6 The angle made by something from a given viewpoint

7 Air Traffic Control Training Series

5.0 GLAREGAUGE INPUTS

This Glare analysis utilises a fixed visual receptor observation method.

"The Observation Point receptor ("OP") simulates an observer at a single, discrete location, defined by a latitude, longitude, elevation and height above ground. This report assesses 9 locations identified in the LVIA."[9]

The points below detail the inputs for analysis in GlareGauge. All azimuth values are relative to true north and all tilt angles relative to the horizontal.

5.1 PV SYSTEM PARAMETERS

PV Array Footprint

-The PV Solar array is simulated spatially with a contiguous planar convex polygon. This polygonal footprint comprises four vertices defined by a latitude, longitude, elevation and height. The footprint encompass all planned (PV) modules.

-As the proposed PV Solar array system is orientated both east and west throughout the array the PV Array Footprint has been modeled for west orientation and east orientation.

PV Array System

-The proposed system is a Fixed-Mount system. The (PV) panels are described by a tilt and orientation. These parameters are referred to as the module configuration of the PV array. See figure 4.

8 SGHAT Users and Technical Manuals

9 SGHAT Users and Technical Manuals

-The module orientation/azimuth (°) is measured clockwise from true north.

-The Panels face both east described as 90° and west described as 270°.

-The module tilt (°) is measured up from flat ground. For example Panels lying flat on the ground (facing up) have a tilt of 0°. Tilt values for Byron Bay Solar Farm are 8°.

