



# Metz Solar Farm Visual Impact Assessment

Version 4

Prepared for  
**Metz Newco PTY LTD**

November 2018



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# Abbreviations

| Abbreviation          | Description                                                                                                                |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------|
| Approved Development  | Metz Solar Farm which was approved on 18 July 2017 including 3 m high solar arrays and the Approved Development Footprint. |
| DEM                   | Digital Elevation Model                                                                                                    |
| EIA                   | Environmental Impact Assessment                                                                                            |
| EP&A Act              | Environmental Planning and Assessment Act 1979                                                                             |
| GIS                   | Geographic Information System                                                                                              |
| Ha                    | Hectares                                                                                                                   |
| LGA                   | Local Government Area                                                                                                      |
| MW                    | Megawatt                                                                                                                   |
| Proposed Modification | Metz Solar Farm proposed modification including 4 m high solar arrays and Proposed Modification Footprint.                 |
| PV                    | Photovoltaic                                                                                                               |
| SEARs                 | Secretary's Environmental Assessment Requirements                                                                          |
| SSD                   | State Significant Development                                                                                              |
| ZTV                   | Zone of Theoretical Visibility                                                                                             |



# 1 Introduction

Eco Logical Australia Pty Ltd has produced this Visual Impact Assessment on behalf of Metz NewCo Pty Ltd to support a Proposed Modification to the existing approval held for the Metz Solar Farm. This version of the document (version 4) considers a revised project footprint (reduced) based on the actual proposed solar array area and incorporates an increased solar array height. The proposed increased height is the result of a design optimisation process which will enable increased renewable energy generation from a smaller footprint.

Specifically, this Visual Impact Assessment considers the potential impact of the Proposed Modification and compares it to impacts associated with the Metz Solar Farm as approved on 18 July 2017 (the Approved Development).

The Proposed Modification seeks to vary the maximum height of the solar array tracking system from 3 m (as approved) to 4 m above natural ground level.

In recognition of concerns raised during prior consultation, the visual sensitivity of resident “R1” has been considered in detail in the Proposed Modification and it is considered the proposal will reduce any impacts on the visual amenity of this property.

Through its commitment to meaningful stakeholder consultation, Metz NewCo has adopted increased setbacks along the southern boundary of the development footprint. The objectives of these enhanced setbacks is to further reduce visual impacts to sensitive nearby receptors.

The key finding of this study is that the proposal to increase the maximum height of the solar array has a negligible effect on the visual amenity impacts associated with the Approved Development. Indeed, the reduction in project footprint that can be achieved with the proposed 4 m solar array more than offsets the visual impacts associated with the increase in infrastructure height.

## 1.1 Visual Impact Assessment Approach

This updated assessment considers potential impacts associated with the current design for the solar farm, rather than more generally for the ‘Site’ (as in assessed as part of the original proposal). Key visual components associated with the Development include:

- Installation of solar panels (the ‘solar array’) providing a combined output of approximately 100 MW; and
- On-site substation and support buildings.

This report provides a Visual Impact Assessment for both the construction and operational phases of the Proposed Modification for Metz solar farm. The Approved Development is classified as “state significant development” (SSD) under Schedule 1 of the *State Environmental Planning Policy (State and Regional Development) 2011*, and as such, has been assessed and approved under Division 4.1 of the *Environmental Planning and Assessment Act, 1979* (EP&A Act).

Modification of a development consent may be granted by the consent authority under Section 96 (2) of the EP&A Act and shall be undertaken in accordance with requirements of Clause 118 of the *Environmental Planning and Assessment Regulation, 2000*.

The current Visual Impact Assessment demonstrates that the proposed modification is substantially the same development as for which the original development was granted, and that visual impacts associated with the proposed modification are minimal.

## **1.2 Project overview**

Metz NewCo Pty Ltd has the required permissions to develop a utility-scale photovoltaic (PV) solar farm at Metz, 18 km east of Armidale, NSW (Figure 1, the Approved Development). The Approved Development will have an electricity generation capacity of approximately 100 Megawatts (MW), and would produce enough energy to power the equivalent of 40,000 average NSW households each year.

The Development will generate electricity through the conversion of solar radiation to electricity through PV panels laid out in rows across the site on steel racks with piled supports. Other infrastructure on site will consist of an electrical substation, amenities and storage facilities, transformers and invertors, underground electrical cabling, telecommunications equipment and mast, vehicular access tracks and parking areas, security fencing and gates (Figure 1-2).

A thirty year land access lease has been negotiated for the life of the Approved Development. At the conclusion of the operational period, the Site will be decommissioned and returned to a suitable condition to allow the resumption of agricultural activities.

## **1.3 Site description**

The Approved Development is located in a sparsely populated rural setting approximately 4.5 km north west of the village of Hillgrove. Two independent residences are located adjacent to the southern boundary of the development which follows Waterfall Way for approximately 1.1 km.

The Proposed Modification Footprint covers an area of approximately 233 ha compared with 482 ha for the Approved Development as the final layout has been developed.

The majority of the Site has been historically cleared for grazing and sown with improved pastures. A number of small *Pinus radiata* (Radiata Pine) plantations are located within the Site and there are patches of retained native woodland scattered throughout. The site slopes gently toward the south east, following Limerick Creek, and there are a number of farm dams within the Site boundary.

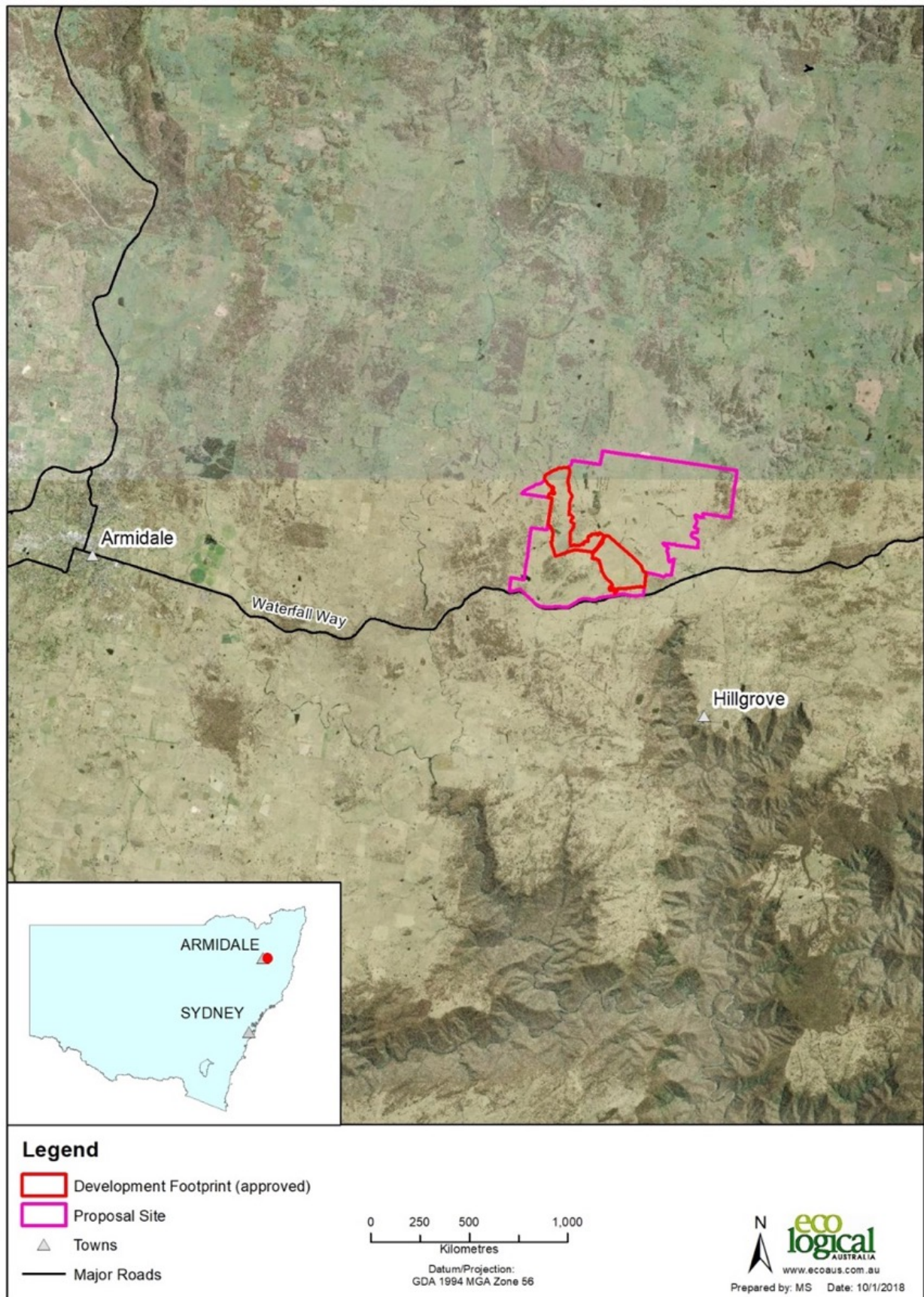


Figure 1-1: Location of the Approved Development.



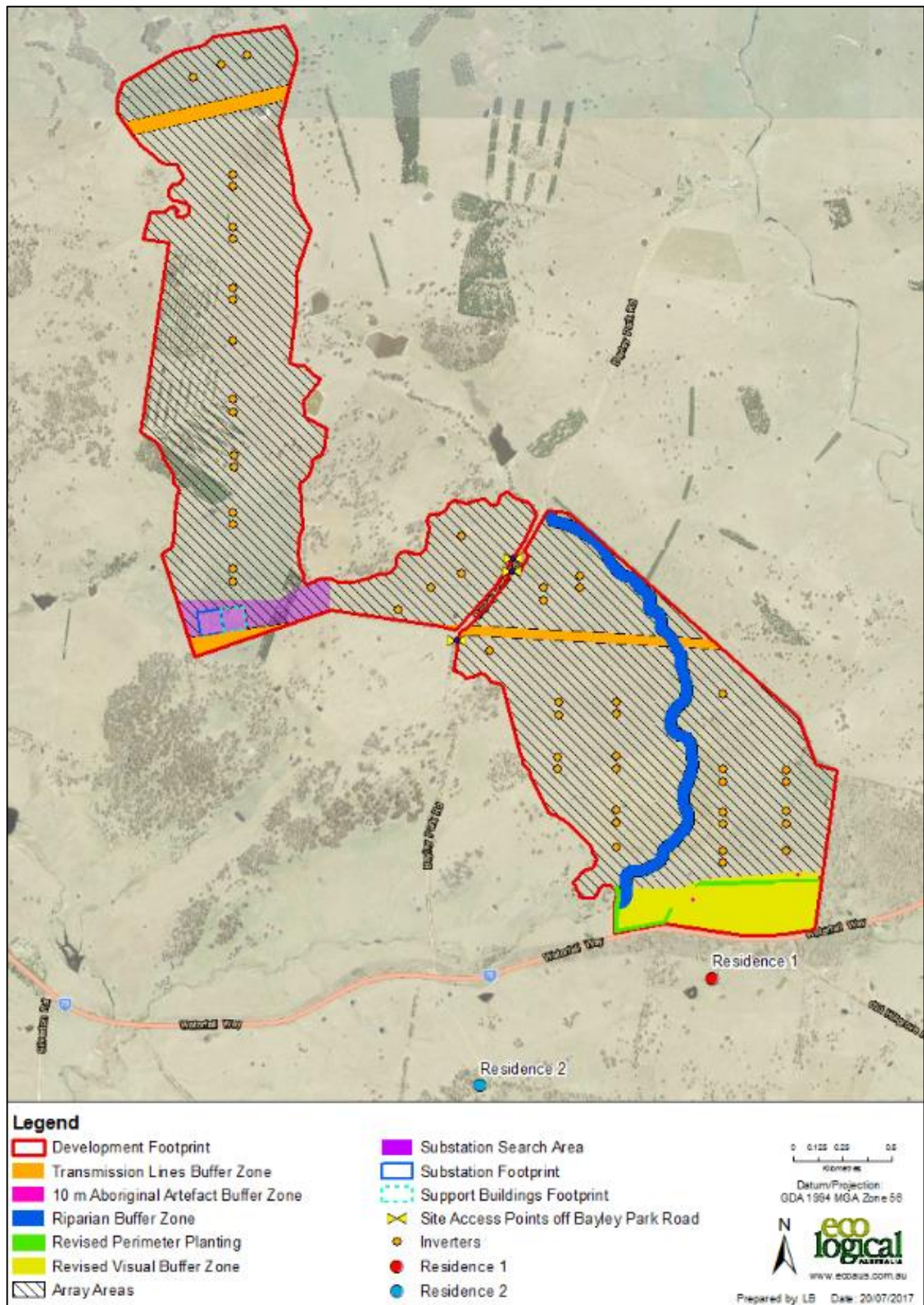


Figure 1-2: Approved Layout

## 2 Assessment Methodology

### 2.1 General

This assessment has been based on the following guidelines which are considered applicable to the evaluation of Visual Impacts relating to the Approved Development, including:

- *Environmental Impact Assessment Guide Note – Guidelines for Landscape Character and Visual Impact* (NSW Roads and Traffic Authority, 2009); and
- *Guidelines for Landscape and Visual Impact Assessment* (GLVIA) (United Kingdom, The Landscape Institute and Institute of Environmental Management and Assessment, 2013).

The methodology used to assess the Visual Impacts of the Approved Development and the approved Clarks Gully Underground Mine, at Hillgrove Station near the intersection of Old Hillgrove Road and Waterfall Way, some 375 m south east of the Site has been adopted for this assessment (Envisage Consulting Pty Ltd, 2015). This provides a standardised assessment methodology for development in the area.

The SEARs set out the assessment requirements for the Visual Impact Assessment, as follows:

*“An assessment of the likely visual impacts of the development (including glare, reflectivity and night lighting on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence to demonstrate it has been developed in consultation with affected landholders”.*

In response, the assessment methodology considers potential impacts across a range of spatial scales, from regional to the immediate field of view, from adjoining public locations as well as private residential locations (viewpoints), considering the construction, operational and post decommissioning phases of the Approved Development

This assessment provides direct comparison of the visual impact of the Approved Development and the Proposed Modification in infrastructure height from 3 to 4 m, with consideration to the associated proposed reduction in size to the development footprint.

### 2.2 Definition of assessment areas

The boundaries of the Development assessment areas vary depending upon which of the following impacts are being considered:

- Impacts in terms of landscape character - are more specific to the area of the landscape directly affected by, or close to, the Development; and
- Impacts to the visual amenity - takes into account a much wider area that considers affected viewers within and beyond the Development area.

Thus, the two identified assessment areas for the visual impact assessment are defined as follows:

- Landscape character assessment area – covers the Development area and its surrounds out to a distance of 2 km. Due to the undulating nature of the landscape, the single character type that defines the area and its widespread nature (discussed below), landscape character impacts beyond this distance would be limited; and

- Visual amenity assessment area – focuses on an area out to 5 km from the Development area, beyond this the visual change would be of such a low nature that impacts would be negligible. This area includes local/mid-ground or foreground views within 1 km of the Development, where any visual change and potential impacts are of most concern, along with mid-ground or subregional views

### 2.3 Landscape Character – Impact Assessment Methodology

Landscape character can be defined as a distinct and recognisable pattern of elements that occur consistently across a particular landscape known discreetly as a Landscape Character Unit (LCU). It refers to the physical characteristics of landscape based on features such as location, land-use, vegetation cover and landform.

The first step in undertaking a landscape character assessment is to identify the LCUs that are associated with the study area. Once identified, the following assessment method was adopted:

- Description of the existing landscape character area which defines its sensitivity to change ‘visual sensitivity’;
- Description of the potential visual changes to a LCU that would result as a consequence of the proposal along with a “magnitude of change” rating;
- An assessment of impact, taking into account the relationship between visual sensitivity (the ability of a landscape character area to absorb a development) and magnitude of change;
- The identification of any mitigation measures that would reduce the visual impact identified; and then
- Results of mitigation strategies are assessed to provide a final assessment of potential residual effects of the Development, using the same criteria outlined above.

The impact to landscape character is determined by balancing the sensitivity of the receptor and the magnitude of impact as a result of the construction, operation and decommissioning of the Development. The correlation between the sensitivity of landscape character and the magnitude of change to determine the level of impact is summarised in Table 1.

**Table 1: Visual impact assessment matrix (adopted from Envisage, 2015)**

| Potential level    |           | Magnitude of change |                 |                 |                             |
|--------------------|-----------|---------------------|-----------------|-----------------|-----------------------------|
|                    |           | Very High           | High            | Moderate        | Low or insignificant        |
| Visual sensitivity | Very High | Very High Impact    | High Impact     | High Impact     | Moderate Impact             |
|                    | High      | High Impact         | High Impact     | Moderate Impact | Low Impact                  |
|                    | Moderate  | Moderate Impact     | Moderate Impact | Moderate Impact | Low Impact                  |
|                    | Low       | Moderate Impact     | Low Impact      | Low Impact      | Low or Insignificant Impact |

#### 2.3.1 Sensitivity Criteria

Landscape Character Areas are assessed for their sensitivity based on a review and analysis of the elements that make up its characteristic attributes. The visual sensitivity of landscape character in rural areas can largely be defined by considering aspects such as relative naturalness or uniqueness. The more disturbed or common a landscape, the less value is placed on it and consequently the less ‘visually sensitive’ it is to change. The visual sensitivity of a landscape character unit is evaluated according to the

five-point scale presented in Table 2. The criteria used are based on guidance provided in GLVIA (2013) with reference to the criteria used to assess the proposed Clarks Gully Mine adjacent to the site (Envisage, 2015).

**Table 2: Visual sensitivity Criteria used for Landscape Character\***

| Visual Sensitivity levels | Landscape Character                                                                                                                                                            |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Insignificant             | Contains predominantly industrial or intensive agricultural infrastructure.                                                                                                    |
| Low                       | General widespread rural landscape with low to moderate levels of native vegetation, and no identified special landscape features or interesting topographic features.         |
| Moderate                  | Rural land with a high levels of native vegetation or undisturbed native woodland with attractive landscape features such as watercourses or interesting topographic features. |
| High                      | Landscapes with well-preserved natural areas, highly valued for conservation or values relating to cultural heritage.                                                          |
| Very High                 | Iconic and dramatic natural landscapes such as those protected as World Heritage Areas or National Parks. Highly valued iconic cultural landscapes may also be included.       |

\*Criteria adapted from the Clarks Gully EIA (Envisage 2015).

