White Rock Wind Farm - Project Approval MP10_160

Modification Application No. 4 - Alternative Grid Connection

Appendix 1

Visual Impact Assessment – prepared by Green Bean Design, July 2016

GREEN BEAN DESIGN landscape architects

WHITE ROCK WIND FARM

Alternative 330kV Grid Connection

Visual Impact Assessment

Prepared for:

White Rock Wind Farm Pty Ltd

Prepared by:

GREEN BEAN DESIGN
landscape architects

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DOUCMENT CONTROL

ITEM	DETAIL
Project Name:	**White Rock Wind Farm - Alternative 330kV Grid Connection**
Report Title:	**Visual Impact Assessment**
Project Number:	**16-221**
Version Number:	**v2**
Status:	**Final**
Author:	**Andrew Homewood**, Registered Landscape Architect, AILA *Graduate Diploma Landscape Management, Bachelor Science (Dual Honours) Landscape Design and Archaeology, National Diploma Horticulture*
Date	**2 July 2016**

Green Bean Design – Capability statement

Green Bean Design (GBD) was established as a landscape architectural consultancy in 1999 and has specialised in landscape and visual impact assessment over the past 10 years. As an independent consultancy, GBD provide professional advice to a wide range of commercial and government clients involved in large infrastructure project development.

GBD owner, and principal landscape architect Andrew Homewood, is a registered landscape architect and member of the Australian Institute of Landscape Architects and the Environmental Institute of Australia and New Zealand. Andrew has over 22 years continuous employment in landscape consultancy and has completed numerous landscape and visual impact assessments for a variety of large scale and state significant infrastructure, including mines, transmission lines/substations, wind farms and solar power developments.

1.1 Introduction

This Visual Impact Assessment (VIA) has been prepared by Green Bean Design (GBD) on behalf of White Rock Wind Farm Pty Ltd (the Proponent). This VIA has been prepared to support a Modification Application (the modification) which proposes an alternative 132kV transmission line and switchyard/substation connection for the approved White Rock Wind Farm (WRWF).

The approved WRWF includes a grid connection to the existing Glen Innes to Inverell 132kV transmission line to the north of WRWF; however, the approved grid connection is constrained and will not allow for the full development of the approved WRWF.

The modification will involve an alternative grid connection to an existing 330kV transmission line at a point approximately 13km west of the approved WRWF. The modification will enable the full development of the approved WRWF and will also allow for the potential indirect development of another wind farm project in the locality. The modification involves development of 13km of an alternative 132kV transmission line and a 132kV/330kV switchyard/substation adjacent to the existing 330kV transmission line. The alternative 132kV transmission line route and 132kV/330kV switchyard/substation location are illustrated in **Figure M01**.