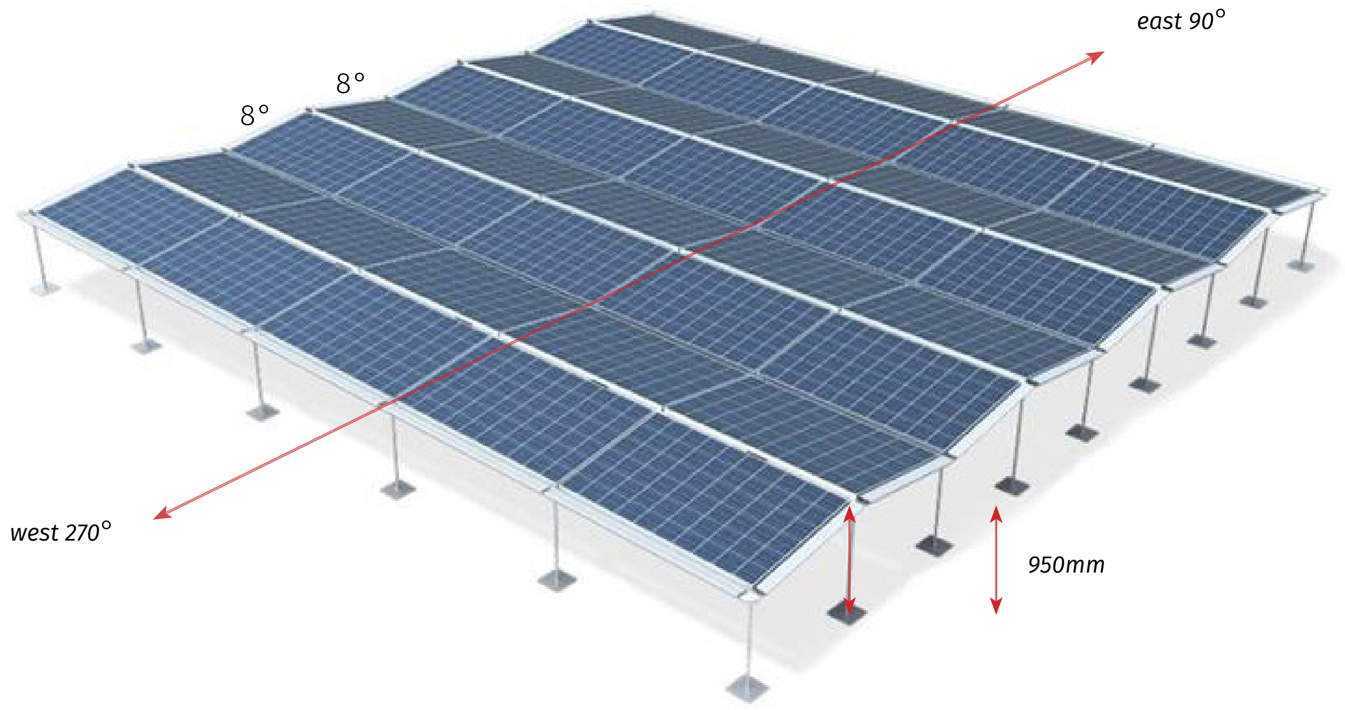


Figure 4 SPV panel system. Illustrating Azimuth, elevation and tilt.

6.0 OBSERVATION POINTS

Observation Points were identified in the Byron Bay Solar Farm, Landscape Character and Visual Impact Assessment as viewing situations requiring analysis due to the potential for visibility from viewing populations in transit or from culturally significant locations. See Figure 6.

7.0 ANALYSIS

Glare with potential for temporary after-image is predicted.

Receptor 4, OP 4, Possum Shoot Road is expected to produce 2786 minutes of "green" glare with low potential to cause temporary after-image during the year between 7 and 9 am in the months of April, May, June, July and August. With a maximum duration of 35 minutes in April and August

and

1233 minutes of "yellow" glare with potential to cause temporary after-image during the year between 7 and 9 am in the months of April, May, June, July and August. With a maximum duration of 38 minutes in May and August

Receptor 8, OP 8, Myocum Road is expected to produce nil minutes of "green" glare with low potential to cause temporary after-image and 1626 minutes of "yellow" glare with potential to cause temporary after-image during the year between 7 and 9 am in the months of April, May June, July and August. With a maximum duration of 20 minutes in July.

Receptor 9, OP9, is expected to produce nil minutes of "green" glare with low potential to cause temporary after-image and 2321 minutes of "yellow" glare with potential to cause temporary after-image during the year between 6 and 8 am in the months of February, March and April and again in August, September and October for up to 23 minutes a day.

8.0 RECOMMENDATIONS AND MANAGEMENT

Off-site vegetation screening at observation points at higher elevations where Glare Hazard may occur.

On site vegetation screening to minimise Glare Hazard at observation points at lower elevations.

Signage alerting receptors to the potential for a Glare Hazard at certain days of the year and times of day.

9.0 CONCLUSIONS

In the winter months before 9am there is the potential for glare for receptors at observation points 8 and 4. In the late Summer and early Autumn months and late Winter and early Spring months before 8am there is the potential for glare for receptors at observation point 9.

At observation point 4 on Possum Shoot Road vegetation does not impede the potential for glare and a greater area of the array is visible due to the elevated position of the viewer.

At observation point 8 on Myocum Road glare potential is limited by the low elevation of the array and interceding vegetation.

At observation point 9 on Myocum road glare potential is limited by the low elevation of the array and interceding vegetation.