### **Magnitude of Visual Change Criteria**

The magnitude of visual change considers the extent to which the existing landscape features or experience of that landscape would be modified as a consequence of the visual impacts of the Development. The magnitude of change likely to occur as a result of the construction, operation and decommissioning of the Development is evaluated according to a five point scale as outlined in Table 3.

**Table 3: Magnitude of visual change definitions used for Landscape Character\***

| Magnitude of Visual Change | Landscape Character                                                                                                                                                              |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Insignificant              | Minor scales of landscape/landform change and vegetation removal, existing urban use, intensive agriculture or industrial infrastructure may be present.                         |
| Low                        | Moderate level of landscape/landform change and minor vegetation removal, existing industrial or intensive agriculture use may be present.                                       |
| Moderate                   | Moderate scale of landscape/landform change and/or vegetation removal, minor water courses possibly impacted, existing industrial or intensive agriculture on or adjoining site. |
| High                       | Large scale landscape/landform change and/or vegetation removal, minor water courses possibly affected, no existing industrial or intensive agriculture on or visible from site. |
| Very High                  | Highly significant scale landscape/landform change, possibly major vegetation and water course impacts, no existing industrial or intensive agriculture on or visible from site. |

\*Criteria adapted from the Clarks Gully EIA (Envisage 2015).

## **2.4 Visual Amenity – Impact Assessment Methodology**

The visual amenity of an area broadly refers to how potential viewers respond to or value a particular landscape. To assess the impact of the Development on visual amenity, receptors and or sensitive viewpoints within the potential area of impact (study area) are identified. The same receptors have been

considered for both the Approved Development and the Proposed Modification so that the results can be directly compared. The assessment then examines the potential impact for each identified viewpoint by balancing the visual sensitivity of the receptor and the magnitude of visual change as a result of the construction, operation and decommissioning of the Development. The correlation between visual sensitivity and the magnitude of visual change to determine the level of impact is summarised in the visual impact assessment matrix presented in Table 1.

#### **2.4.1 Viewpoint Selection**

A desktop assessment of sensitive receptors within the study area identified a selection of public and private viewpoints that together would represent the overall visual amenity impacts of the Development. The desktop assessment included the generation of maps showing Zones of Theoretical Visibility (ZTV) of the Proposed Modification which illustrate areas of potential visibility across the study area. ZTVs are generated using GIS software and landform data (Digital Elevation Data (DEM)).

Given the nature of the Proposed Modification, no new viewpoints were required as the revised ZTV indicated that there was no significant increase in visibility and no new receptors were impacted. The same viewpoints were utilised so that the difference between the Approved Development and the Proposed Modification could be assessed. It should be noted that ZTVs do not take into account the screening effects of local features such as subtle variations in landform, vegetation cover or existing development features. In addition, the following assumptions were made when generating the ZTVs:

- All panels were assumed to be installed at the maximum height of 4 m above the natural surface area; and
- The height of the substation and all supporting buildings is assumed to be 8 m (the maximum height).

Therefore, based on the limitations of ZTV modelling and the conservative assumptions underlying the model, it is considered that the ZTVs represent a 'worst-case' scenario but are a good starting point for assessing the operational impacts of the Proposed Modification.

#### **2.4.2 Viewpoint assessment methodology**

Once the representative viewpoints were identified the following assessment approach for each viewpoint was adopted:

- An assessment of the visual sensitivity;
- A description of the likely visual change and an assessment of the magnitude of visual change;
- An overall assessment of the potential impact;
- The identification of any mitigation measures that would reduce the visual impact identified;
- An assessment of mitigation strategies to provide a final assessment of potential residual effects of the Approved Development, using the same criteria outlined above; and
- A direct comparison between the Approved Development and the Proposed Modification.

In addition to this, ZTVs (as described above) were also generated at the most affected viewpoints to determine which parts of the Approved Development and Proposed Modification would be visible from these viewpoints. A site visit then identified any intervening variations in landform or vegetation that would screen or obscure those views.



### Visual Sensitivity Criteria

The sensitivity in relation to visual amenity is dependent on a combination of the location, context and the importance of the viewer. The sensitivity level attributed to Visual Amenity is determined by considering the distance of a sensitive receptor from the development, the potential for views, and whether it is a public or private viewpoint. Residential viewpoints are considered more sensitive than public viewpoints. The sensitivity of visual amenity receptors are evaluated according to the five point scale provided in Table 4. The same visual sensitivity criteria were applied to both the Approved Development and the Proposed Modification. The criteria used are based on guidance provided in GLVIA (2013) with reference to the criteria used to assess the proposed Clarks Gully Mine adjacent to the site (Envisage, 2015).

**Table 4: Visual sensitivity criteria used for Visual Amenity\***

| Visual Sensitivity levels | Visual Amenity                                                                                                                                                                                                                                                                                                                          |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Insignificant             | Residential viewpoints within 5 km with no, or very limited potential views; or<br>Public viewpoints within 2 km with limited potential views and a low number of viewers.                                                                                                                                                              |
| Low                       | Residential viewpoints over 2 km away with the potential for some views; or<br>Public viewpoints over 3 km viewed by a high number of viewers; or<br>Public viewpoints within 1 km viewed by a low number of viewers, or by transient viewers (such as road users).                                                                     |
| Moderate                  | Residential viewpoints within 1-2 km with potential for some views of the project; or<br>Public viewpoints between 1-3 km viewed by a high number of viewers; or<br>Public viewpoints within 1 km viewed by moderate number of viewers with potential extensive views of the Development; or by transient viewers (such as road users). |
| High                      | Residential viewpoints less than 1 km away with some views of the Development.<br>Public viewpoints within 1 km viewed by a high number of viewers with views of the Development.                                                                                                                                                       |
| Very High                 | Residential viewpoints within 1 km with extensive or intrusive views of the Development; or<br>Public viewpoints within 1 km, viewed by a high number of viewers with extensive views of the Development.                                                                                                                               |

*Criteria adapted from the Clarks Gully EIA (Envisage, 2015).*

### Magnitude of Change Criteria

The magnitude of visual change for visual amenity considers the degree of change, particularly with respect to changes from characteristically 'rural' views to those which contain infrastructure. The magnitude of visual change for each viewpoint is evaluated according to the five point scale provided in

Table 5. The criteria used are based on the based on guidance provided in GLVIA (2013) with reference to the criteria used to assess the proposed Clarks Gully Mine adjacent to the site (Envisage, 2015).

**Table 5: Magnitude of visual change definitions used for Landscape Character and Visual Amenity\***

| Magnitude of Visual Change | Visual Amenity                                                                                                                                |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Insignificant              | Minor scale of change, not significantly different in scale or type to existing views and/or landscape character.                             |
| Low                        | Low to moderate scale change, not significantly different in scale or type to existing views and/or landscape character.                      |
| Moderate                   | Moderate visual change to views as a result of landscape change and construction of infrastructure where it was previously a rural landscape. |
| High                       | High visual change to views as a result of landscape change and construction of infrastructure where it was previously a rural landscape      |
| Very High                  | Significant visual change to views as a result of substantial landscape change within close proximity.                                        |

*\*Criteria adapted from the Clarks Gully EIA (Envisage, 2015).*

### 3 Project Description

Since the approval of the project further detail design has commenced which has enabled an optimisation and ultimately reduction of the projects footprint. This has reduced the overall footprint by approximately 250 hectares increasing setbacks from many of the boundaries and allowing additional retention of vegetation on site. The reduction in footprint has in part been enabled by the use of a solar PV design approach that has resulted in an increase in the overall height of the solar fields.

In summary the changes associated with the Proposed Modification and the Approved Development are:

- An increase in the maximum solar array height from 3 m to 4 m above natural ground level (except in areas visible from assessed as high visual impact); and
- A reduction in footprint area required for development from the approved footprint.

The proposed layout is shown below in Figure 3.

The development will comprise of approximately 400,000 individual solar panels with a combined generation capacity of approximately 100 MW. The solar panels would be fitted to a single-axis tracking system which would track the sun from east to west as it moves throughout the day.

Maximum solar array height applies to the height of the top edge of the panels when used in conjunction with a tracking system. The maximum solar array height will only be reached at dawn and dusk when panels are facing the horizon line. As the panels slowly track the sun during the day their height will change with a minimum height of approximately 2 m being reached at midday (When the panels are effectively horizontal to the ground). While the solar array only reaches maximum height for a short period of time each day, this assessment takes a precautionary approach and evaluates the visual impacts based on the maximum height of the solar array.

The solar array will be supported by approximately 50,000 piles which would be mechanically driven or screwed into the ground. Figure 3-2 illustrates an operational tracking solar farm. The solar array would be wired in 'blocks' that would be connected to inverters (the approximate size of a shipping container) located throughout the Development. Blocks would not necessarily appear as discrete entities but would appear as a series of continuous rows.

Other visible elements of the Development would include:

- Onsite access tracks;
- Substation (connects the Development to the national electricity grid);
- Onsite above ground cabling and electrical connections;
- Support buildings alongside the substation including communications equipment;
- Perimeter fence (approximately 2.5 m high);
- Vegetation buffers for screening;
- Temporary construction compound; and
- Firebreaks.

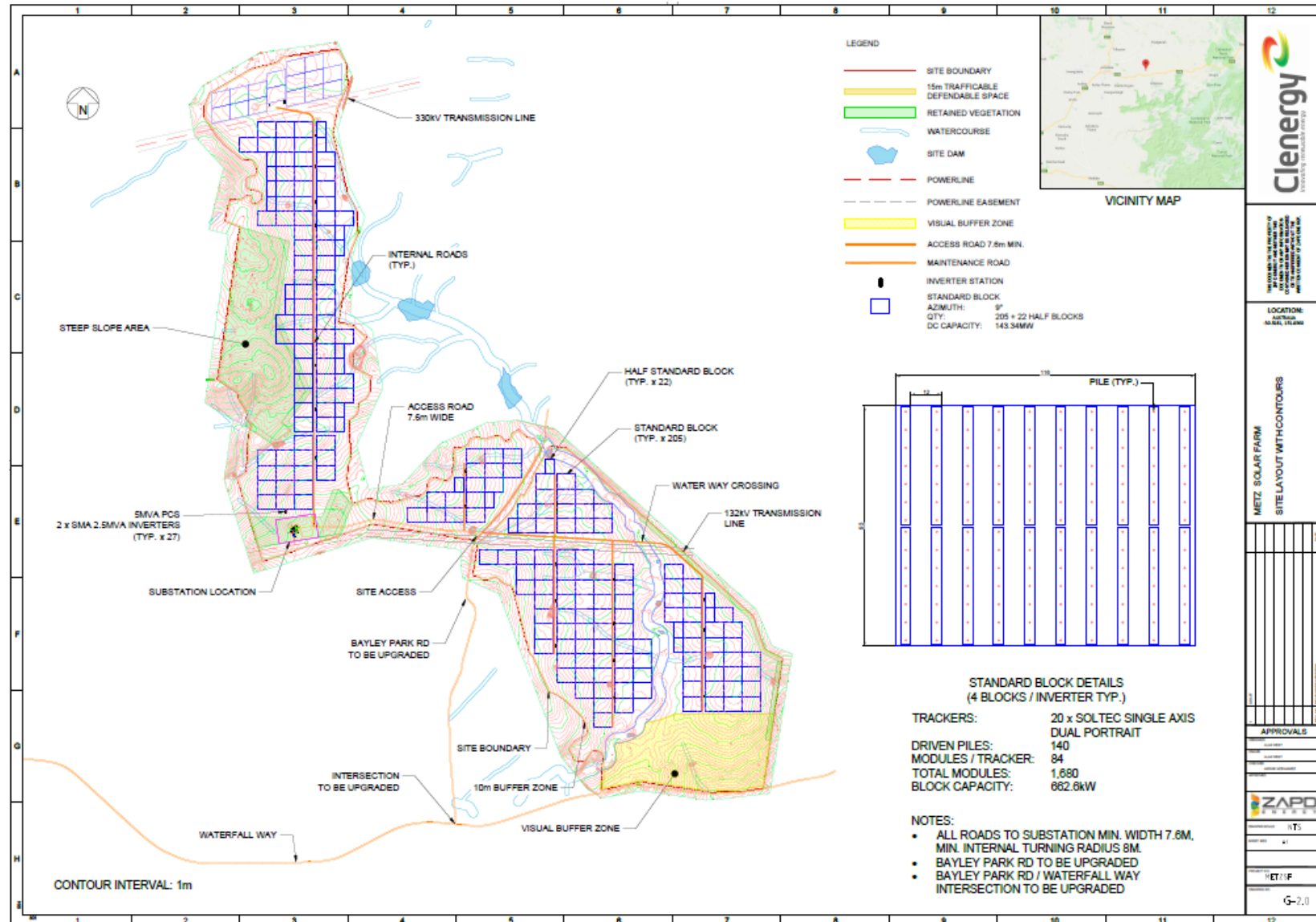


Figure 3-1: Site layout for proposed modification

The Approved Development allows for rows of solar panels (the 'solar array') at a maximum height of 3 m which would be the most visible component of the development. The Proposed Modification will increase the maximum height of this infrastructure from 3 to 4 m. The inverters, while visible throughout the development would be located, as far as possible away from the southern edge of the array to minimise visibility from outside the solar farm. The substation and support buildings (up to 8 m high) have also been carefully located to take advantage of the Sites topography, vegetation and distance to sensitive receptors to ensure visibility is minimised.

Increasing the array height to 4 m allows the proponent to reduce the size of the footprint of the Approved Development as the new technology uses modular components that allow for a more efficient utilisation of the site. Both the Approved and the Proposed Modification Footprints will be assessed and compared in this assessment.



**Figure 3-2: Fully assembled tracking array solar farm showing inverter housing (image courtesy Nextracker Australia, actual system may differ).**

## 4 Context of Existing Environment

### 4.1 General context of the location

The Development lies adjacent to Waterfall Way, a state highway that joins the Pacific Highway on the NSW North Coast to the New England Highway in Armidale. The landscape is undulating and of rural nature, mainly supporting agricultural enterprises. Access to the development site is via Bayley Park Road, an unpaved, no through local road that provides property access to the landholding. Close by is Bakers Creek Gorge and Bakers Creek Falls, with the main lookout located approximately 1.8 km from the development site along Old Hillgrove Road. The historic village of Hillgrove is located approximately 4.5 km to the south east. The nearest national park is Oxley Wild Rivers National Park, located 11 km downstream of Bakers Creek Falls.

### 4.2 Landform, Geology & Soils

Landform within the Site consists of undulating hills with a relatively low gradient. The majority of the development site occurs at elevations between 990 to 1090 m above sea level. The landscape grades gently from hillsides with granite outcroppings, to alluvial basins with moderately fertile soils. The valleys are broad. There are no cliffs, escarpments, or gorges within the Site, but such features are located within close vicinity.

The Geology of the Site consists of fine grained Permo-Carboniferous sedimentary rocks, granites and multiple Tertiary basalt flows. Soils across the development site contrast on sedimentary rocks and granite, mellow (soft and friable) and well drained on upper slopes, to harsh and poorly drained on lower slopes. Variable stony loams to deep black earths occur over basalt in valley floors.

### 4.3 Vegetation

Land within the Site and wider landholding has been historically cleared for grazing purposes and most has been sown with improved pastures. A number of small *Pinus radiata* (Radiata Pine) plantations are located within the proposed Site and there are patches of retained native woodland scattered throughout.

Regionally, cold air drainage influence inverts the tree patterns in wide valleys. *Eucalyptus caliginosa* (Broad-leaved Stringybark), *Eucalyptus melliodora* (Yellow Box), *Eucalyptus blakelyi* (Blakely's Red Gum), *Angophora floribunda* (Rough-barked Apple), and *Eucalyptus bridgesiana* (Apple Box) occurs on sedimentary rocks. *Eucalyptus laevopinea* (Silver-top Stringybark) occurs on dry aspects, and *E. blakelyi*, *E. melliodora*, and *E. bridgesiana* occur on moist, well-drained slopes. Regionally, *Eucalyptus novo-anglica* (New England Peppermint) occurs concurrently with *Eucalyptus viminalis* (Ribbon Gum) on flats, however neither of these species were detected within the development Site.

### 4.4 Hydrology

The hydrology of the Site is typified by ephemeral first order drainage lines. Several of these drainage lines intersect each other across the development site to form Limerick Creek which is classed as a third order stream (Strahler, 1952).

Limerick Creek joins Cooney Creek approximately 1.5 km downstream of the proposed Site. Cooney Creek flows into Gara Gorge, part of the Oxley Wild Rivers National Park, before joining Salisbury Waters to eventually join the Macleay River and flow to the Pacific Ocean near South West Rocks.



#### 4.5 Landuse

The primary landuse within the region is mixed agriculture including both sheep and cattle grazing, as well as cropping. Improvement of pastures is a common practice within the region, and the majority of the Site has been visibly cultivated within the 6 months prior to assessment.

Due to altitude, climate, and soil types, plantations of *P. radiata* are common on many pastoral leases within the region and stands of *P. radiata* occur within the development Site.

Near to the Site, within Bakers Creek gorge, is the Hillgrove underground mining operation which produces antimony and gold concentrate.

#### 4.6 Major Roads

Waterfall Way is 165 km long and, as noted, provides the main route to site and is also the major highway connecting the inland centre of Armidale with the northern NSW coast, where it ends at the Pacific Highway. The route passes through scenic countryside in places and has become recognised as a tourist drive providing access to National Parks and spectacular waterfalls, from which it takes its name. Seven national parks, three of which are listed as World Heritage Areas are located on or close to the route. Daily traffic numbers in the vicinity of the Development site are estimated at 1,676 vehicles per day (TTM, 2017a).

#### 4.7 Minor Roads

Within the broader 5 km study area there are a number of minor roads off Waterfall Way providing access to properties and to the village of Hillgrove, approximately 4.5 km to the Development's south east. Bayley Park road, intersects Waterfall Way on its northern side and provides access to the development site. It is an unpaved, no through local road that provides property access only to the landholding. Accordingly public access and use of Bayley Park road is extremely low

#### 4.8 Residences and Villages

Although there are a number of residences located on the Landholding itself, the only non-associated, residences within 2 km with potential for visibility of the Development are:

- "Cubba Cubbah" – Lot 5 DP 606050 – 730 m from southern boundary
- "Kiama" – Lot 1 DP 598741 – 1,364 m from south western boundary

The village of Hillgrove, with an approximate population of less than 100, is located approximately 4.9 km south east of the Development.