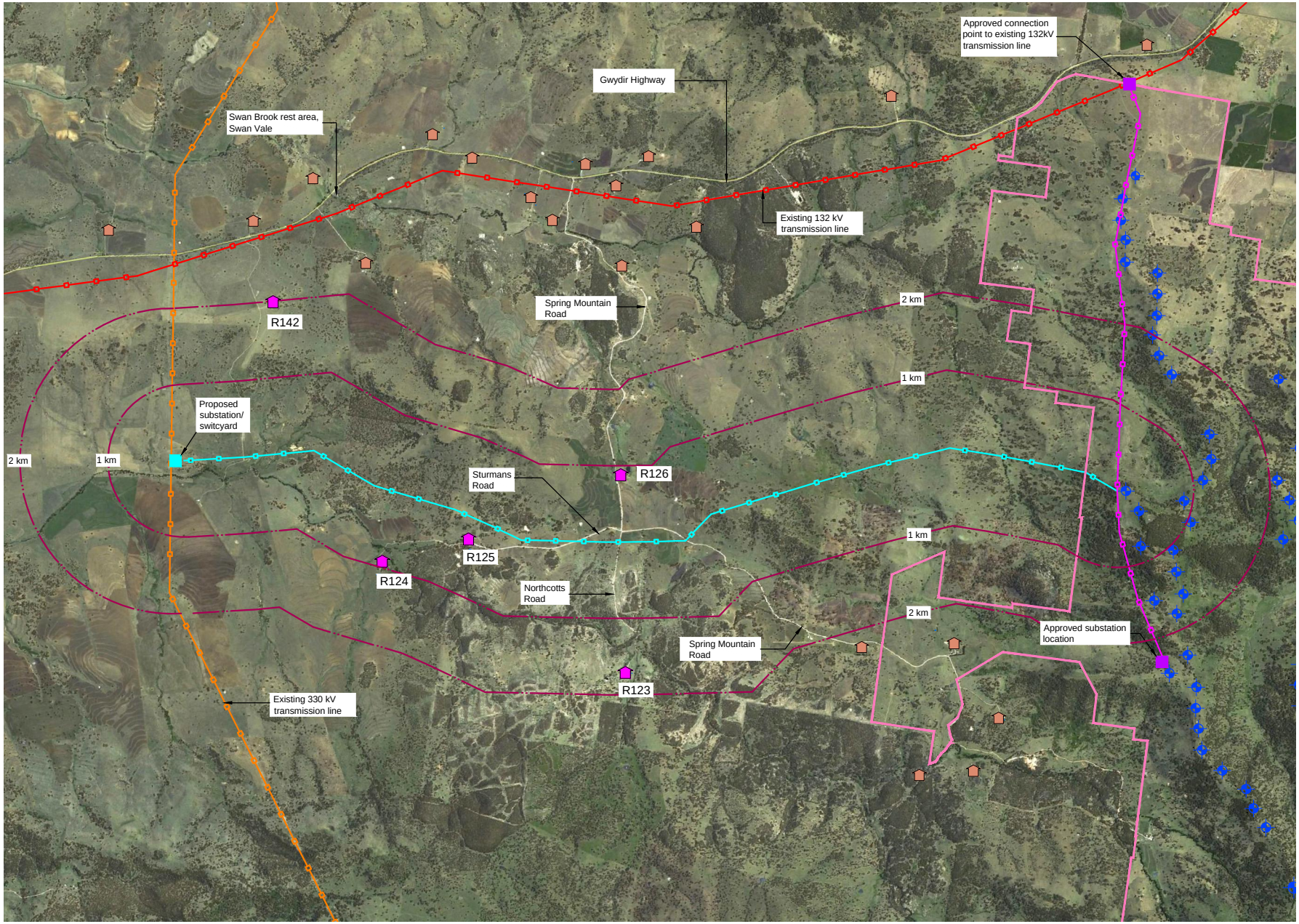
1.2 Key tasks

This VIA included the following key tasks:

- Desktop study addressing visual character of the alternative 132kV transmission line alignment and immediate surrounding area
- Identification of the alternative alignment view catchment
- Site inspection, fieldwork and photography
- Assessment and determination of Visual Absorption Capability
- Preparation of figures to support the VIA
- Assessment of visual impact from publicly accessible view points and residential dwellings and
- Discussion of mitigation measures and how they may reduce levels of potential visual impact.

1.3 Project description

The alternative grid connection will include a 132kV overhead transmission line within a 50m easement from WRWF to a new substation at a location adjacent to the existing 330kV transmission line. The alternative alignment involves a 132kV transmission line approximately 13km in length, running generally east to west between WRWF and the 330kV transmission line. The alternative 132kV transmission line is likely to be constructed and operated as a double circuit line to provide the capacity to enable export of the energy from the full approved WRWF development and the White Rock Solar Farm that obtained development consent in



Legend

- Approved White Rock 132kV power line
- Alternative 132kV transmission line
- Residential dwelling within 2 km of alternative transmission line
- Residential dwelling beyond 2 km of alternative transmission line
- Stage 1 White Rock wind turbine
- White Rock Wind Farm site boundary
- Existing 330kV transmission line
- Existing 132kV transmission line
- Approved substation
- Alternative substation and switchyard location
- Distance from alternative132kV transmission line

0km 1km

Figure M01
Alternative 132kV transmission line and substation/switchyard connection

White Rock Wind Farm Alternative 330kV Grid Connection

WHITE ROCK Wind Farm

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June 2016. The existing Glen Innes to Inverell 132kV transmission line is single circuit and has a maximum capacity of about 170MW and prevents full development of the approved WRWF. Comparisons of single and dual circuit 132kV transmission lines are illustrated in **Figure M02**. Subject to final detailed design and engineering requirements, the alternative 132kV transmission line will include a range of tension, supporting and angle poles to a height approximately 35m above ground level. The key visual components of the alternative 132kV transmission line will be generally similar to the approved 132kV power line being developed for the WRWF Stage 1 development. The transmission line will comprise:

- single tapered concrete poles up to 35m high
- aluminium alloy 132kV conductors and
- an aerial earth wire and communications link.