Proposed Dingo Lane Solar Farm

Proposed Byron Bay Solar Farm

Figure 5 SGHA Site Plan

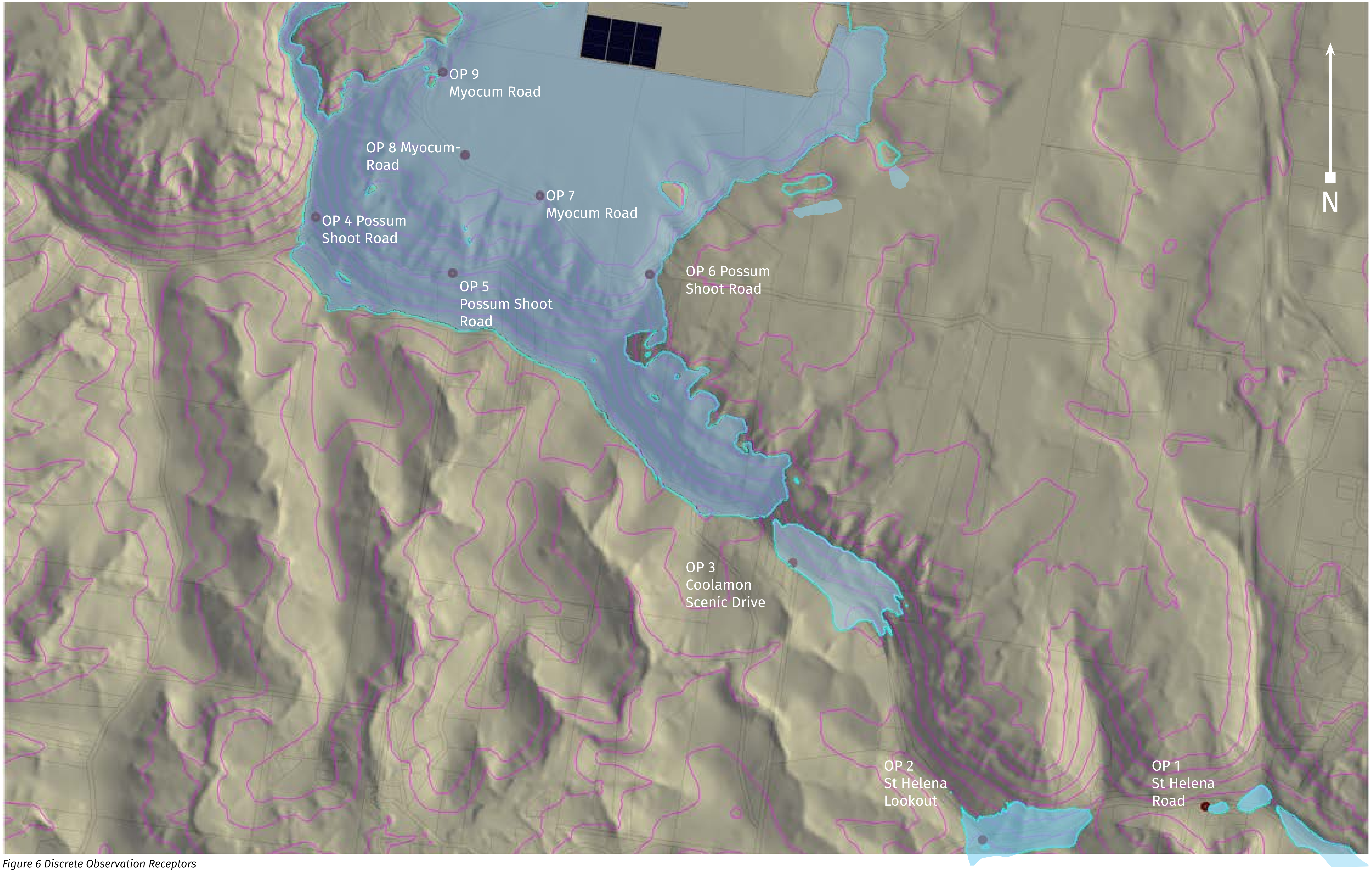


Figure 6 Discrete Observation Receptors

APPENDIX 1 FORGE SOLAR GLAREGAUGE GLARE HAZARD ANALYSIS

ForgeSolar

Site Configuration: PPOINTS1 TO 9 EAST

Project site configuration details and results.

Created **Nov. 16, 2020 6:39 p.m.**
Updated **Nov. 16, 2020 6:40 p.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.002 m pupil diameter
0.017 m eye focal length
9.3 mrad sun subtended angle
Timezone **UTC10**
Site Configuration ID: 45822.8242

Summary of Results No glare predicted!