#### 4.9 Landscape Character

The landscape character of the Site and the wider study area can be classified as a single Landscape Character Unit (LCU1) dominated by wide undulating to rolling hills which form part of the broader Armidale Plateau sub-region (OEH, 2016). The LCU is rural, with a few homesteads scattered across the wider landscape. Due to historic clearing for agriculture, vegetation cover is generally low except along ridgetops, within road reserves, in isolated patches in paddocks and gullies and within gardens surrounding homesteads. The sensitivity of LCU1 is assessed as **low**, for it is of a type that is widespread and common in the local area and does not have any notable landscape features or attributes that set it apart. Typical images of LCU1 are shown in Figures 5 and 6.

Contrasting LCU1 is the Bakers Creek Gorge (LCU2) which lies to the south of Old Hillgrove Road, with its dense native vegetation, dramatic gorge landform and the Bakers Creek Falls. This in turn leads to the World Heritage Listed Oxley Wild Rivers National Park (LCU3) a further 11 km downstream and although outside the study area has been considered due to its importance at the National scale. However, while the landscape sensitivity of each of these LCUs is **high**, as the Approved Development will not be visible from these LCUs they have not been considered further in this report.



Figure 4-1: Typical regional views from Hillgrove Common showing rolling rural landscape and cleared vegetation.



Figure 4-2: Southern boundary of the development area as viewed from Waterfall Way looking east (far right).

#### 4.10 General Visibility

The Development site has a relatively confined area of visibility due to it being positioned within a narrow valley that runs in a general north-east/south-west direction that is at a similar elevation to the surrounding landscape. Infrastructure associated with the Development is located along the valley floor and lower slopes within the headwaters of the Limerick Creek catchment. The hills defining the Limerick Creek catchment limit views of the majority of the site, which generally only becomes visible in the southern most sections near to Waterfall Way. In addition, existing stands of vegetation along road reserves and within paddocks further filter views of the project from the surrounding properties and broader area.

The southern boundary of the Approved Development's developable area is setback between 400 and 500 m along the 1.1 km interface with Waterfall Way. The proposed modification increases the minimum setback from Waterfall Way for most of the project including an increased from 300 metres to 500 metres for the southern array, resulting in an a smaller and more articulated layout compared with the approved layout which showed the solar fields be constructed up to and in alignment with the site edges. Topography and vegetation in this area naturally obscures potential views of the development site. The potential area of visibility along Waterfall Way extends from east of Bailey Park Road to just east of the junction with Old Hillgrove Road. Distant view and glimpses of the site are possible from Stockton Road and Hillgrove village.

## 6 Visual Impact Assessment

### 6.1 Landscape character impact assessment

The landscape impact assessment considers the direct and indirect impacts of the Proposed Modification on LCUs associated with the Site. In this case, due to the contained nature of landscape in which the Development is located, this assessment is limited to the potential impacts on the single landscape character unit (LCU1) identified within the 2 km study area (Section 4.9).

An assessment, taking into account the relationship between 'visual sensitivity' (the ability of a landscape character area to absorb a development) and the 'magnitude of visual change' is used to determine the potential impact of the Development on LCU1.

#### 6.1.1 Landscape Character Unit 1 (LUC1)

The visual sensitivity of LUC1 has been assessed as **low** (as described in section 4.9) for both the Approved Development and the Proposed Modification. Although LUC1 is an attractive rural landscape, it is of a type and scale that is widespread in the local area and which does not display particular defining qualities of note. LUC1 is not covered by a designated landscape classification such as a State Forest, National Park or a World Heritage Area.

The magnitude of visual change to LCU1 during the construction and operation of the Approved Development or the Proposed Modification is considered to be **high**, as the introduction of a solar farm constitutes a large scale change to the visual characteristics of the site and the surrounding area. This is largely due to the otherwise rural nature of LUC1. There will also be relatively minor changes to vegetation cover and landform as a consequence of the development.

It should be noted, that due to the location of the development, within an undulating valley, it is never possible to view the solar farm in its entirety. In addition, the magnitude of visual change decreases with distance from the site, as shielding from the topography of the landscape and vegetation interact to reduce views of the Development, such that, it is no longer the defining feature.

Following decommissioning, all above-ground infrastructure would be removed and the site would be returned to agricultural production. Thereafter, the magnitude of visual change is considered to be insignificant due to the very minor residual changes to landform and vegetation that would remain (such as access tracks, and site drainage).

Based on these findings, with reference to Table 1, the overall impact on the landscape character within the study area is assessed as **low** for the Approved Development. This is unchanged for the Proposed Modification. With the addition of mitigation, which is discussed in Section 6 below, the overall assessment does not change and residual effects are also assessed as **low** for both the Approved Development and the Proposed Modification.

## 6.2 Visual Amenity Impact Assessment

### 6.2.1 Viewshed analysis

A series of ZTV maps have been generated to understand the potential extent of the visibility of the Proposed Modification within the study area (5 km). The ZTV maps for the solar array and the Substation and support buildings are presented in Figures 7 and 8, respectively.

The ZTV for the Proposed Modification clearly illustrates that, despite the large scale of the Development (Figure 6-1), theoretical visibility is limited by the undulating topography that characterises the landscape within which it sits. Furthermore, Figure 6-1 demonstrates that the solar array associated with the Proposed Modification results in a decrease in visibility relative to the Approved Development.

The landscape's ability to contain the visual influence of the development was a key factor in the selection of the site. Within the study area (5 km), the main extent of visibility (the areas in purple) are the areas immediately surrounding the Development out to approximately 500 metres, after this visibility drops away significantly. The southern section of the Development is generally more visible than the northern section. Topography, vegetation cover and the absence of sensitive receptors (residences, roads or public access areas) limit potential impacts in other directions. Potential visibility to the north is limited to the highest points in the landscape, which are generally vegetated and due to the vegetation cover are unlikely to have views towards the site, while visibility to the east and west is shielded by the relatively steep hills on either side of the proposed Site.

The ZTV for the substation and support buildings (Figure 6-2), indicates that despite being considerably taller than the solar arrays, they are noticeably less visible due to careful site selection (including a micro-siting allowance). The most likely views of the Substation and support buildings are to the west of the Site, but again this is only in areas of high elevation without residential receptors or public access. Furthermore, the narrow field of potential visibility lends itself to effective vegetation screening options if it is considered necessary. The Proposed Modification does not change predicted visibility of the substation and support buildings.



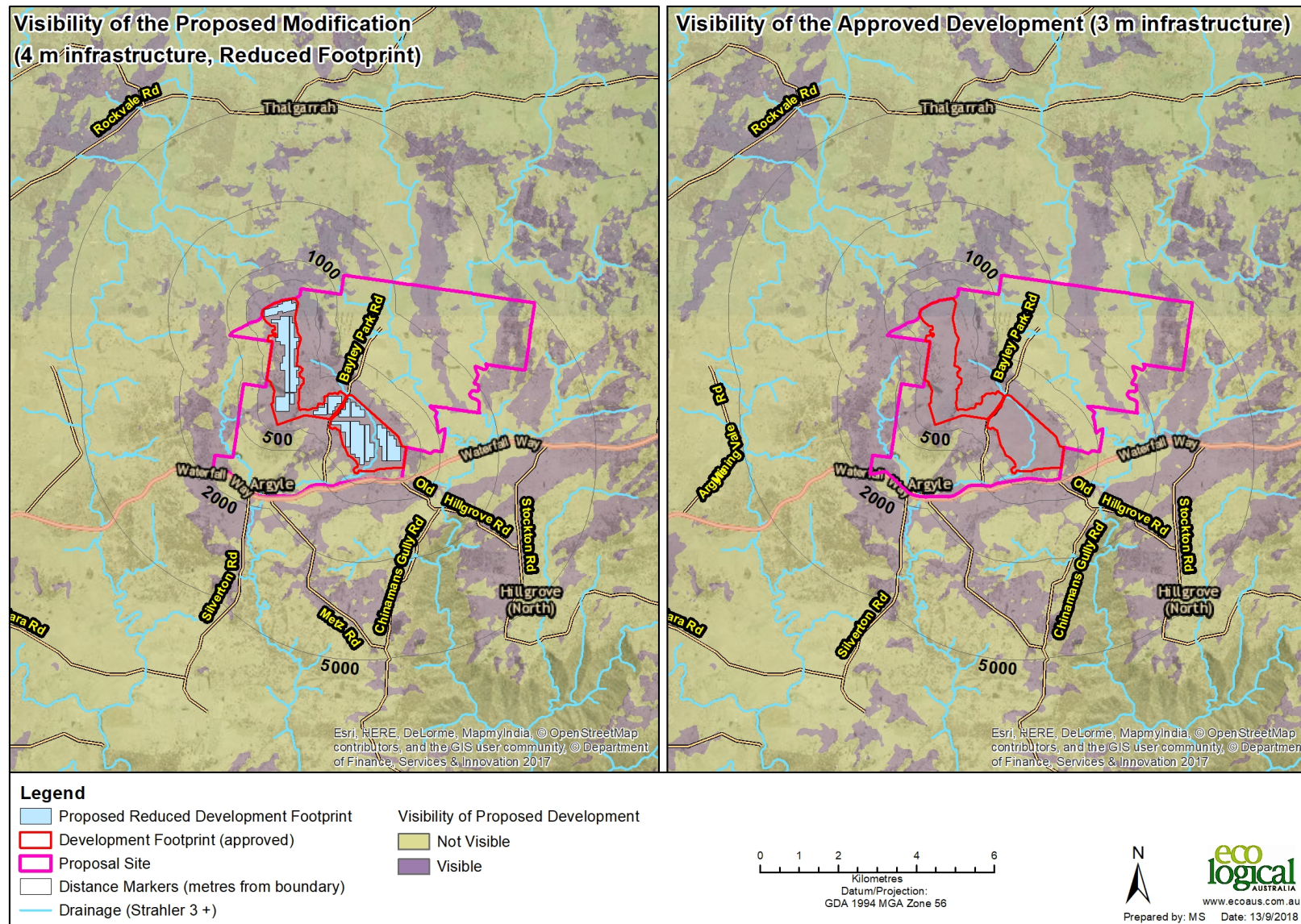
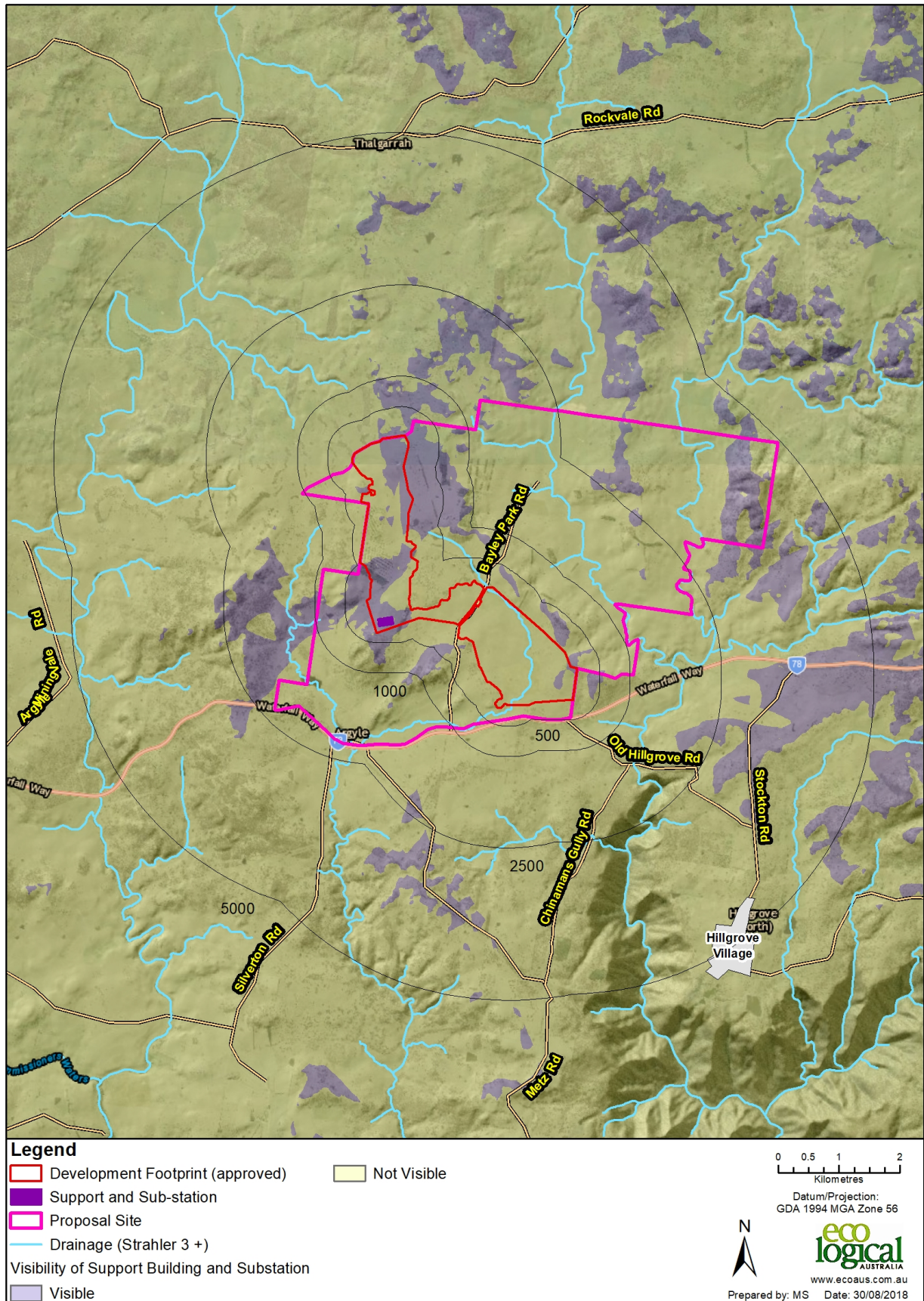


Figure 6-1. ZTV model indicating Development visibility at a sub-regional level (4m vs 3m height)





**Figure 6-2: ZTV results illustrating theoretical substation and support building visibility at a sub-regional level.**

### 6.3 Visual Amenity Impact Assessment

#### Viewpoint selection

The updated ZTVs for the Proposed Modification indicate no additional impacted viewpoints compared with the Approved Development; therefore no new viewpoints are required for this comparative assessment.

Six viewpoints have been selected to inform the visual amenity assessment and to help determine and describe the potential impact of the Development on visual amenity. The viewpoints represent the most 'exposed' views of the Development, from the most 'sensitive' receptors, broadly from within the study area (

Figure 6-3).

To illustrate the predicted views of the Development, photographic views have been produced for each viewpoint. All photographs were taken at 1.7 m above ground level using a 33 mm lens (ISO 50, f/2.4).

Table 6 below, describes the viewpoints selected for assessment of the proposed modification, the potential visibility from each viewpoint, the assessed visual sensitivity and how these results compare to the results of the Approved Development. In certain cases the changes associated with the Proposed Modification have reduced visual impacts in comparison with the Approved Development layout.

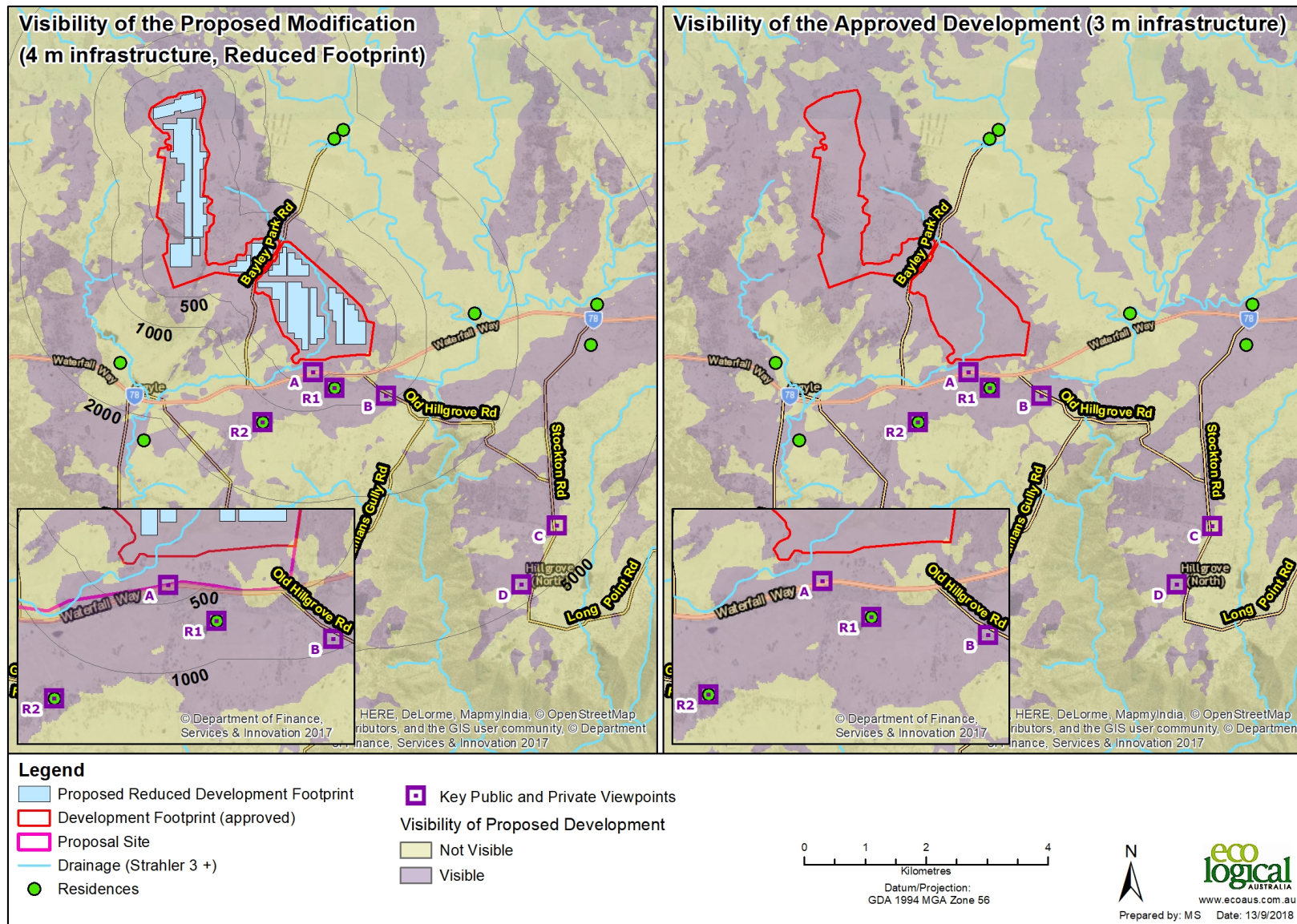
**Table 6: Overview of viewpoints selected for assessment**