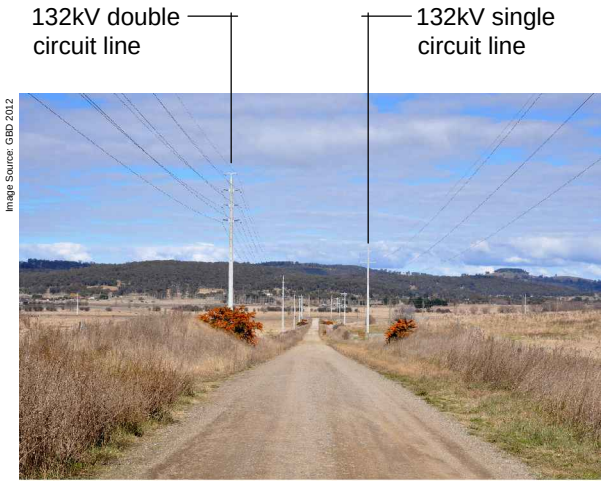
Typical images of an existing 132kV dual circuit transmission line (extending from the Glen Innes substation) are illustrated in **Figure M02**.

The alternative grid connection at the existing 330kV transmission line will require a switchyard/substation to be constructed at the connection point to the existing 330kV transmission line. The alternative facility will enable the connection of the full WRWF output and provide a point that could also be used to connect other renewable energy projects.

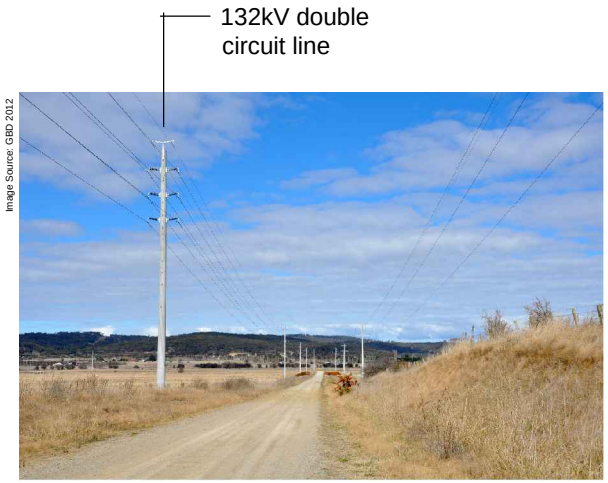
Typical images for 132kV and 330kV switchyard/substation structures are illustrated in **Figure M03**. The tallest structures of the facility are the overhead gantries that provide the landing structures for 330kV conductors and that are designed to provide for the required electrical safety clearances. The switchyard/substation facility will be located within rural agricultural land and is unlikely to be significantly visible from any surrounding residential dwelling or public road corridor.

1.4 Existing Landscape Character

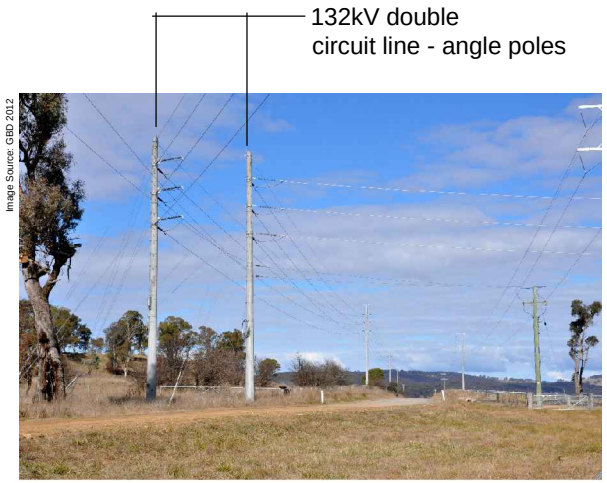
The alternative 132kV transmission line route will extend through a rural landscape of pastoral grazing land with small pockets of cultivated cropping land. The landform along the alternative alignment is undulating to gently sloping with steeper hillside sections extending toward the approved substation and wind farm location on White Rock Mountain. There is a noticeable variety of topographical features within the local and regional landscape and an overall moderate landscape scale with a range of distant to mid distance views into



Comparative single and double circuit 132kV transmission line (supporting structures)