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
PV array 1	8.0	90.0	0	0	-

Component Data

PV Array(s)

Name: PV array 1
Description: EAST TILT PPOINTS
Axis tracking: Fixed (no rotation)
Tilt: 8.0 deg
Orientation: 90.0 deg
Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad
Approx. area: 57,696 sq-m

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-28.623972	153.518647	5.00	0.90	5.90
2	-28.622364	153.518944	5.00	0.90	5.90
3	-28.622828	153.522172	5.00	0.90	5.90
4	-28.624433	153.521875	4.50	0.90	5.40

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	m	m	m
OP 1	-28.652808	153.546161	134.00	1.60	135.60
OP 2	-28.654164	153.536556	182.00	1.60	183.60
OP 3	-28.643628	153.527836	135.00	1.60	136.60
OP 4	-28.630211	153.507131	148.00	1.60	149.60
OP 5	-28.632358	153.513047	103.00	1.60	104.60
OP 6	-28.632353	153.521789	41.00	1.60	42.60
OP 7	-28.629283	153.516981	17.50	1.60	19.10
OP 8	-28.627736	153.513528	14.00	1.60	15.60
OP 9	-28.624564	153.512697	23.50	1.60	25.10

PV Array Results

Summary of PV Glare Analysis PV configuration and predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
PV array 1	8.0	90.0	0	0	-	-

Click the name of the PV array to scroll to its results

PV & Receptor Analysis Results detailed results for each PV array and receptor

PV array 1 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: OP 1	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: OP 6	0	0
OP: OP 7	0	0
OP: OP 8	0	0
OP: OP 9	0	0

No glare found

Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- 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.
- Several 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.
- 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.)
- 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.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
- Glare analysis methods used: OP V1, FP V1, Route V1
- Refer to the **Help page** for assumptions and limitations not listed here.

ForgeSolar

Site Configuration: PPOINTS1 TO 9 WEST

Project site configuration details and results.

Created **Nov. 16, 2020 6:47 p.m.**
Updated **Nov. 16, 2020 6:49 p.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.002 m pupil diameter
0.017 m eye focal length
9.3 mrad sun subtended angle
Timezone **UTC10**
Site Configuration ID: 45823.8242

Summary of Results Glare with potential for temporary after-image predicted

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
PV array 1	8.0	270.0	2,786	5,180	-

Component Data

PV Array(s)

Name: PV array 1
Description: WEST TILT PPOINTS
Axis tracking: Fixed (no rotation)
Tilt: 8.0 deg
Orientation: 270.0 deg
Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad
Approx. area: 57,696 sq-m

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-28.623972	153.518647	5.00	0.90	5.90
2	-28.622364	153.518944	5.00	0.90	5.90
3	-28.622828	153.522172	5.00	0.90	5.90
4	-28.624433	153.521875	4.50	0.90	5.40

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	m	m	m
OP 1	-28.652808	153.546161	134.00	1.60	135.60
OP 2	-28.654164	153.536556	182.00	1.60	183.60
OP 3	-28.643628	153.527836	135.00	1.60	136.60
OP 4	-28.630211	153.507131	148.00	1.60	149.60
OP 5	-28.632358	153.513047	103.00	1.60	104.60
OP 6	-28.632353	153.521789	41.00	1.60	42.60
OP 7	-28.629283	153.516981	17.50	1.60	19.10
OP 8	-28.627736	153.513528	14.00	1.60	15.60
OP 9	-28.624564	153.512697	23.50	1.60	25.10

PV Array Results

Summary of PV Glare Analysis PV configuration and predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
PV array 1	8.0	270.0	2,786	5,180	-	-

Click the name of the PV array to scroll to its results

PV & Receptor Analysis Results detailed results for each PV array and receptor

PV array 1 potential temporary after-image

Component	Green glare (min)	Yellow glare (min)
OP: OP 1	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	2786	1233
OP: OP 5	0	0
OP: OP 6	0	0
OP: OP 7	0	0
OP: OP 8	0	1626
OP: OP 9	0	2321

PV array 1 - OP Receptor (OP 1)

No glare found

PV array 1 - OP Receptor (OP 2)