| Viewpoint                                  | Approximate distance from the Development | Viewpoint description and potential visibility of the Development                                                                                                                                                                                                                                                                        | Viewpoint sensitivity                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A – Waterfall Way<br>Approved Development  | 220 m                                     | Waterfall Way is the main through road between Armidale and the NSW Coast. The Development would be highly visible along a stretch of approximately 1.3 km of the road. Due to changes in topography and vegetation within the road reserve and broader landscape, the site would generally not be visible elsewhere from Waterfall Way. | Despite limited visibility of the Approved Development over the road as a whole, and that viewers are likely to be in transit, its proximity to Waterfall Way within the Study Area has the potential for views of the Approved Development by a high number of road users each day. Therefore the sensitivity of the viewpoint is <b>moderate</b> . |
| A – Waterfall Way<br>Proposed Modification | 380 m<br>(minimum)                        |                                                                                                                                                                                                                                                                                                                                          | Unchanged - The Proposed Modification increases the setback from Waterfall Way from 200 m to 380 m. and significantly more for the majority of the interface. However, the sensitivity of the viewpoint remains <b>moderate</b> .                                                                                                                    |

| Viewpoint                                       | Approximate distance from the Development | Viewpoint description and potential visibility of the Development                                                                                                                                                                                                                                                                                                                 | Viewpoint sensitivity                                                                                                                                                                                                            |
|-------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| B – Old Hillgrove Road<br>Approved Development  | 730 m                                     | Old Hillgrove Rd intersects with Waterfall way to the Development's south east and is the old route to Hillgrove Village. A small part of the southern Development Footprint is visible for approximately 650 m when travelling in a north westerly direction along Old Hillgrove Road. However, views are obscured by vegetation within Waterfall Way road corridor (Figure 12). | Visual sensitivity of Old Hillgrove Road is assessed as <b>low</b> due to potential views being limited by existing vegetation and the road being of only local significance, and potential viewers are likely to be in transit. |
| B – Old Hillgrove Road<br>Proposed Modification | 920 m                                     |                                                                                                                                                                                                                                                                                                                                                                                   | Unchanged - Visual sensitivity of Old Hillgrove Road is assessed as <b>low</b> despite increased setback distances.                                                                                                              |
| C – Stockton Road<br>Approved Development       | 4.1 km                                    | Stockton Road intersects Waterfall Way providing the main access to Hillgrove Village. The southern part of the Development Footprint would have some visibility for northbound traffic, albeit distant and oblique to the direction travelled.                                                                                                                                   | Visual sensitivity of Stockton Road is assessed as <b>low</b> due to the distance of more than 3.5 km limiting potential views of the Development, and potential viewers are likely to be in transit.                            |
| C – Stockton Road<br>Proposed Modification      | 4.3 km                                    |                                                                                                                                                                                                                                                                                                                                                                                   | Unchanged - Visual sensitivity of Stockton Road is assessed as <b>low</b> .                                                                                                                                                      |
| D – Hillgrove Common<br>Approved Development    | 4.5 km                                    | Hillgrove Common is a publically accessible common at the northern side of Hillgrove. It would have distant views of the southern parts of the Development although views would be considerably limited through existing vegetation and the narrow vertical band of visibility of the development within the landscape.                                                           | Visual sensitivity of Hillgrove Common is assessed as <b>low</b> due to the considerable distance from the Proposed Development, meaning that potential views would form only a small portion of an expansive rural view.        |
| D – Hillgrove Common<br>Proposed Modification   | 4.7 km                                    |                                                                                                                                                                                                                                                                                                                                                                                   | Unchanged - Visual sensitivity of Hillgrove Common is assessed as <b>low</b> .                                                                                                                                                   |

| Viewpoint                               | Approximate distance from the Development | Viewpoint description and potential visibility of the Development                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Viewpoint sensitivity                                                                                                                                                                                                                               |
|-----------------------------------------|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R1 – Cubba Cubbah Approved Development  | 490 m                                     | This residence is located 230 m south of Waterfall Way and may have limited views upwards over part of the south eastern portion of the Development. The house itself is orientated towards Waterfall Way, a highway that lies between it and the Development, and onwards towards the Development. Site visibility is partially obscured due to well established vegetation surrounding the residence itself, as well as moderate vegetation densities within the 134 m wide road corridor. Vegetation screenings have been planted by the landholder along 700 m of the property boundary adjoining the road corridor, with mixed results and generally slow patterns of growth. | The local topography and existing screening provide filtering/limitation of views, However, the sensitivity of the viewer (residential) and its close proximity to the Approved Development results in a <b>high</b> visual sensitivity assessment. |
| R1 – Cubba Cubbah Proposed Modification | 730 m                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Changed – Increased setbacks for infrastructure markedly reduce visual sensitivity, however, the sensitivity of the viewer (residential) and its close proximity to the Development results in a <b>moderate</b> visual sensitivity assessment.     |
| R2 – Kiama Approved Development         | 1.1 km                                    | This residence is located approximately 1 km south west of the southern boundary of the Proposal Site. From this location the Development occupies a reasonably small portion of the mid ground view (Figure 17). The residence is at a similar elevation to the development however, a low ridge significantly obscures visibility of the development footprint from the residence. Well- developed gardens surrounding the house site would further limit views towards the Development.                                                                                                                                                                                         | Due to potential views being limited through distance and screening, the visual sensitivity of this receptor is considered to be <b>moderate</b> .                                                                                                  |
| R2 – Kiama Proposed Modification        | 1.3 km                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Unchanged - Despite increased setback distances, the visual sensitivity of this receptor is considered to be <b>moderate</b> .                                                                                                                      |





**Figure 6-3: Key Public and Private viewpoints selected for visual amenity impact assessment for Proposed Modification.**

## 6.4 Comparative Impact Assessment for each Viewpoint

Visual amenity impact assessments for each viewpoint are provided in the following section.

### 6.4.1 Public viewpoints

#### **A - Waterfall Way**

Waterfall Way is a main route that links the Pacific Highway on the coast to the New England Highway at Armidale in NSW. Promoted as a tourist drive the road supports both regional and local road users. The view from this viewpoint is typical of the undulating rural landscape of this area. Due to historic clearing for agriculture, vegetation cover from this viewpoint is generally low except along ridgetops, road reserves and in isolated patches in both the foreground and mid-ground view.

The southern boundary of the Approved Development Footprint is setback from Waterfall Way by between 200 and 322 m. The Proposed Modification increases this setback for the majority of the solar field (Figure 6-4). The increase in the setback distance between parts of the Proposed Modification and Waterfall Way reduces the length of road from which it could be possible to see large areas of the solar array when compared to the Approved Development. The setback distance also has the effect of narrowing the already constrained vertical depth of view for road users from Waterfall Way when compared to the Approved Development. This has the overall effect of limiting the perception of the scale of the development from this viewpoint.

A ZTV from this viewpoint (Appendix A) has been generated to understand the extent of views from Waterfall Way. The ZTV confirms that visibility of both the Approved Development and the Proposed Modification would be confined to the southern part of the Site in line with the findings of the viewpoint assessment above.

Based on the findings of the viewpoint assessment the magnitude of visual change as a consequence of the Development is considered to be **high** for both the Approved Development and the Proposed Modification, due to the views of the southern area of the solar array that would be observed from this viewpoint. The visual sensitivity of the viewpoint has been assessed as **moderate** for the Approved Development and the Proposed Modification (Table 7), therefore; with reference to Table 1, the visual amenity impact of the Approved Development and the Proposed Modification would be **moderate**.

Approved mitigation plans shall be updated for the Proposed Modification in order to maximise the effectiveness of vegetation screening (discussed in Section 6).





**Figure 6-4: Viewpoint A – Proposed Modification from Waterfall Way.**

***B - Old Hillgrove Road***

Old Hillgrove Road intersects with Waterfall Way to the south east of the Development and is the old route to Hillgrove Village. This road would predominantly be used by local road users. Again, the view from this viewpoint is typical of the undulating agricultural landscape of the area. The landscape rises gently towards a ridge which defines the extent of the site that can be seen from this viewpoint. Vegetation in the area is concentrated in the road corridors and within the traveling stock reserve to the east of the Site.

The southern end of the Proposed Modification would be visible for approximately 800 m when travelling in a north westerly direction along Old Hillgrove Road. The Approved Development is visible for approximately 850 m. However, for both the Approved Development and the Proposed Development the extent of the potential views from this viewpoint is restricted by the topography and setback of the Site as illustrated by the ZTV generated for this viewpoint (Appendix A). Additionally, views are further obscured by vegetation within the road corridor of Waterfall Way (Figure 6-5).



**Figure 6-5: Viewpoint B – Proposed Modification from Old Hillgrove Road (arrows indicate extent of solar array visibility).**

Based on the findings of the viewpoint assessment, the magnitude of visual change as a consequence of the introduction of the Development is considered to be **moderate** for both the Approved Development and the Proposed Modification due to the topography of the site limiting views of the Development and the existing roadside vegetation that would obscure views towards the site. The visual sensitivity of the viewpoint has been assessed as **low** for both the Approved Development and the Proposed Modification (Table 7); therefore, with reference to Table 1, the visual amenity impact of the Development from this viewpoint would be **low** for both the Approved Development and the Proposed Modification.

### **C - Stockton Road**

Stockton Road intersects Waterfall Way providing the main access route to Hillgrove Village. This road is primarily used by local residents and people travelling in vehicles to the mining operation at Hillgrove Mine. Again, the view from this viewpoint is typical of the undulating agricultural landscape of the area. The landscape is extensively cleared with vegetation cover concentrated along ridgetops and in isolated patches in gullies and along waterways and roads. Powerlines linking Hillgrove to the national grid run through the foreground of the view.

Distant views with a limited vertical range of the southern portion of the Development would be observed from this viewpoint (Figure 6-6). As the Site is more than 3.5 km away from the viewpoint, views of the Development would only form a small portion of this expansive rural view.



Based on the findings of the assessment for this viewpoint, the magnitude of visual change that would occur as a consequence of the introduction of the Development is considered to be **low** for both the Approved Development and the Proposed Modification due to the distance of the viewpoint from the Development and the intervening vegetation that would obscure views towards the Site. The visual sensitivity of the viewpoint has been assessed as **low** for both scenarios (Table 7); therefore, with reference to Table 1, the visual amenity impact of the Development from this viewpoint would be **Low/insignificant**.



**Figure 6-6: Viewpoint C – Proposed Modification from Stockton Road near Hillgrove Cemetery (arrows indicate extent of solar array visibility).**

#### ***D - Hillgrove Common***

Hillgrove Common is a publicly accessible common at the northern side of the Hillgrove Village. The view from this elevated viewpoint is more expansive and open than views obtained from locations closer to the site (Figure 6-7). Again, the undulating agricultural nature of the landscape is typical of the area. However, vegetation cover is more dominant in this view as the vegetation concentrated along ridgetops obscures views of some of the areas of land which have been cleared for agriculture.

Very distant views of the southern part of the Development would be visible from this viewpoint. As the viewpoint is more than 4.5 km from the Site the Development would only be perceived as a narrow vertical band in the background of an otherwise expansive rural view.

Based on the findings of the viewpoint assessment, the magnitude of visual change as a consequence of the introduction of the Development is considered to be **low** for both the Approved Development and the Proposed Modification due to the distance between the viewpoint and the Site limiting potential views. The visual sensitivity of the viewpoint has been assessed as **Low** for both scenarios (Table 7); therefore, with reference to Table 1, the visual amenity impact of the Development from this viewpoint would be **Low/insignificant** for both the Approved Development and the Proposed Modification.



**Figure 6-7: Viewpoint D – Approved Development from Hillgrove Common (arrows indicate extent of solar array visibility).**

#### **6.4.2 Private viewpoints**

The nearest affected residences are located south of Waterfall Way. Each residence was visited in order to assess the relative visibility of the Approved Development, and to assess and discuss the viability of potential mitigation actions in reducing potential impacts.

##### ***R1 - Cubba Cubbah***

Located approximately 490 m south of the southern boundary of the Approved Development and 730 m south of the Proposed Modification layout, the Cubba Cubbah residence is situated at a lower elevation than the Proposed Modification. The house itself is orientated towards Waterfall Way, a highway that lies between the residence and the proposed Site.

The view from this viewpoint is dominated in the foreground by a garden that surrounds the property which partly filters views beyond the property boundary. The view then extends over the road corridor (134 m), which includes stands of mainly native trees which further filter views up towards the top of a small rise that is mostly cleared and forms part of the visual buffer for Site (Figure 6-8 and Figure 6-9). In the background, it is possible to see obscured views of the vegetated ridges of the surrounding hills. The landowner has planted a tree line (approximately 700 m) along the property boundary bordering Waterfall Way to the west of the residence. Overall, the view is categorized as agricultural with a man-made feature (the highway) intersecting the mid-ground.





**Figure 6-8: Viewpoint R1 – north east view towards Proposed Modification from outer garden area of Cubba Cubbah (arrows indicate extent of solar array visibility).**

A detailed assessment of the extent of the likely views of the Approved Development from this viewpoint indicate that views would be limited to a small section of the southernmost area of the proposed Site. This is illustrated by the ZTV map generated to help understand the extent of potential views of the Development from this viewpoint (Appendix A, Figure A-3a). The light green shading on the ZTV map indicates areas that would be potentially visible within the proposed Site boundary of the approved development and the dark green show the very marginal increased zones of theoretical view resulting from the Proposed Modification.

It should be noted that ZTVs do not take into account the screening effect of existing local features such as subtle variations in landform, and existing vegetation cover noted in the viewpoint description that further filter and screen views from this viewpoint. Potential visibility of the Development Footprint is further reduced by the proposed siting of the solar array further from R1 (Appendix A, Figure A-3b) and then effectively mitigated through the commitment to establish a vegetation screen (Appendix A, Figure A-3c).





**Figure 6-9: Viewpoint R1 – north view towards Proposed Modification from outer garden area of Cubba Cubbah (arrows indicate extent of solar array visibility).**

Based on the findings of the viewpoint assessment, unmitigated, small portions of the Approved Development would still be visible filtered through current vegetation in mid-ground views. This, coupled with its proximity to the Site results in a potential magnitude of visual change that is **high**. The visual sensitivity of the viewpoint is assessed as **high** for (Table 7); therefore, with reference to Table 1, the visual amenity impact of the Approved Development from this viewpoint would be **high**.

The increased height of the Proposed Modification has potential to marginally increase the extent of mid-distance views of the solar array from R1 (dark green shading on ZTV in Figure A-3a). However, the increased impact of these views will be mitigated by the overall setback from the site meaning the perceptibility of 1 metre increase in height is substantively diminished and the increased setback/articulation of the proposed Modification compared with the approved development. The area of actual solar array likely to be visible Figure A-3b is shown to be relatively small and distant, accordingly the visual amenity impact of the proposed Modification is judged to be **moderate**.

**Notwithstanding this outcome, the proponent seeks to ensure potential visual impacts associated with this receptor are limited. Accordingly, the proponent proposes to implement targeted screening along the respective southern boundary of the site to further mitigate the views from this sensitive receiver. This screening will be aligned with sections of the solar array that are nearest to the southern boundary and will also involve promoting regeneration of vegetation within the Waterfall Way road corridor.**

Modelling undertaken through 'Airborn Insight' is provided in Appendix B and shows the visual mitigation effects of employing a set-back (as with the proposed new footprint) in addition to vegetation screening.

During consultation, the landholder indicated three additional potential future home development sites located within the property. Although on separate titles (*pers. comm.* 6/01/2016), no further planning application has been prepared for any site.

Potential visual impacts from these undeveloped sites were assessed as **moderate, low** and **insignificant** as part of the approval process and mitigation strategies that could be implemented if the sites were developed in the future were identified. The Proposed Modification is not likely to change these outcomes and no further consideration is given to these sites.

## **R2 - Kiama**

Located approximately 1 km south west of the southern boundary of the Proposal Site the Kiama residence is situated at a similar elevation to the majority of the development Site. The house itself is orientated towards Waterfall Way and set well back from the road. This viewpoint (Figure 6-10) is located in the eastern corner of an established garden surrounding the Kiama residence looking out towards the Development. The view is typical of the wide, mostly cleared and undulating agricultural landscape of the area. In the foreground the landscape slopes away from the house over the road corridor and down into a small valley before rising up to a ridge which defines the extent of the boundary of the Development from this viewpoint. The mid-ground and background views are characterised by cleared land punctuated by scattered mostly native paddock trees and clusters of introduced and native trees.

While the Kiama residence is at a similar elevation to the Development, the topography of the landscape shields most of the Site from this viewpoint. The ZTV map generated to understand the potential extent of views, confirms that views of the Approved Development would be contained to a relatively small area of the solar array running along Limerick Creek. Furthermore, the proposed modification would have a very minor impact on visibility as shown by the small areas of dark green in Appendix A, Figure A-4a, with potential views limited to a fairly narrow vertical range due to the flat nature of the Development site. It should be noted that ZTVs do not take into account the screening effect of local features such as subtle variations in landform, or vegetation cover noted in the viewpoint description that filter and screen views from this viewpoint. Furthermore, the setbacks from the site mean that the increased height will be imperceptible in reality.

Based on the findings of the viewpoint assessment, unmitigated, the magnitude of visual change is considered to be **moderate** for both the Approved Development and the Proposed Modification due to the distance of the Development and topographical screening that limits the scale of the impact within the broader view. The visual sensitivity of the viewpoint has been assessed as **moderate** for both scenarios (Table 7); therefore, with reference to Table 1, the visual amenity impact of the Development from this viewpoint would be **moderate and unchanged**.



**Figure 6-10: Viewpoint R2 – Proposed Modification from Kiama (arrows indicate extent of solar array visibility).**

#### ***Other considered viewpoints***

The site is generally obscured or screened from sight from other residences located within 5 km of the site, particularly to the east and west. However, the southern portion of the solar farm will be distantly visible from residences within Hillgrove, particularly those on the western side of Brackin Street. Given that Hillgrove is approximately 4.5 km from the development site, it is not anticipated that there will be significant changes to views from any residences at Hillgrove, which are represented in terms of impact by viewpoint D.

As noted, importantly the Approved Development and Proposed Modification are not visible from Bakers Creek Falls or Oxley Wild Rivers National Park and accordingly, these sites were not assessed further as either viewpoints or as part of the broader landscape assessment.