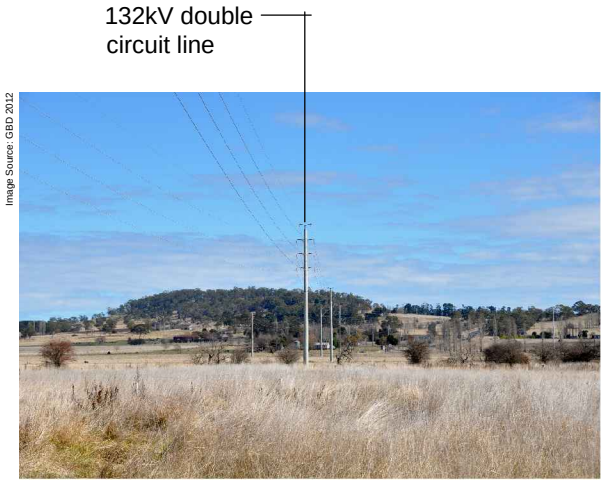


Double circuit 132kV transmission line (supporting structure) along road

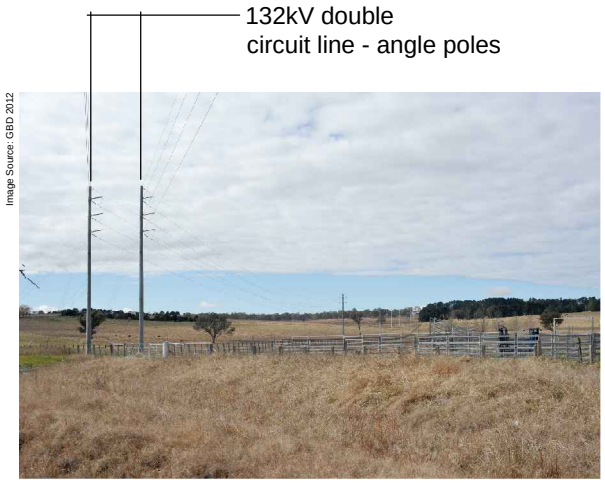


Double circuit 132kV transmission line (angle pole structure) at road crossing

132kV double circuit line crossing rural agricultural land

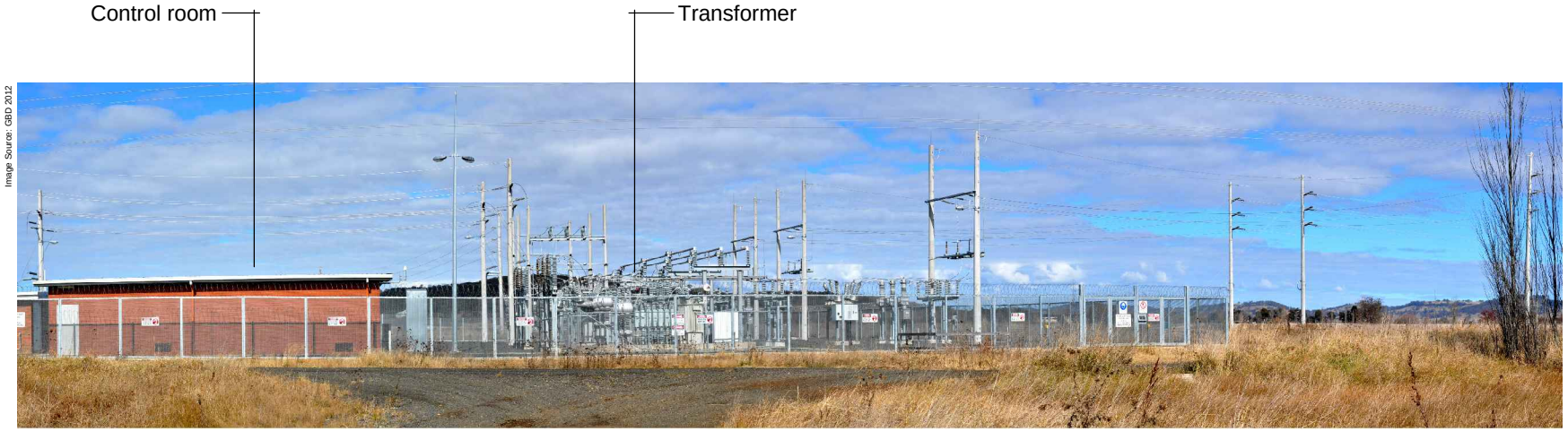


132kV double circuit line crossing rural agricultural land



Double circuit 132kV transmission line (angle pole structure) at road crossing

Figure M02
Typical transmission line photographs



Glen Innes 132kV substation

Macarthur 132/330kV substation

Macarthur 132/330kV substation (aerial view)

Figure M03
Typical substation/switchyard photographs

neighbouring landscapes. Landcover reflects the predominant surrounding rural land use and results in a simple and uniform landscape pattern. Human settlement is sparse and dispersed with some evidence of contemporary structures including built agricultural facilities, roads and overhead transmission lines. Landscape characteristics exhibited along the alternative 132kV transmission line route are reasonably common within a local and regional context.

1.5 Panoramic photographs

A series of digital photographs were taken during the course of the fieldwork to illustrate existing views in the vicinity of a number of view locations inspected and assessed as part of this VIA.