No glare found

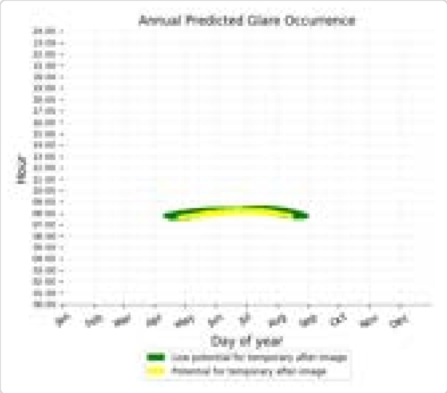
PV array 1 - OP Receptor (OP 3)

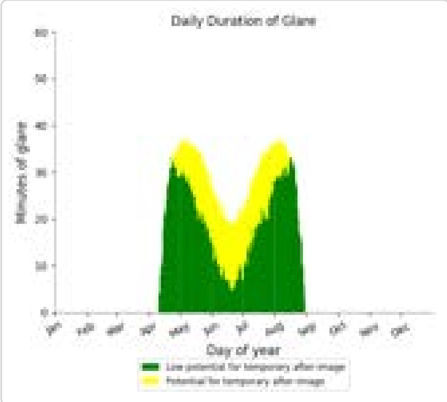
No glare found

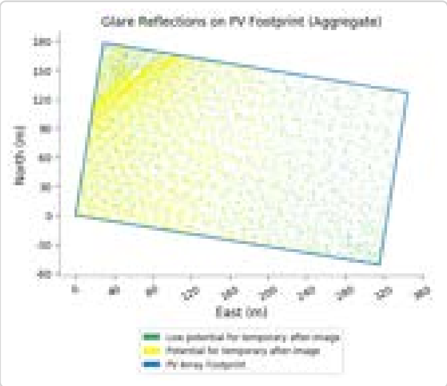
PV array 1 - OP Receptor (OP 4)

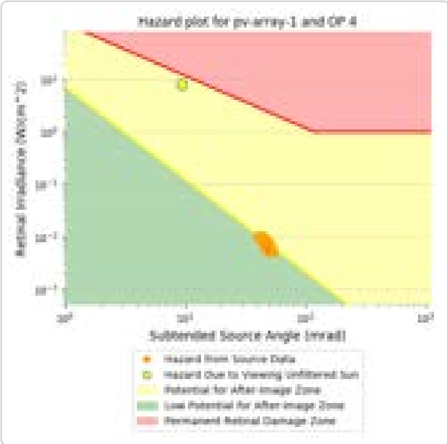
PV array is expected to produce the following glare for receptors at this location:

- 2,786 minutes of "green" glare with low potential to cause temporary after-image.
- 1,233 minutes of "yellow" glare with potential to cause temporary after-image.









PV array 1 - OP Receptor (OP 5)

No glare found

PV array 1 - OP Receptor (OP 6)

No glare found

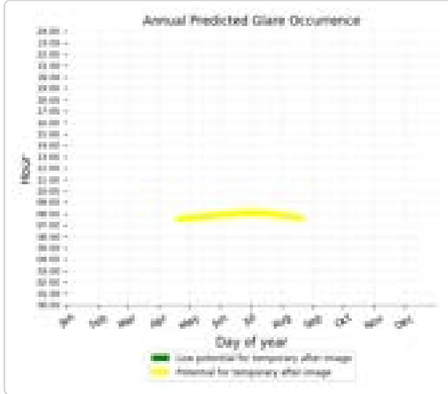
PV array 1 - OP Receptor (OP 7)