#### **6.4.3 Viewpoints Summary**

Table 7 summarises the predicted visual amenity impacts at key public and private viewpoints and recommended mitigation strategies.

**Table 7: Summary of impacts to visual amenity and recommended mitigation strategies for the Proposed Modification**

| Viewpoint                                       | Approximate distance | Visual sensitivity | Magnitude of visual change | Visual Amenity impact | Recommended Mitigation                                                                                                                           |
|-------------------------------------------------|----------------------|--------------------|----------------------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| A – Waterfall Way<br>Approved Development       | 220 m                | Moderate           | High                       | Moderate              | Setback/articulate infrastructure; Establish vegetation screenings to minimise visibility of solar arrays.                                       |
| A – Waterfall Way<br>Proposed Modification      | 380 m                | Moderate           | High                       | Moderate              |                                                                                                                                                  |
| B – Old Hillgrove Road<br>Approved Development  | 730 m                | Low                | Moderate                   | Low                   | Establish vegetation screenings to minimise visibility of solar arrays; and Promote regeneration of vegetation in road corridor (Waterfall Way). |
| B – Old Hillgrove Road<br>Proposed Modification | 920 m                | Low                | Moderate                   | Low                   |                                                                                                                                                  |
| C – Stockton Road<br>Approved Development       | 4.1 km               | Low                | Low                        | Low/<br>Insignificant | None required.                                                                                                                                   |
| C – Stockton Road<br>Proposed Modification      | 4.3 km               | Low                | Low                        | Low/<br>Insignificant |                                                                                                                                                  |
| D – Hillgrove Common<br>Approved Development    | 4.5 km               | Low                | Low                        | Low/<br>Insignificant | None required.                                                                                                                                   |
| D – Hillgrove Common<br>Proposed Modification   | 4.7 km               | Low                | Low                        | Low/<br>Insignificant |                                                                                                                                                  |
| R1 – Cubbah<br>Approved Development             | 490 m                | High               | High                       | High                  | Maximise infrastructure setback/articulation                                                                                                     |

| Viewpoint                                        | Approximate distance | Visual sensitivity | Magnitude of visual change | Visual Amenity impact | Recommended Mitigation                                                                                                                                  |
|--------------------------------------------------|----------------------|--------------------|----------------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| R1 – Cubba<br>Cubbah<br>Proposed<br>Modification | 730 m                | High               | Moderate                   | Moderate              | Establish vegetation screenings to minimise visibility of solar arrays; and<br><br>Promote regeneration of vegetation in road corridor (Waterfall Way). |
| R2 – Kiama<br>Approved<br>Development            | 1.1 km               | Moderate           | Moderate                   | Moderate              | Promote regeneration of vegetation in road corridor (Waterfall Way); and                                                                                |
| R2 – Kiama<br>Proposed<br>Modification           | 1.3 km               | Moderate           | Moderate                   | Moderate              | Establish further vegetation screenings to minimise visibility of solar arrays should this be deemed necessary post construction.                       |

At sites assessed to have low, moderate or high visual amenity impacts, the extent of potential views of the Development were modelled using a GIS viewpoint model (Appendix A). Summary statistics for the Proposed Modification indicate that changed visibility associated with the proposed 4.0 m maximum solar array height are generally offset by the Proposed Modification Footprint (i.e. reduced footprint size) (Table 8).

As the assessment demonstrates, in each case the reduced footprint associated with the Proposed Modification more than offsets any increased visibility associated with the proposed increase in array height.

**Table 8: Area visible within development footprint for 3 m and 4 m maximum array heights**

| Observer point         | Infrastructure height (m) | Area visible within footprint (ha) |
|------------------------|---------------------------|------------------------------------|
| A – Waterfall Way      | 3 (approved)              | 147                                |
|                        | 4 (proposed)              | 78                                 |
| B - Old Hillgrove Road | 3 (approved)              | 30                                 |
|                        | 4 (proposed)              | 12                                 |
| R1 - Cubba Cubbah      | 3 (approved)              | 10                                 |
|                        | 4 (proposed)              | 5                                  |
| R2 - Kiama             | 3 (approved)              | 77                                 |
|                        | 4 (proposed)              | 40                                 |



## 6.5 Other considerations

### 6.5.1 Night lighting

The Proposed Modification makes no changes relative to the Approved Development. There is no requirement to light the solar farm at night. The only facilities with provisions for night lighting will be associated with the substation and the support buildings. Lighting at these locations will be predominantly on-demand only. The viewshed analysis indicates that the substation and the support buildings areas are well shielded and not visible from potential sensitive receivers (Appendix A). As such, further assessment is not required.

### 6.5.2 Air traffic

The nearest public airport is Armidale Regional Airport, located approximately 25 km west of the development site. However, interpretation of topographical maps and aerial imagery indicates a number of private rural landing strips on properties within the surrounding district. Commercial north-south flightpaths are spread across northern NSW, including within the vicinity and the Development site.

Generally speaking, concerns regarding glare from solar farms has focussed on solar facilities on, or adjacent to airfields. Spaven Consulting (2011) concluded that off-airfield ("*en route*") facilities are unlikely to present glare problems to pilots, for the following reasons:

- glare is likely to present a hazard only during critical phases of flight, especially approach and landing, the *en route* phase is not normally a critical phase;
- glare occurs almost exclusively at low angles of elevation, aircraft in the *en route* phase of flight will be at higher angles of elevation;
- pilots in the *en route* phase are already subjected to glare from a number of existing sources such as large assemblies of parked cars, major glasshouse facilities and large bodies of water, etc; and
- the pilot view from most cockpits, is severely limited in the downward direction by the aircraft structure, thus blocking the line of sight to any source of glare on the ground.

The presence of the Development is anticipated to have an insignificant visual impact on local airfields traffic. PV panels are no more reflective than areas of vegetation such as forests, crops or grasslands and far less reflective than standing water such as water in dams, rivers and lakes, all features which pilots regularly fly over or adjacent to (NGH, 2010).

Further evidence of the limited risks posed by reflections from PV panels is the increasing installation of large solar arrays within airports in order to take advantage of large open areas and high local day-time electricity demand. Australian examples include Adelaide Airport, Alice Springs Airport, Newman (WA) Airport and Ballarat Airport (Solar Choice, 2013).

The Proposed Modification makes no changes relative to the Approved Development.

### 6.5.3 Road traffic

As discussed above, reflectivity of solar panels is generally similar, or lower, than surrounding landscape features so would not have a visual impact on road uses. Potential glint and glare impacts to road traffic shall be further minimised through:

- Selection of muted and non-reflective construction materials; and
- Installation of security fencing and screening vegetation between road users and infrastructure.

The Proposed Modification increases most setbacks relative to the Approved Development.

#### **6.5.4 Cumulative visual impacts**

A Development Consent has been granted to Hillgrove Mines Ltd for the establishment of an underground gold and antimony mine at Clarks Gully, near the junction of Old Hillgrove Road and Waterfall Way.

Cumulative visual impacts may result from certain viewpoints, should concurrent development and/or operation of the proposed Metz solar farm and the proposed Clarks Gully Mine occur, particularly:

- R1 - Cubba Cubbah;
- A – Waterfall Way; and
- B – Old Hillgrove Road.

The visual amenity assessment prepared for the Clarks Gully Mine (Envisage, 2016) indicates that the proposed Clarks Gully Mine shall be partially visible from the existing residence at Cubba Cubbah and assessed the overall impact to visual amenity as high. It is considered likely, that from the same vantage point it may be possible to view parts of the Development, although not necessarily within the same vista due to separation distance and angle. Potential cumulative impacts at this site have been considered and addressed in developing a comprehensive mitigation strategy aimed at significantly reducing the visibility of the Development from the existing residence at Cubba Cubbah as is discussed below.

The proposed Clarks Gully Mine is not visible to eastbound travellers on Waterfall Way adjacent to the Development (Envisage, 2015), however, partial views of both developments may occur in rapid succession creating a perceived cumulative visual impact. Proposed mitigation measures (increase to most setbacks and vegetation screening) have been developed to minimise this perception.

Combined views of both Clarks Gully Mine and the Development may be apparent to westbound travellers on Old Hillgrove Road. In this case, the recommended general and site specific mitigation strategies for Metz solar farm will assist to reduce impacts to visual amenity associated with this development.

The Proposed Modification makes no changes relative to the Approved Development.

## 7 Mitigation Measures

### 7.1 Proposed Mitigation Measures

The following mitigation measures will be implemented over the life of the project. Specifically, they are targeted at mitigating impacts from Viewpoints 'A' (Waterfall Way, moderate potential impact), 'B' (Old Hillgrove Rd, low potential impact), 'R1' (Cubba Cubbah, high potential impact) and 'R2' (Kiama, moderate potential impact). However, the measures will have the overall effect of reducing severity of impacts at all representative viewpoints and as such, visual impacts throughout the local area:

- Establish minimum setbacks as per the revised footprint associated with the Proposed Modification;
- Establish vegetation buffers located within the Site boundary to maximise potential visual screening for R1;
- Support vegetation regeneration within the Waterfall Way regeneration where permissible in collaboration with key stakeholders/land managers;
- Ensure the establishment of the vegetation buffers are commissioned before the Proposed Modification becomes operational;
- Continue to consult with neighbouring landholders to identify, where possible, the location of mutually agreeable vegetation screening both pre and post construction. Ensure actual screening meets mitigation expectations and broaden planting if it does not;
- Use muted, low contrast colours for O&M infrastructure, so that they blend into the landscape as far as possible;
- Where possible, select infrastructure to minimise potential for reflectivity and glare;
- Locate substation, support buildings, construction site compound and lay down areas away from visual receptors and apply visual screening if necessary;
- Minimise night lighting at the substation and associated support buildings; and
- Minimise vegetation clearing and earthworks and rehabilitate progressively.

### 7.2 Landscaping Plan

A landscaping plan has been developed in response to the findings of this assessment and in consultation with affected landholders, with the objective of minimising visual impacts at sensitive receptors, particularly viewpoints 'A', 'R1' and 'R2' (Armidale Tree Group 2017). The landscaping plan shall be updated and submitted for approval subsequent to the approval of the Proposed Modification.

## 8 Residual Impacts

Predicted residual impacts following the introduction of mitigation measures discussed above are outlined in Table 9 below. Changes associated with the Proposed Modification are relatively minor when compared with the Approved Development. Accordingly, there is no change in the assessed impact, however, the increased setbacks associated with the Proposed Modification will generally *reduce* visual impacts relative to the Approved Development.

**Table 9: Summary of residual effects of Proposed Modification**

| Assessment area        | Impact Assessment (Proposed Modification) | Anticipated residual effect following mitigation                                                                                                                                                                      |
|------------------------|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Landscape character    | <b>Low</b>                                | <b>Low.</b> Vegetation planting will, over time, further reduce changes within the landscape in proximity to the Development.                                                                                         |
| A – Waterfall Way      | <b>Moderate</b>                           | <b>Moderate</b> , with the introduction of the Visual Buffer Zone, reducing to <b>low</b> as the vegetation buffers establish and combine with existing vegetation to further obscure views.                          |
| B – Old Hillgrove Road | <b>Low</b>                                | <b>Low</b> , with the introduction of the Visual Buffer Zone, reducing to <b>low</b> / <b>Insignificant</b> as vegetation buffers establish and combine with existing vegetation to obscure views.                    |
| C – Stockton Road      | <b>Low</b>                                | <b>Low / Insignificant.</b>                                                                                                                                                                                           |
| D – Hillgrove Common   | <b>Low</b>                                | <b>Low / Insignificant.</b>                                                                                                                                                                                           |
| R1 – Cubba Cubbah      | <b>High</b>                               | Reducing to <b>High/Moderate</b> with the introduction of the Visual Buffer Zone, and further reducing to <b>Moderate</b> and then <b>low</b> over time as vegetation buffer will almost entirely shield development. |
| R2 – Kiama             | <b>Moderate</b>                           | <b>Moderate</b> , reducing to <b>low</b> as vegetative planting is established and combines with existing vegetation to obscure views.                                                                                |

## 9 Conclusion

This Visual Impact Assessment considers a Proposed Modification to the existing approval held for the Metz Solar Farm, comprising a revised and decreased project footprint and an increased maximum solar array height (from 3 m to 4 m). The benefit of raising the array height is an increase in the efficiency of the Solar Farm and therefore an increase in renewable energy generation from a reduced overall project footprint.

Inherent within the Proposed Modification is a commitment to implementing vegetation screening measures, additional to the increased setbacks, to ensure visual impacts on sensitive receptor R1 are commensurate with or less than the Approved Development.

This assessment considers the visual sensitivity of each receptor combined with the magnitude of visual change to determine the level of visual impact to nearby sensitive receptors. In each case and subject to mitigation measures, the changes associated with the Proposed Modification result in:

- No change in visual sensitivity associated with each receptor;
- No increase in the magnitude of visual change; and
- No increase in visual impact.

As such, it is concluded that the Proposed Modification does not have a significant visual impact greater than that of the Approved Development. Rather, due to the greater setback distances from receptors that can be achieved with the improved electricity generation capacity associated with the 4 m array, the potential visual impacts of the Proposed Modification are reduced when compared to those of the Approved Development.

Accordingly, the key benefits of the Proposed Modification are an increase in efficiency of the Solar Farm, and therefore more renewable energy available to customers, and a reduction in potential visual impacts. All other factors remain as previously assessed for the Approved Development.

The Proposed Modification maintains and updates as necessary all mitigation strategies associated with the Approved Development. These include:

- a commitment to increasing setbacks from Waterfall Way where possible; and
- an updated vegetation buffer zone that enhances natural visual screening.

In conclusion, the Proposed Modification will have a low visual impact on the landscape character of the local area. Potential visual amenity impacts associated with the increased array height will be offset by the adoption of a smaller development footprint that is located further from nearby sensitive receptors than that of the Approved Development, particularly along the southern boundary of the site.

As such, it is concluded that the Proposed Modification does not have a significant visual impact beyond that of the Approved Development and that potential visual impacts remain essentially unchanged, or enhanced, relative to the approved project.



# References

- Armidale Tree Group, 2017. *Metz Solar Farm Landscaping Plan-V1*. Prepared for Geolyse Pty Ltd for Infinergy Pacific Ltd.
- Envisage Consulting Pty Ltd, 2015. *Clarks Gully Mine – Visual Amenity Assessment*. Prepared for Eco Logical Australia.
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- Solar Choice, 2013. Solar farm projects near airports: Is glare an issue? September 19, 2013 in ACT, Commercial solar power, Positioning solar PV panels, Solar Farms
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- TTM, 2017a. Road Safety Audit. Metz Solar Farm, Bayley Park. Existing Stage.
- United Kingdom's Landscape Institute and Institute of Environmental Management and Assessment, 2013. *Guidelines for Landscape and Visual Impact Assessment, 3<sup>rd</sup> Edition*.

# Appendix A – Development visibility from selected viewpoints

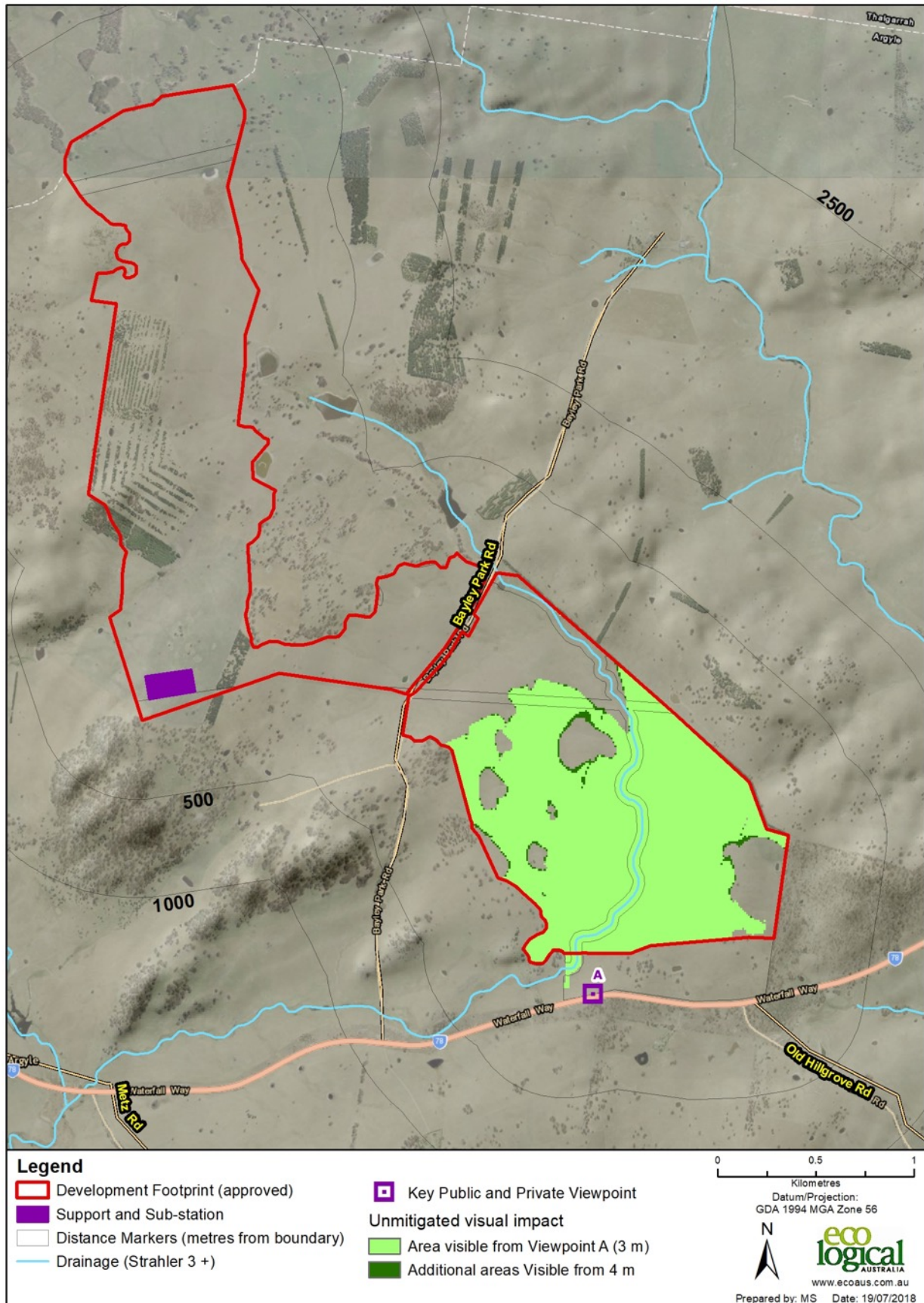


Figure A-1a: Approved Development visibility from Viewpoint A.