The photographs were taken with a tripod mounted digital Nikon D700 camera with a prime 50mm lens. Individual photographs were digitally stitched together to form a segmented panorama image to provide a visual illustration of the existing view from each photo location.

The real world coordinate location for each panorama photograph was recorded with a hand held GPS unit to an accuracy of around plus or minus four meters. Additional information including the bearing or direction of each photograph, time of day and prevailing weather conditions was also recorded.

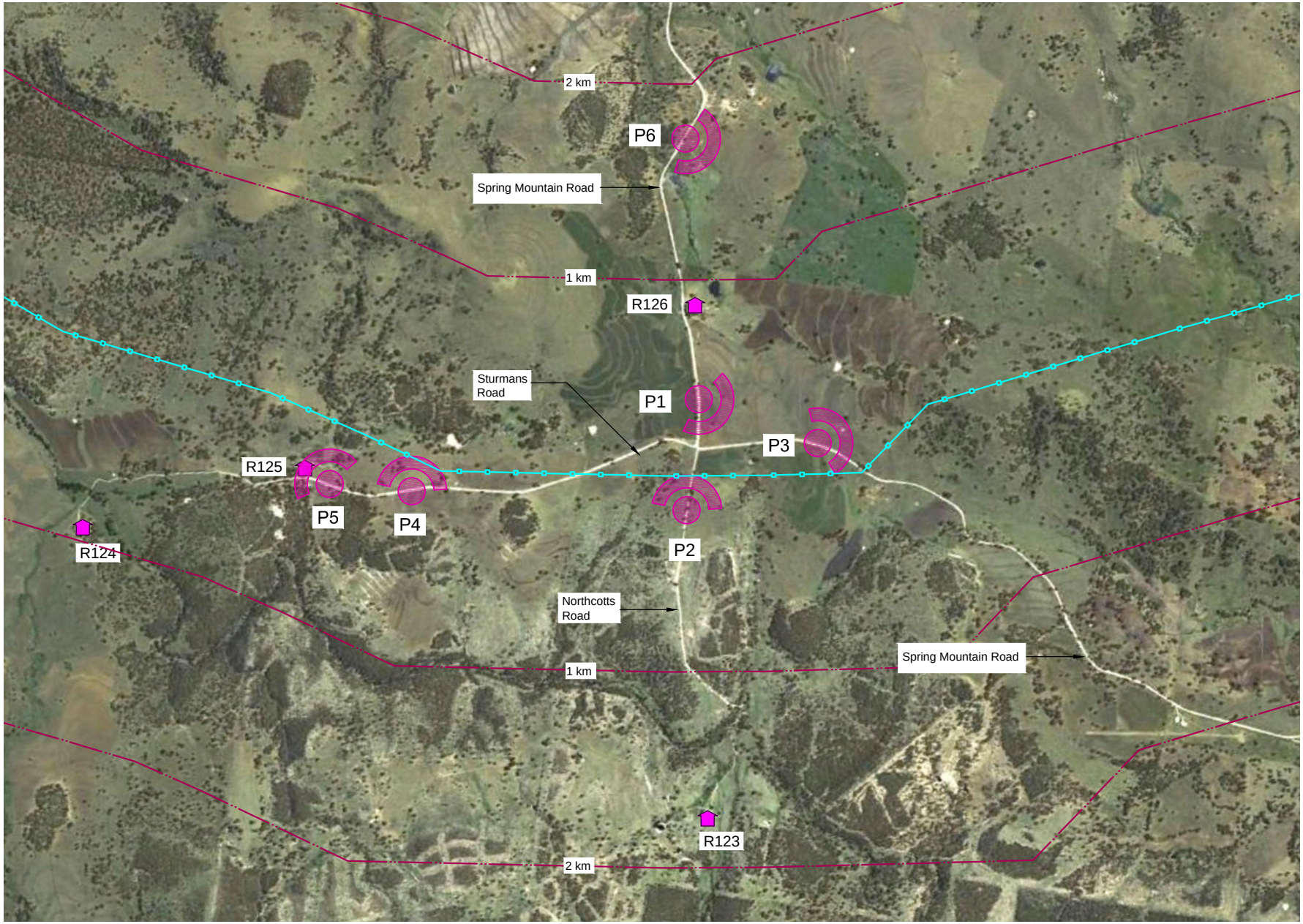
The panoramic photographs presented in this VIA have been annotated to identify key features or structures located within the existing view.

The panoramic photograph locations are illustrated in **Figure M04**, and the panoramic photographs illustrated in **Figures M05** to **M08**.