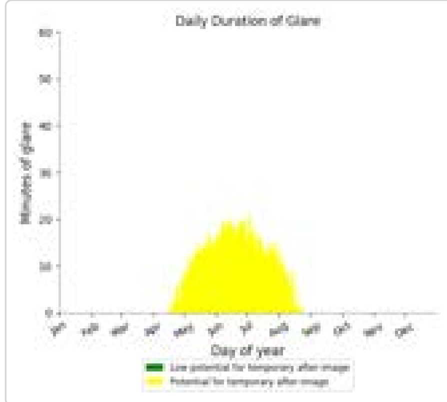
No glare found

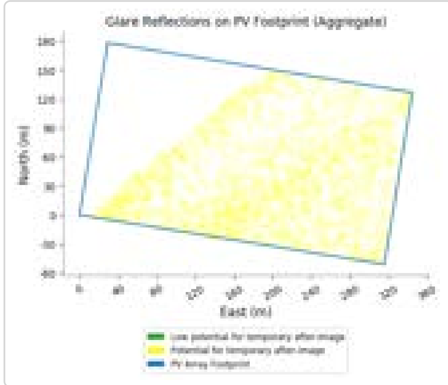
PV array 1 - OP Receptor (OP 8)

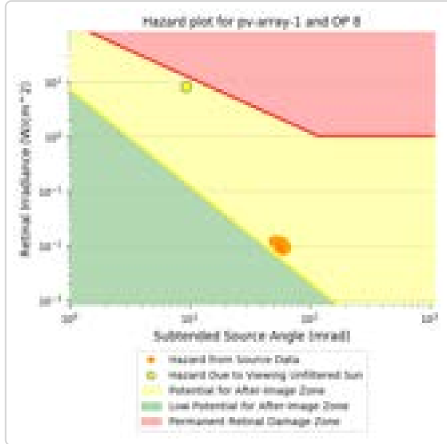
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 1,626 minutes of "yellow" glare with potential to cause temporary after-image.





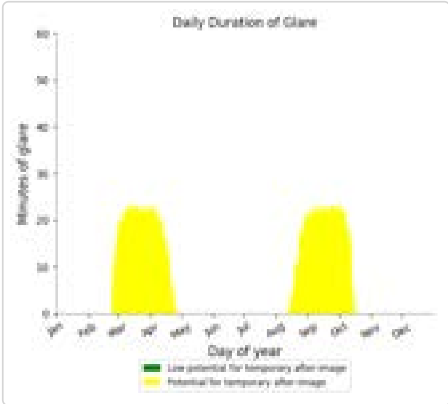


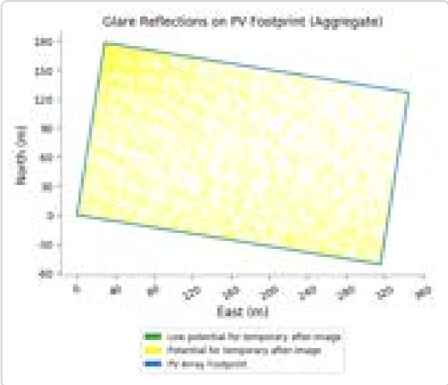


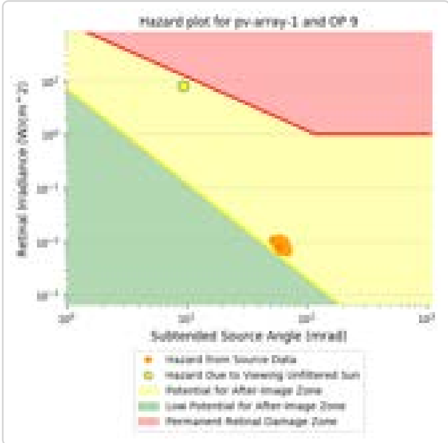
PV array 1 - OP Receptor (OP 9)

PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 2,321 minutes of "yellow" glare with potential to cause temporary after-image.







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Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- 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.
- Several 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.
- 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.)
- 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.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
- Glare analysis methods used: OP V1, FP V1, Route V1
- Refer to the **Help page** for assumptions and limitations not listed here.

BYRON BAY SOLAR FARM

Landscape Character, Visual Impact and Solar Glare Assessment

LANDSCAPE ARCHITECTS

November 2020