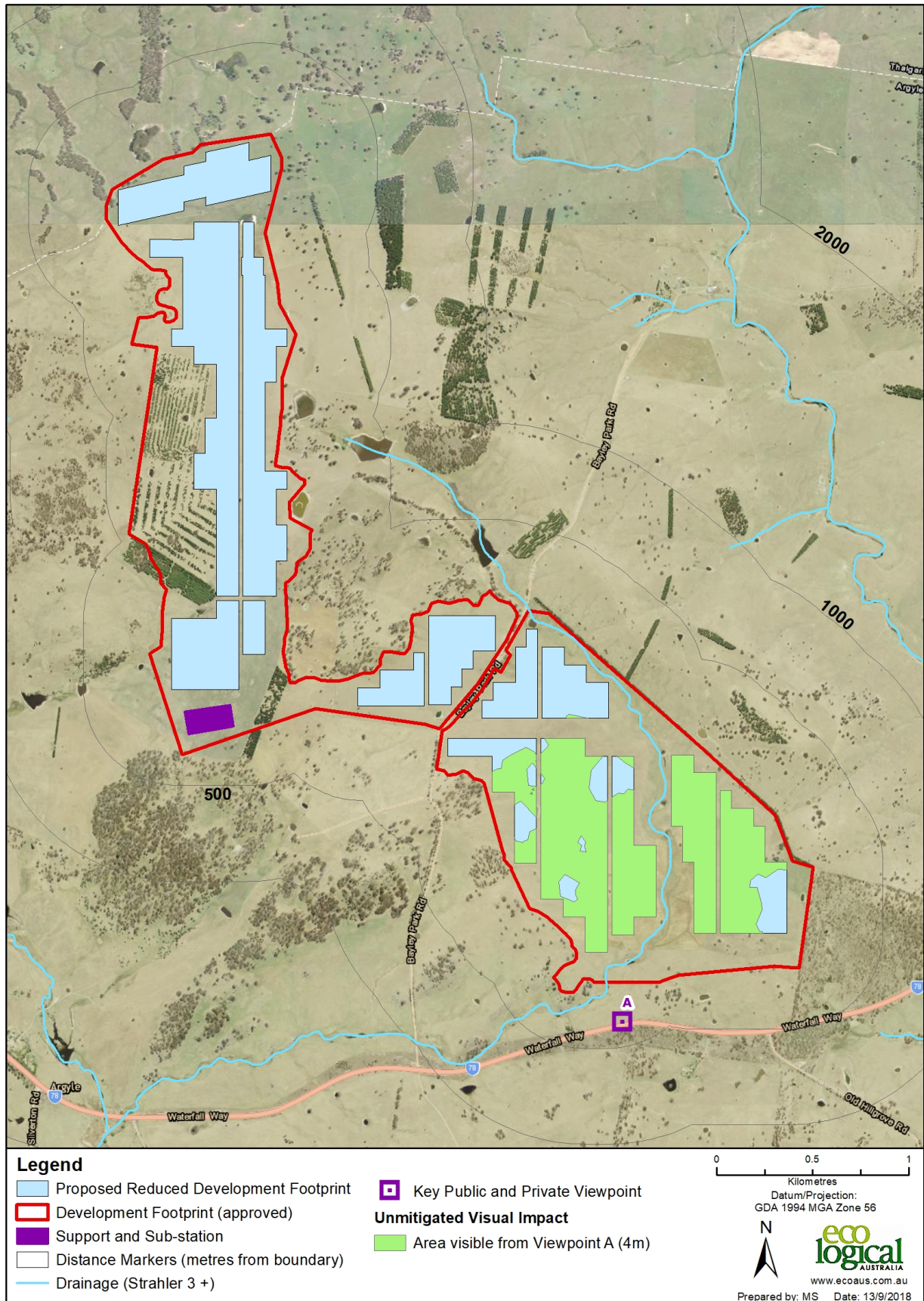


Figure A-1b: Proposed solar array visibility from Viewpoint A.



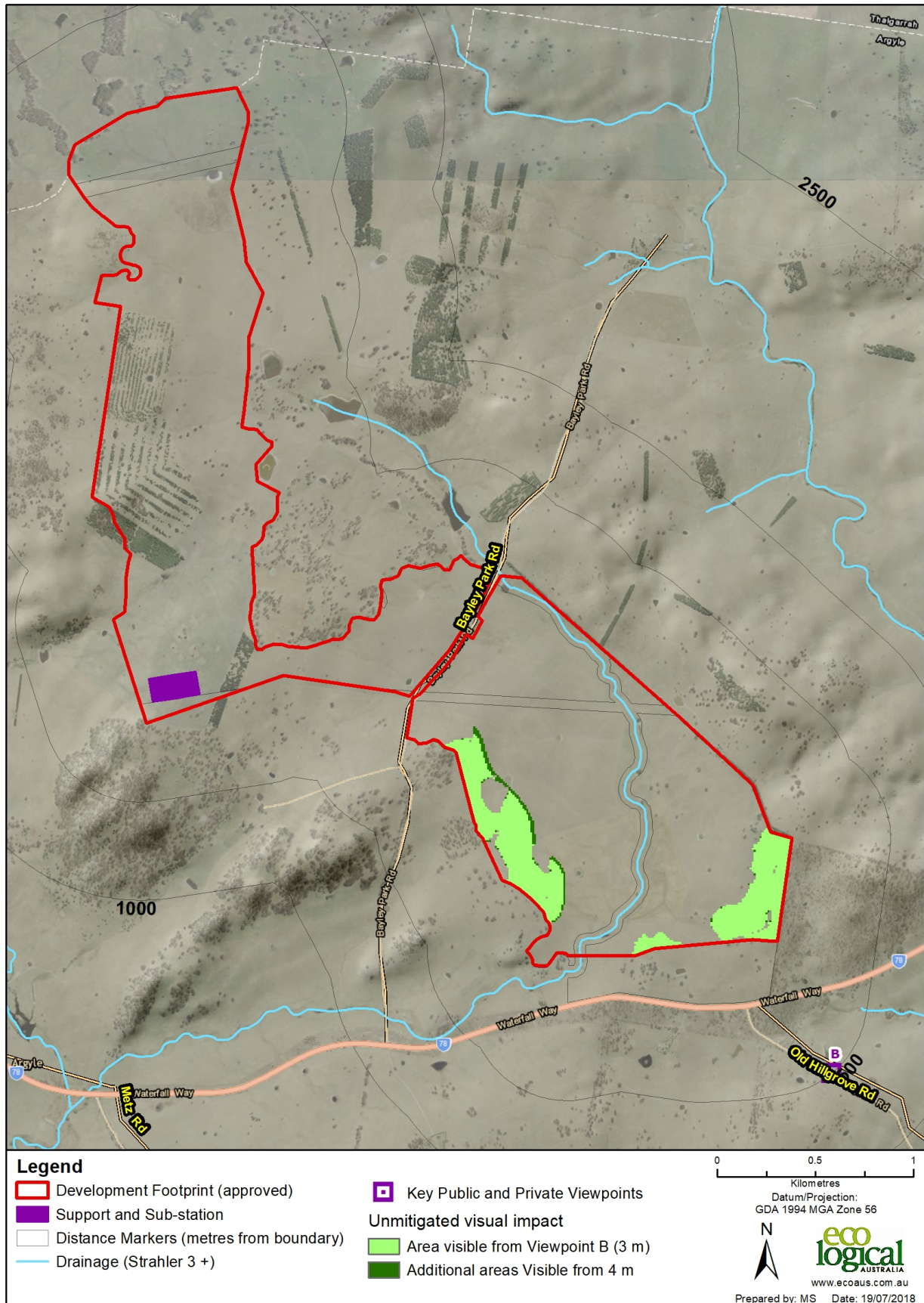


Figure A-2a: Approved Development visibility from Viewpoint B



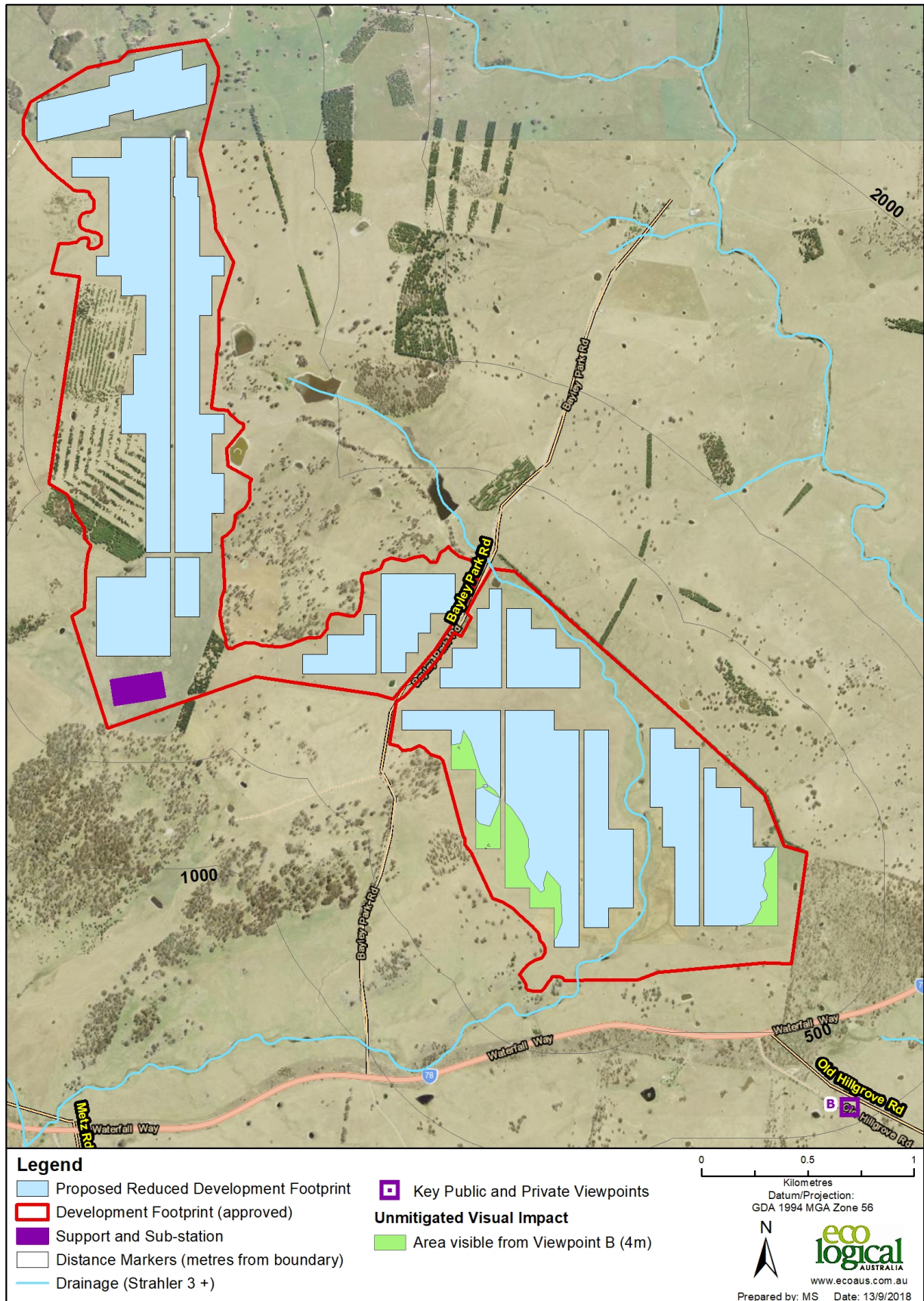


Figure A-2b: Proposed solar array visibility from Viewpoint B.