1.6 View Catchment

For the purpose of this VIA, the view catchment is defined as the area within which the alternative 132kV transmission line will be most readily visible from surrounding areas. Identification of the view catchment considers the character of the landscape, landform and existing structural elements with regard to their potential for localised visual screening effects.

For the purpose of this VIA, the view catchment has been determined within a 2km offset from either side of the alternative 132kV transmission line route. Beyond 2km, views toward the alignment may have a greater tendency to be screened by undulating landform or the presence of vegetation for portions of the alternative



Legend

Photo location P1

Alternative 132kV transmission line

Residential dwelling within 2 km of alternative transmission line

Residential dwelling beyond 2 km of alternative transmission line

Distance from altenative 132kV transmission line

0km 500 m

Figure M04
Panorama photo locations

White Rock Wind Farm

Alternative 330kV Grid Connection

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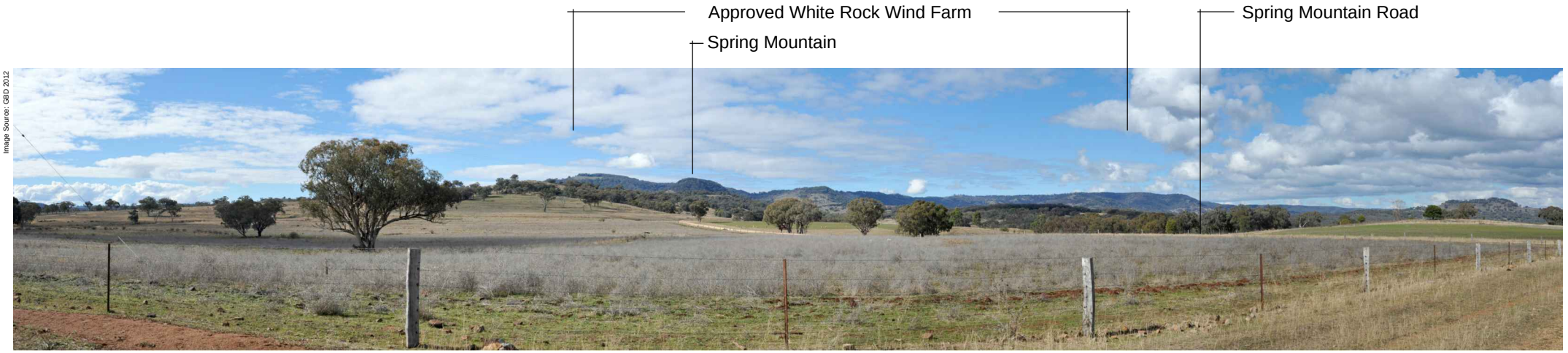