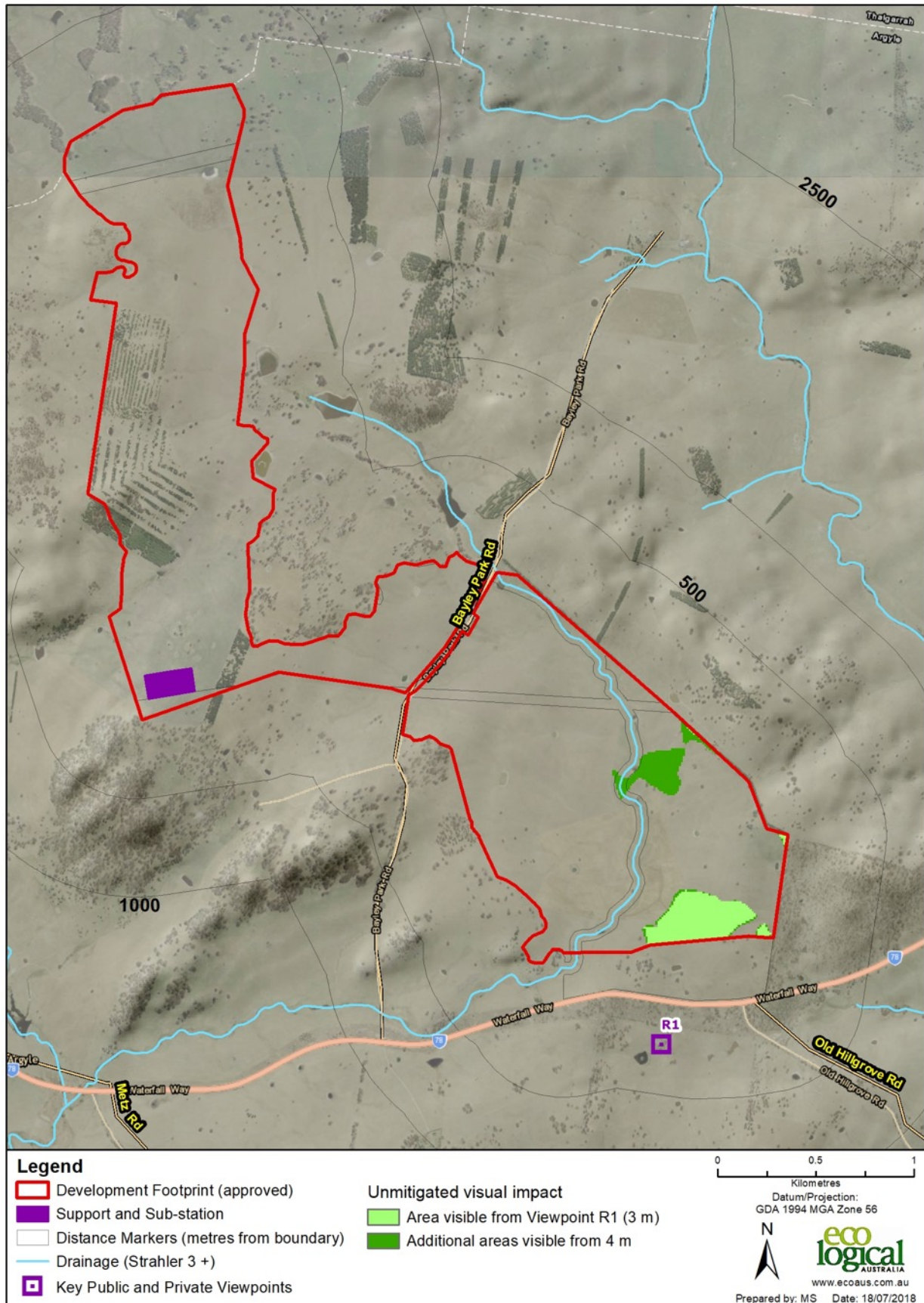


Figure A-3a: Approved Development visibility from Residence R1



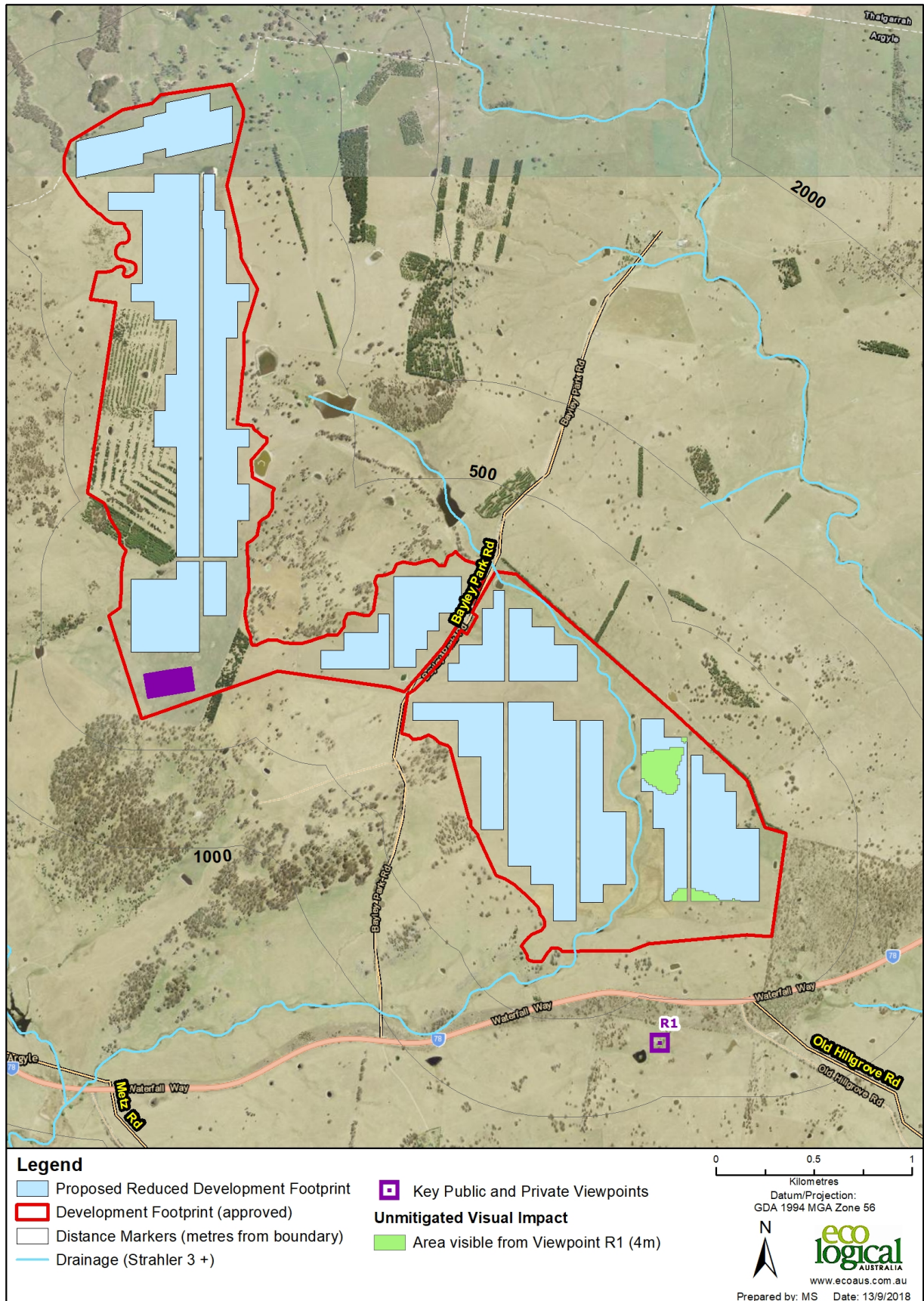
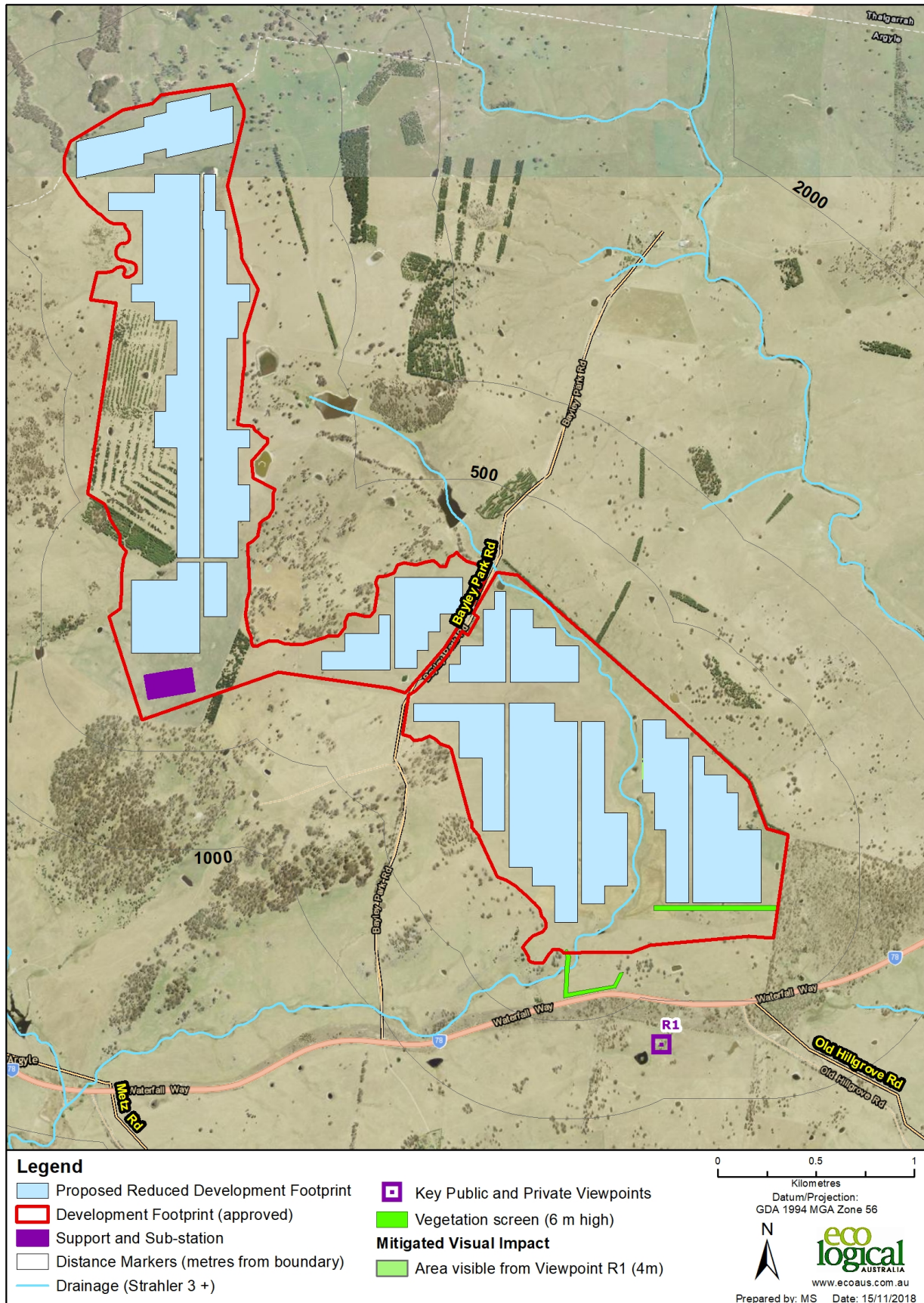


Figure A-3b: Proposed solar array visibility from Residence R1.





**Figure A-3c: Proposed Mitigated Modification visibility from Residence R1.**



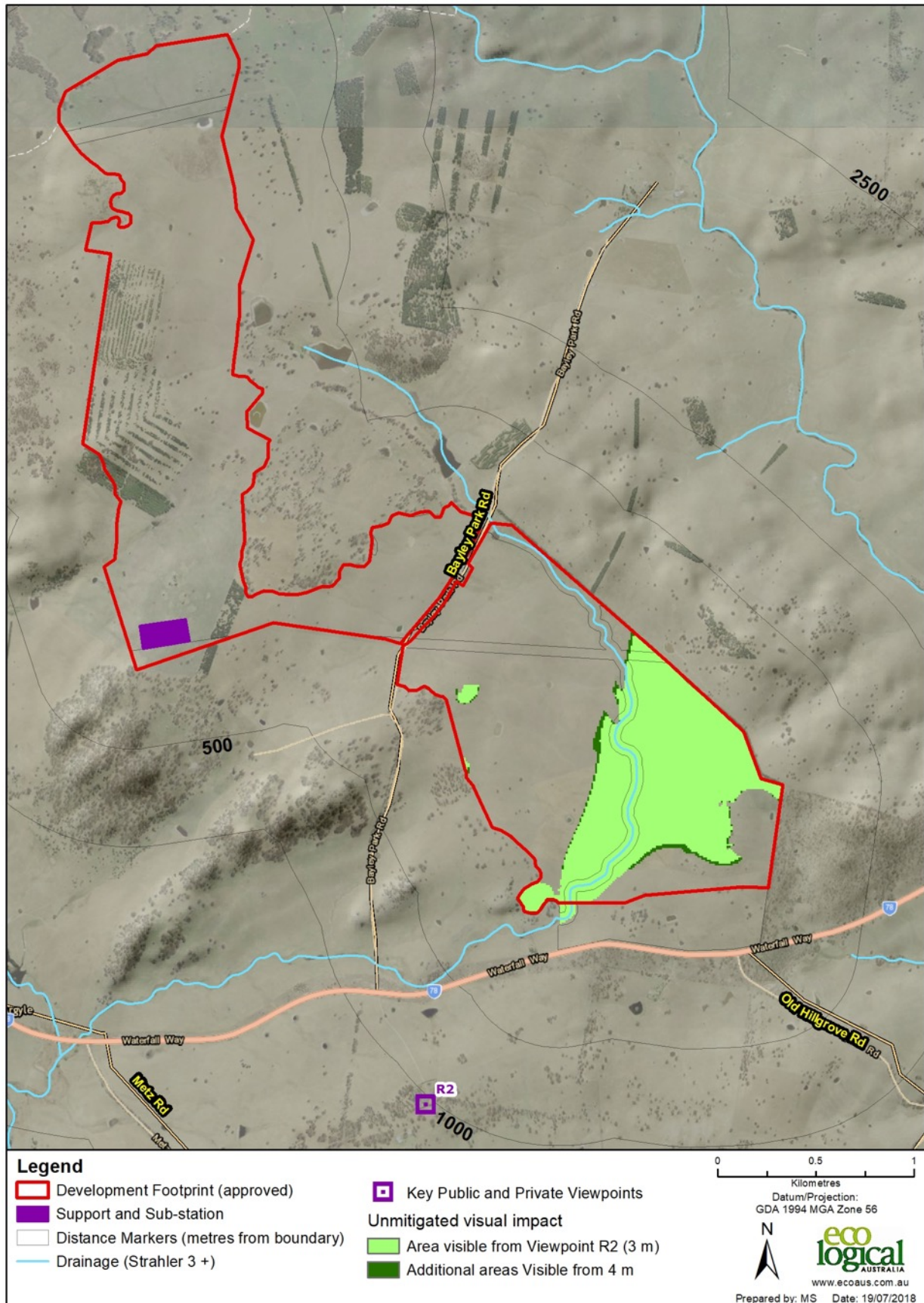


Figure A-4a: Approved Development visibility from Residence R2



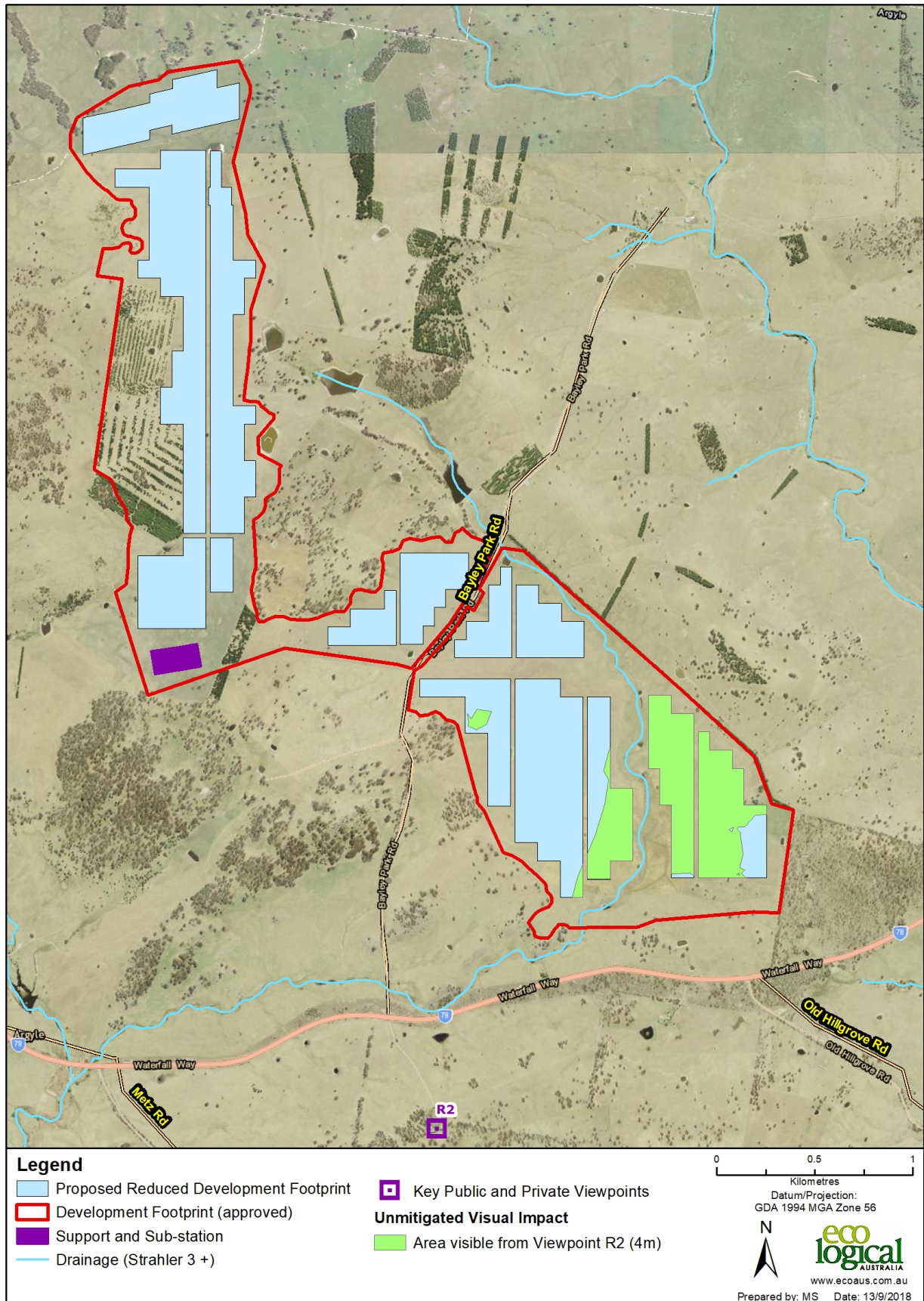


Figure A-4b: Proposed solar array visibility from Residence R2.

## Appendix B – Airborn Insight, Visibility Analysis Modelling

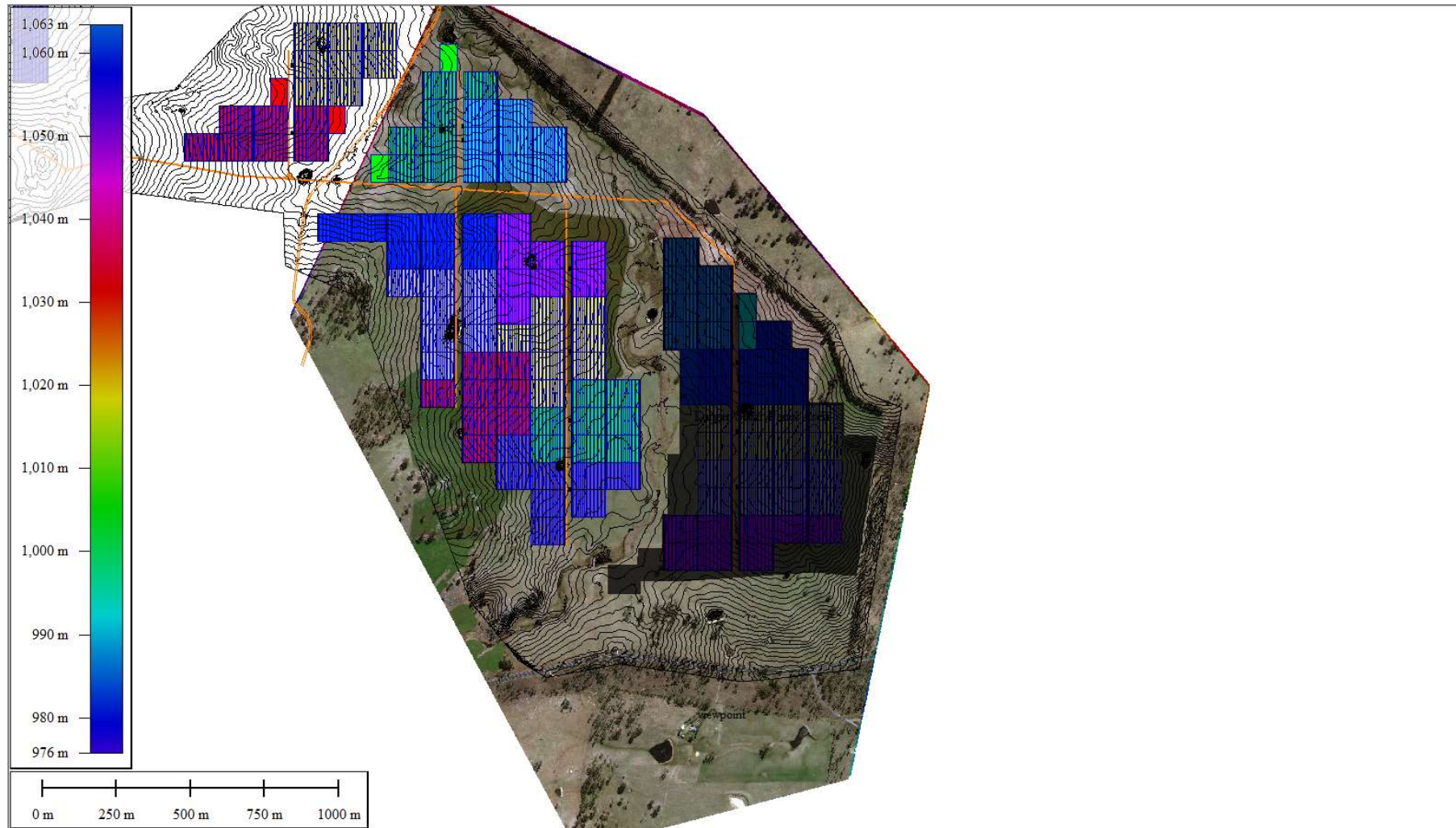


Figure 1 - Approved Solar Array area. 3m tall.





Figure 2 – Reduced Solar Array Area, 200m setback. 4m tall.



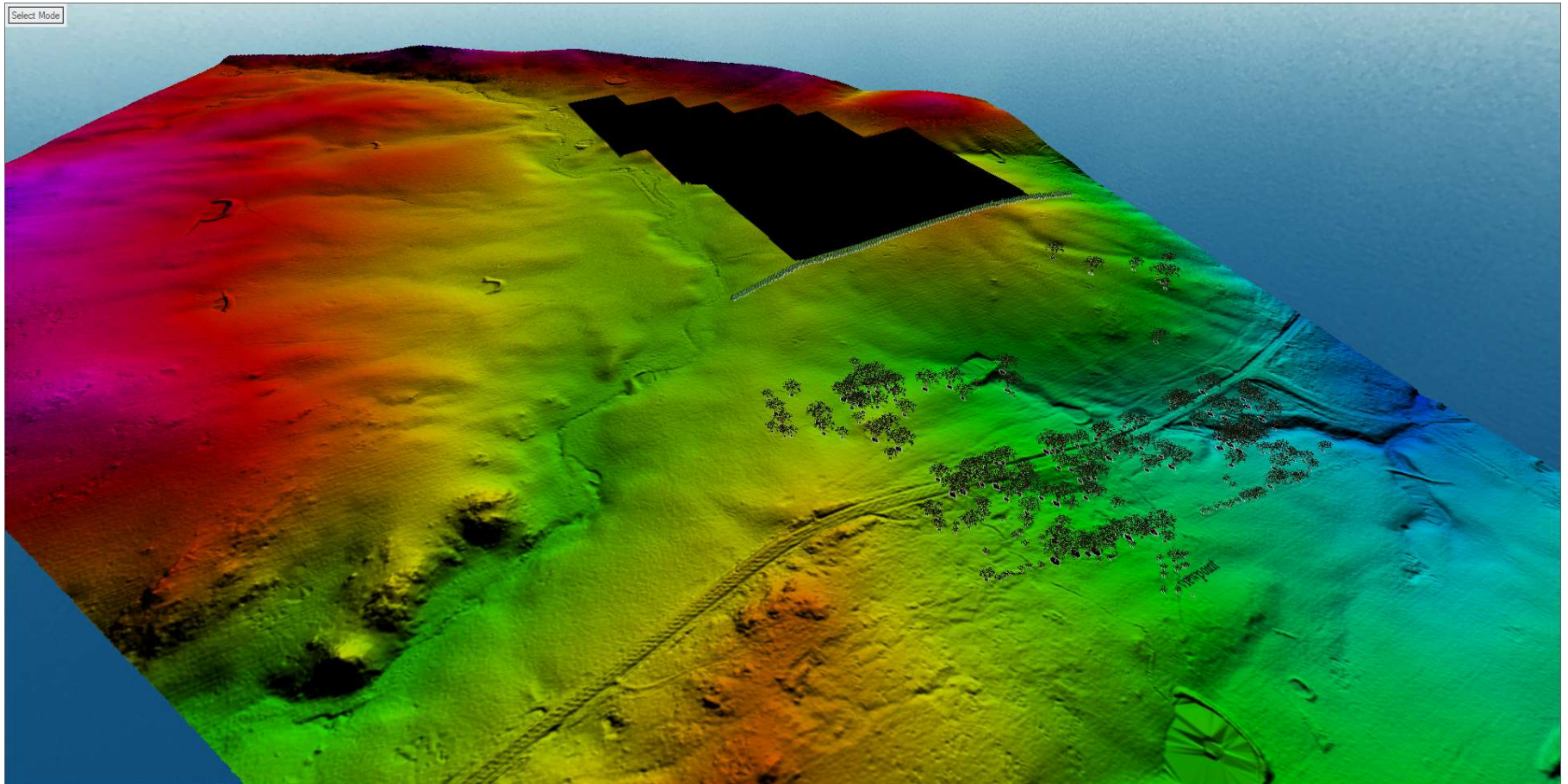


Figure 3 - Solar Array 200m setback. 4m tall.



Figure 4 - Solar Array 200m setback. 4m tall.





Figure 5 – Viewpoints 1 & 2

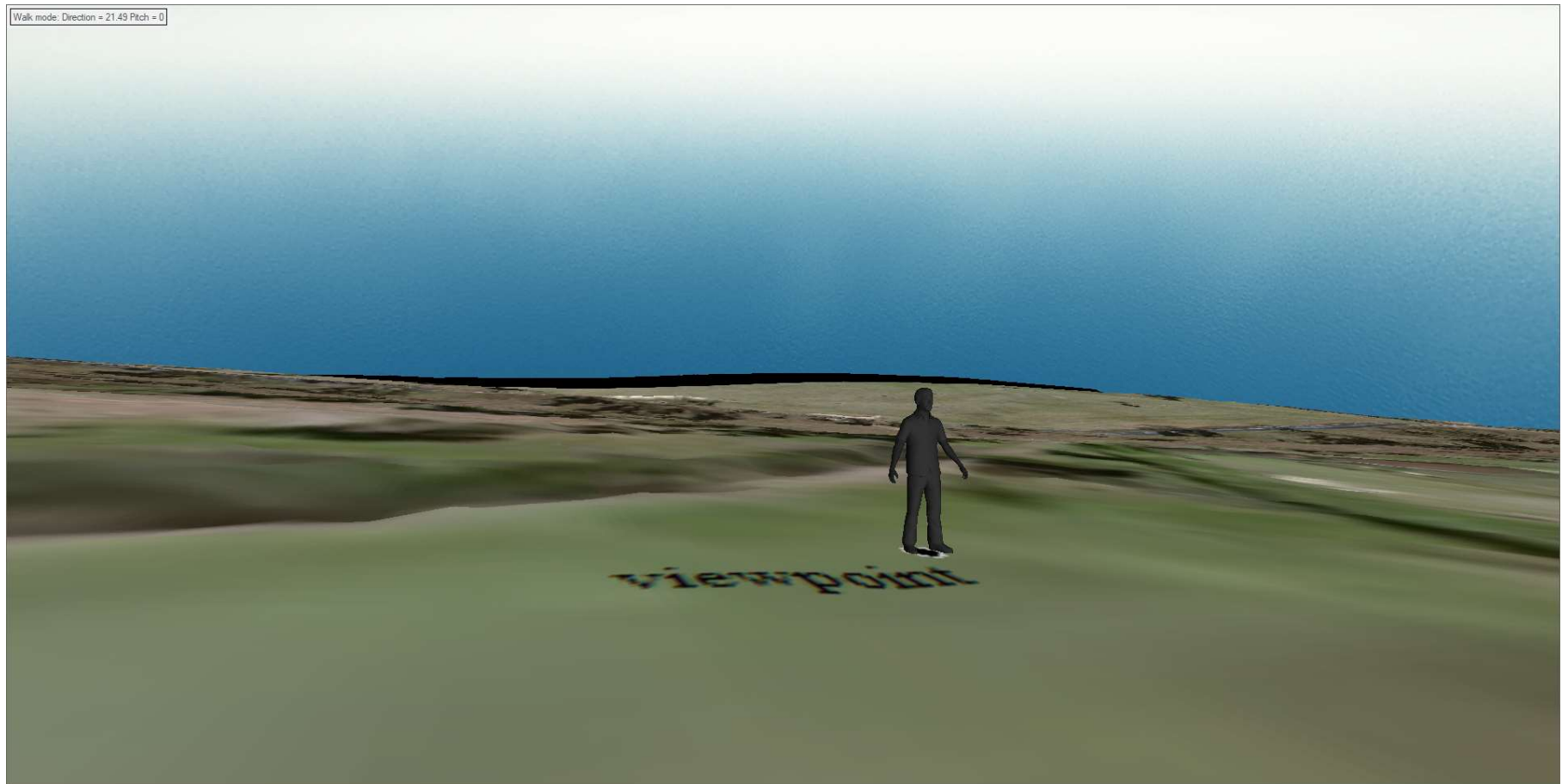


Figure 6 - VP1. Approved solar panel area at 3m height. Existing trees removed and landscaping screen trees removed.



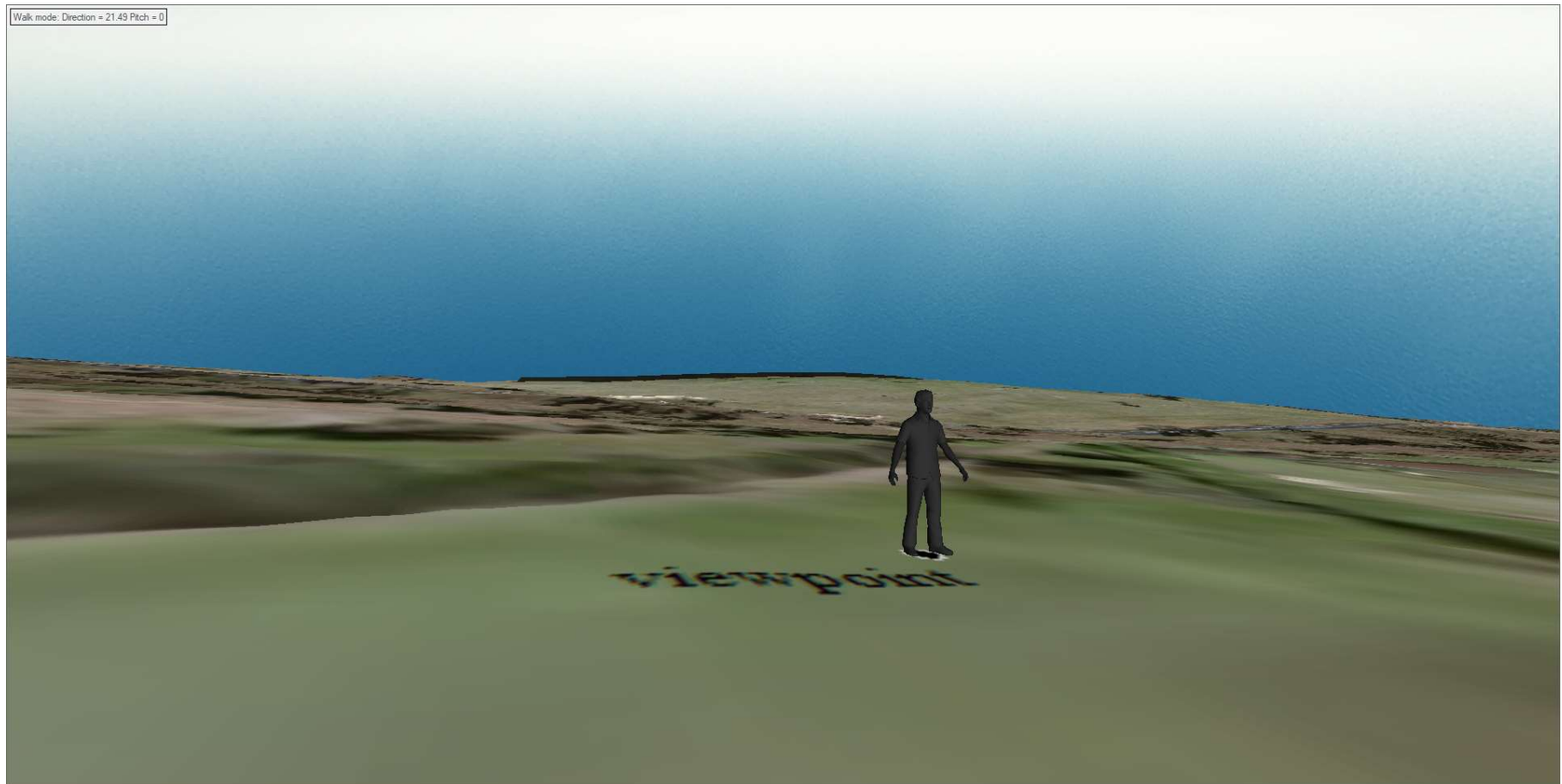


Figure 7 – VP1. Reduced solar panel area (200m set back) at 4m height. Existing trees and landscape screening trees removed



Figure 8 – VP1. Reduced solar panel area (200m set back) at 4m height. Existing trees shown. Landscape screening trees removed.



Figure 9 – VP1. Reduced solar panel area (200m set back) at 4m height. Existing trees and landscape screening trees shown.



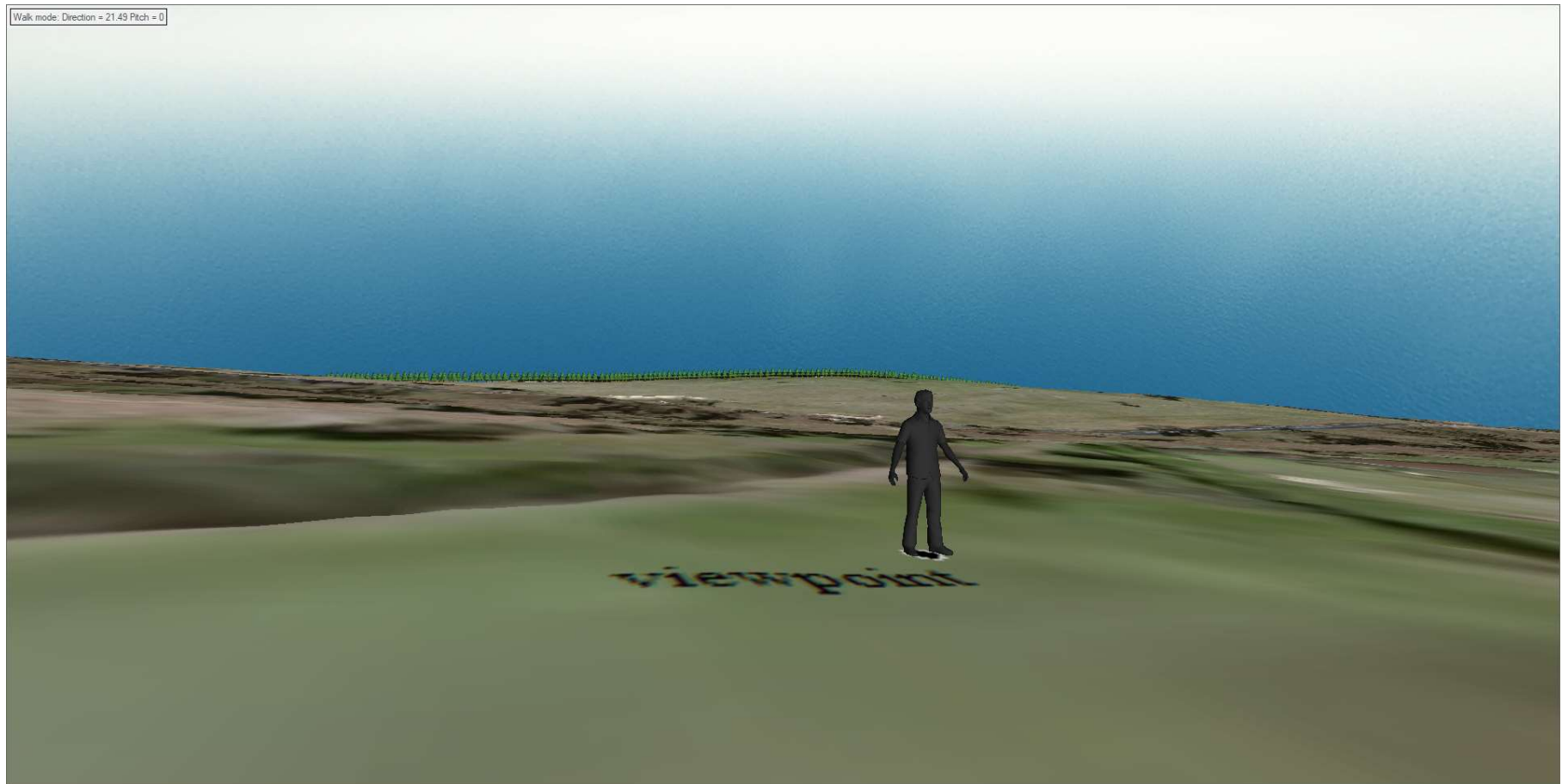


Figure 10 – VP1. Reduced solar panel area (200m set back) at 4m height. Existing trees removed and landscape screening trees shown.





Figure 11 - VP2. Approved solar panel area at 3m height. Existing trees removed and landscaping screen trees removed.



Figure 12 - VP2. Reduced solar panel area (200m set back) at 4m height. Existing trees and landscape screening trees removed

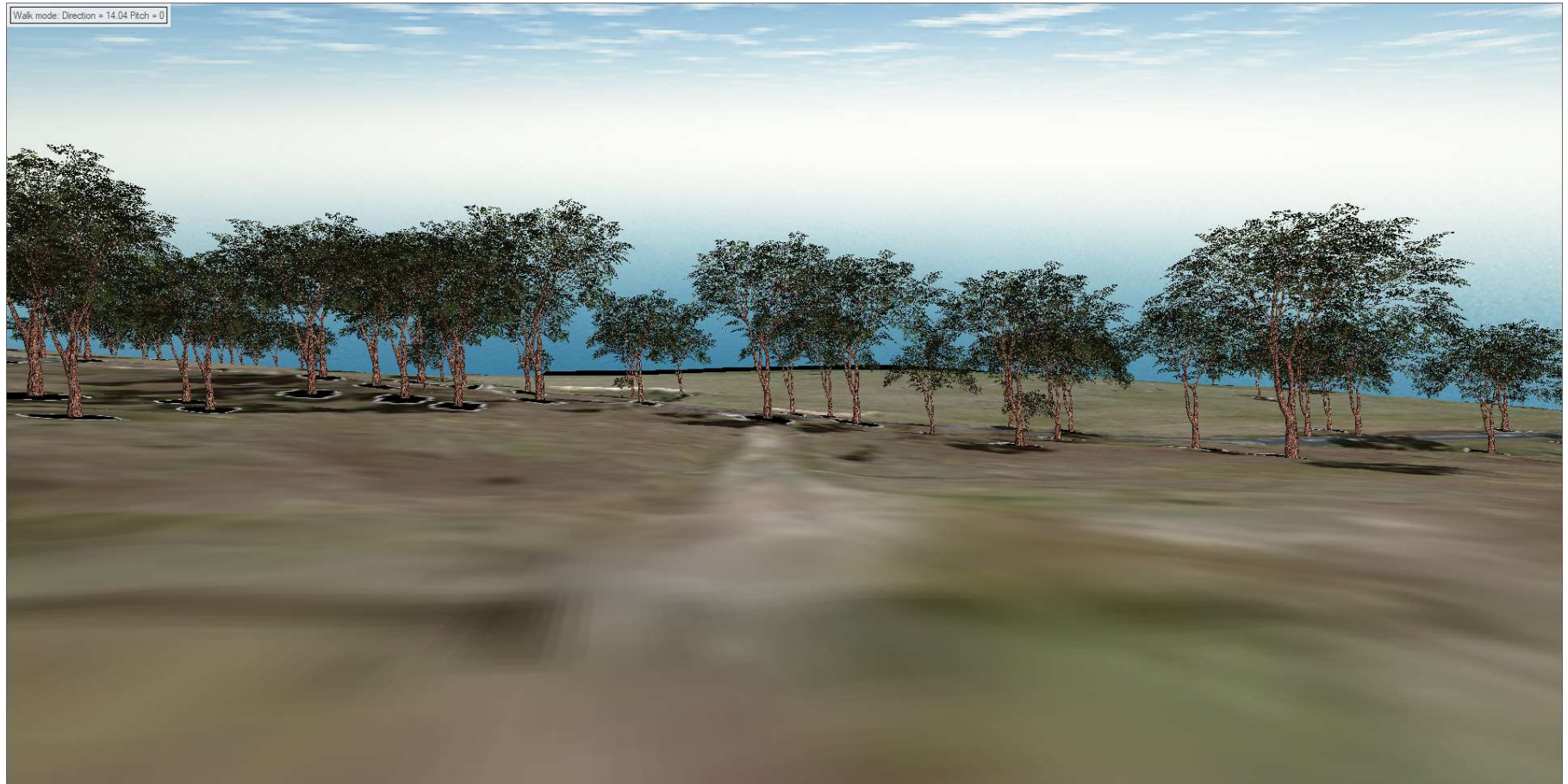


Figure 13 – VP2. Reduced solar panel area (200m set back) at 4m height. Existing trees shown. Landscape screening trees removed.





Figure 14 - VP2. Reduced solar panel area (200m set back) at 4m height. Existing trees and landscape screening trees shown.





Figure 15 - VP2. Reduced solar panel area (200m set back) at 4m height. Existing trees removed and landscape screening trees shown



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