Photo Location P1A- View north east to south from Spring Mountain Road

Photo Location P1B- View south to south west from Spring Mountain Road

Figure M05
Panorama Photo P1A & B

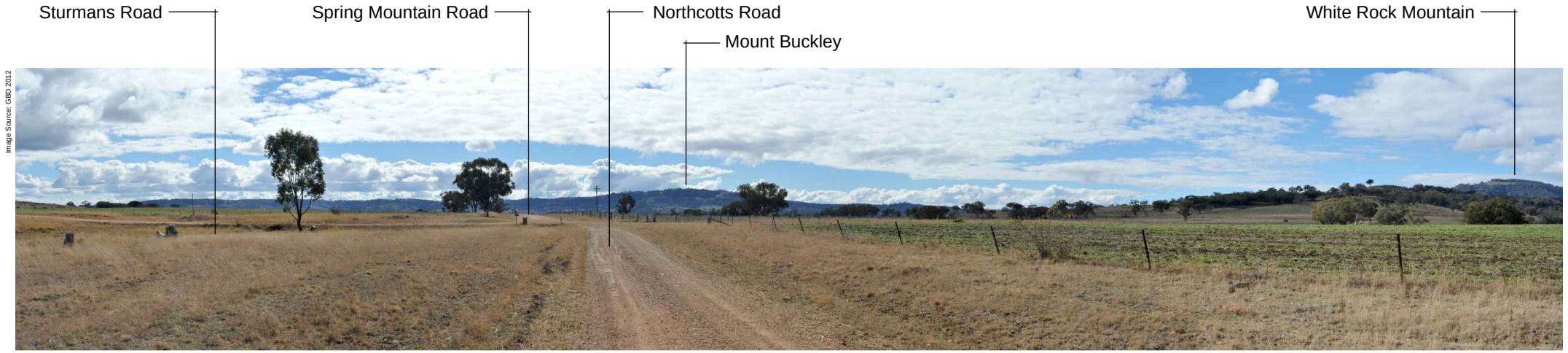

Photo Location P2- View north to east from Northcotts Road

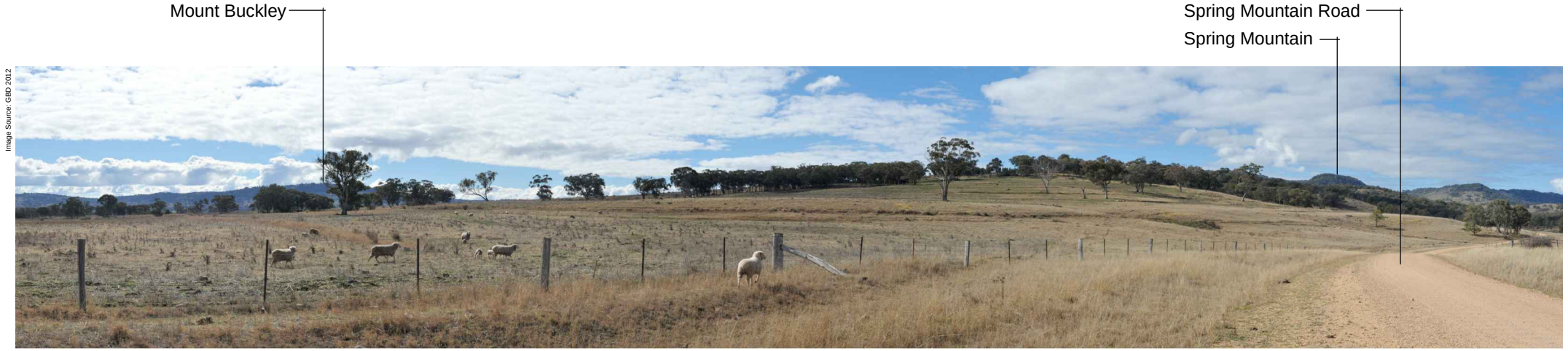

Photo Location P3- View north to east from Spring Mountain Road

Figure M06
Panorama Photo P2 & P3

Image Source: GBD 2012

Photo Location P4- View north from Sturmans Road

Sturmans Road

Image Source: GBD 2012

Photo Location P5- View north to north west from Sturmans Road

Figure M07
Panorama Photo P4 & P5

Photo Location P6- View east to south east from Spring Mountain Road

Figure M08
Panorama Photo P6

alignment. It is also considered that whilst some structures will be noticeable from areas beyond a 2km viewshed, they are unlikely to appear as a dominant visual element within the landscape at this distance or result in any significant visual impact.

The view catchment is a theoretical area, where views toward the alternative alignment could, in some situations, be blocked by buildings, vegetation or local landform features at specific points within the 2km offset, and similarly glimpses of the alternative transmission line or substation will be available from isolated positions outside the view catchment area.

1.7 Visual Absorption Capability

Visual Absorption Capability (VAC) is a classification system used to describe the relative ability of the surrounding landscape to accept modifications and alterations without the loss of landscape character or deterioration of visual amenity. VAC relates to physical characteristics of the landscape that are often inherent and often quite static in the long term. Undulating areas with a combination of open views interrupted by groups of trees and small forested areas will have a high capability to visually absorb the alternative transmission line without significantly changing its amenity. On the other hand, areas of cleared vegetation on level ground with limited screening, or areas spanning across prominent ridgelines without significant vegetation, will have a lower capability to visually absorb the alternative transmission line without changing the visual character and potentially reducing visual amenity.

Given the extent and combination of existing natural and cultural character along the alternative transmission line route, the capability of the landscape to absorb the key components of the transmission line and the switchyard/substation is considered moderate to high.

1.8 Visual Assessment

This VIA identified 5 residential dwellings within the alternative transmission line or proposed substation 2km offset, as well as 3 local unsealed roads across which the alternative transmission line will span. The following table outlines each location, distance from the alternative alignment and substation, context of existing view toward the alternative alignment, overall visibility and potential for visual impact.

Table 1 Visual Assessment Matrix

View Location	Approximate distance from:		View context	Overall visibility and potential impact
	132kV route	Sub-station		
Residential dwelling R123	1.7 km	6.1 km	Distant views north from the residential dwelling and its immediate curtilage toward the proposed alternative 132kV alignment will be largely screened by an undulating landform as well as an established tree cover across surrounding slopes.	Nil/low
Residential dwelling R124	919 m	2.7 km	Medium to long distance views from the residential dwelling and its immediate curtilage will be partially screened by tree cover within the vicinity of the dwelling. The alternative 132kV alignment will also be viewed against a backdrop of sloping hillside with scattered tree cover. The alternative alignment may be visible as it crosses a low ridgeline descending south west toward a creek line.	Low
Residential dwelling R125 (Associated landowner)	300 m	3.6 km	Short distance views extend north from the residential dwelling and its immediate curtilage toward the alternative 132kV alignment. Views will be partially screened by tree cover within the vicinity of the dwelling. The alternative 132kV alignment will also be viewed against a backdrop of sloping hillside with scattered tree cover.	Low
Residential dwelling R126 (Associated landowner)	818 m	5.3 km	Distant views south to south east from the residential dwelling and its immediate curtilage will be largely screened by tree cover between the residential dwelling and the alternative 132kV transmission line.	Low
Residential dwelling R142 (Associated landowner)	1.9 km	2.3 km	Distant views south from the residential dwelling and its immediate curtilage will be blocked by a landform sloping gently up toward a low ridgeline south of the residential dwelling.	Nil
Motorists on Spring Mountain, Northcotts and Sturmans Roads	Varies	>5km >5 km 3-5 km	View distance from vehicles travelling along short sections of local unsealed roads will vary, with some power line structures proximate to view points where the alternative alignment spans road corridors. Views will tend to be of short duration and limited by direction of travel.	Low

A total of 5 residential dwelling locations were identified through the desk top study. An assessment of the visibility rating for each residential dwelling location determined that:

- 1 of the 5 view locations have been determined to have a **nil** visibility rating and
- 4 of the 5 view locations have been determined to have a low visibility rating.

The proposed substation/switchyard will be located approximately 2.3km from the nearest residential view location (R142) and is unlikely to be visible due to landform and vegetation blocking views. The proposed substation/switchyard will have a low level of visibility from distant view locations within the surrounding landscape and is unlikely to be visible from the Gwydir Highway.

The existing 330kV lattice towers in the vicinity of the alternative substation/switchyard location are not visible from the Gwydir Highway to the north of the substation location due to intermediate terrain. The lattice towers are higher than the substation gantry structures will be.

The Swan Brook Rest Area (see below) is approximately 3.7km northeast of the proposed substation location. It occurs adjacent the Gwydir Highway and Swan Brook. No view of the proposed facilities and structures is anticipated.

Plate 1 – The Swan Brook Rest Area adjoining the Gwydir Highway

1.9 Mitigation

Although the overall visual impact is relatively low, potential mitigation measures may be developed where possible to avoid, reduce and offset the level of visual impact associated with the alternative 132kV transmission line and substation/switchyard facilities. Wherever possible, pole angle positions will be selected and placed in strategic locations to minimise potential visual impact (e.g. avoiding, where possible, skyline views) and to provide a maximum setback from residences and roads. The selection of construction materials

will consider use of low reflectivity material to reduce the potential for sunlight glint. This latter mitigation applies equally to the substation and switchyard facility.

1.10 Conclusion

The alternative 132kV transmission line and switchyard/substation will be located in a landscape with a moderate to high visual absorption capability. The existing physical characteristics of the landscape surrounding the alternative transmission line and substation will tend to reduce the overall visibility and visual impact of the alternative connection facilities.

There are a very low number of people travelling through, or residing in the landscape surrounding the alternative transmission line alignment and connection facilities.

Views from vehicles travelling along short sections of local roads will extend toward the alternative transmission line, including locations where the alternative transmission line spans Spring Mountain, Northcotts and Sturmans road corridors; however, the duration of view is likely to be very short.

The Gwydir Highway is approximately 2.4km to 4km north of the alternative transmission line route. Terrain will obstruct views to the section of line west of Spring Mountain Road but the line to the east of Spring Mountain Road may be intermittently visible at distances of 3 to 4km but resulting in a low visual impact.

Views toward the alternative 132kV transmission line alignment from residential dwellings within 2km of the alternative alignment are unlikely to result in a high visual impact. Four of the five residential dwellings (R123, R124, R126 and R142) will have restricted views toward the alternative transmission line alignment due to surrounding topography and vegetation. One residential dwelling (R125) will have potentially short distance views toward a short section of the alternative alignment; however, existing tree cover will partially obscure views. The alternative location for the substation/switchyard connection to the existing 330kV transmission line is unlikely to result in any significant visual impact with views from surrounding receiver locations largely screened by scattered tree cover and landform.

The visual impact of the alternative 132kV transmission line and substation can be further reduced by adopting the mitigation measures outlined in Section 1.9.