APPENDIX F

SURFACE WATER ASSESSMENT

APPENDIX F

Advisian

WorleyParsons Group

Boral Resources (NSW) Pty Ltd

Peppertree Quarry Modification 4

Surface Water Assessment

February 2016

Version Control

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Table of Contents

List of Figures

List of Tables

List of Abbreviations

AEMR	Annual Environmental Management Report
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
ARI	Average recurrence interval
ARMCANZ	Agriculture and Resources Management Council of Australia and New Zealand
Boral	Boral Resources (NSW) Pty Ltd
BoM	Bureau of Meteorology
CAP	Catchment Action Plan
EC	Electrical Conductivity
EA	Environmental Assessment
EPA	Environmental Protection Authority
EP&A Act	Environmental Planning and Assessment Act 1979
EPL	Environmental Protection Licence
HRC	Healthy Rivers Commission
NWQMS	National Water Quality Management Strategy
PoEO Act	NSW *Protection of the Environment Operations Act 1997*
SEPP	State Environmental Planning Policy
SWMOP	State Water Management Outcomes Plan
SWA	Surface Water Assessment
The Quarry	Peppertree Quarry
The Project	Peppertree Quarry Modification 4
WMA	*Water Management Act 2000*
WQOs	Water Quality Objectives
WSP	Water Sharing Plan

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1 Introduction

1.1 Background

Boral Resources (NSW) Pty Ltd (Boral) owns and operates the Peppertree Quarry (the Quarry), a hard rock quarry located in Marulan South, New South Wales.

Boral is seeking to modify the current Project Approval (PA 06_0074) under Section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act), to provide for the following:

- Extend daily in-pit operating hours at the Quarry by 6 hours; and
- Develop a new overburden emplacement area.

The modification proposed above will constitute Modification 4 to the current Project Approval.

This Surface Water Assessment has been prepared by Advisian on behalf of Boral. This document is an appendix to the Environmental Assessment (EA) for the proposed Peppertree Quarry Modification 4 project ("the Project").

The Quarry is located in Marulan South, 10 kilometres (km) southeast of Marulan, 35 km east of Goulburn and approximately 175 km south-west of Sydney, within the Goulburn Mulwaree Local Government Area (LGA) in the Southern Tablelands of NSW (Figure 1.1). Access is via Marulan South Road, which connects the Quarry and Boral's Marulan South Limestone Mine with the Hume Highway approximately 9 km to the northwest. Boral's private rail line connects the Quarry and Limestone Mine with the Main Southern Railway approximately 6 km to the north.

The Quarry is located on Boral owned land approximately 650 hectares (ha) in size, which includes the Quarry site, approximately 70 ha in size, and additional granodiorite resources to the south and surrounding land.

1.2 Project Outline

The aspects of Project that are relevant to this report are outlined below.

Overburden emplacement at the Quarry is currently approved within noise bunds located along the northern and eastern boundaries of the site, an emplacement area to the east of the approved quarry pit and a western emplacement area and noise bund to the west of the Quarry across Boral's private railway line. Remaining overburden was proposed to be emplaced within the south pit of Boral's adjoining Limestone Mine.

The noise bunds were completed during construction of the Quarry, and the eastern overburden emplacement area will reach capacity in early 2016. Mine planning for the Limestone Mine has ruled out emplacement within the south pit. The Limestone Mine, under its forthcoming development application, is seeking to hold 5 million m^3 (approximately 13 Mt) of overburden for the Quarry, however, this will not be approved until late 2016. As an interim measure, Boral is seeking to place approximately 1 million m^3 of overburden within a new overburden emplacement, to the south of the approved 30 year quarry pit (shown in green in Figure 1.2). Overburden stripped from the pit will be transported by trucks along the most direct haul route possible (see Figure 1.2). This new overburden emplacement area will be needed in early 2016 and will take approximately 12 months to establish.

The proposed new overburden emplacement will be located within the south-eastern extent of the future hard rock (granodiorite) resource, which extends south from the existing Quarry pit, to the northern end of the Limestone Mine's north pit. A significant granodiorite resource also exists on Boral's lands to the north of the existing Quarry pit, extending northwards from Tangarang Creek. The proposed southern overburden emplacement will not sterilise resource as Boral will relocate this southern emplacement in the future if the southern granodiorite resource needs to be accessed. Although the southern overburden emplacement may be relocated in the future, this is unlikely to be required for at least the next 25 years. The proposed emplacement will therefore be landscaped and rehabilitated in accordance with the existing *Peppertree Quarry Landscape and Rehabilitation Management Plan*.

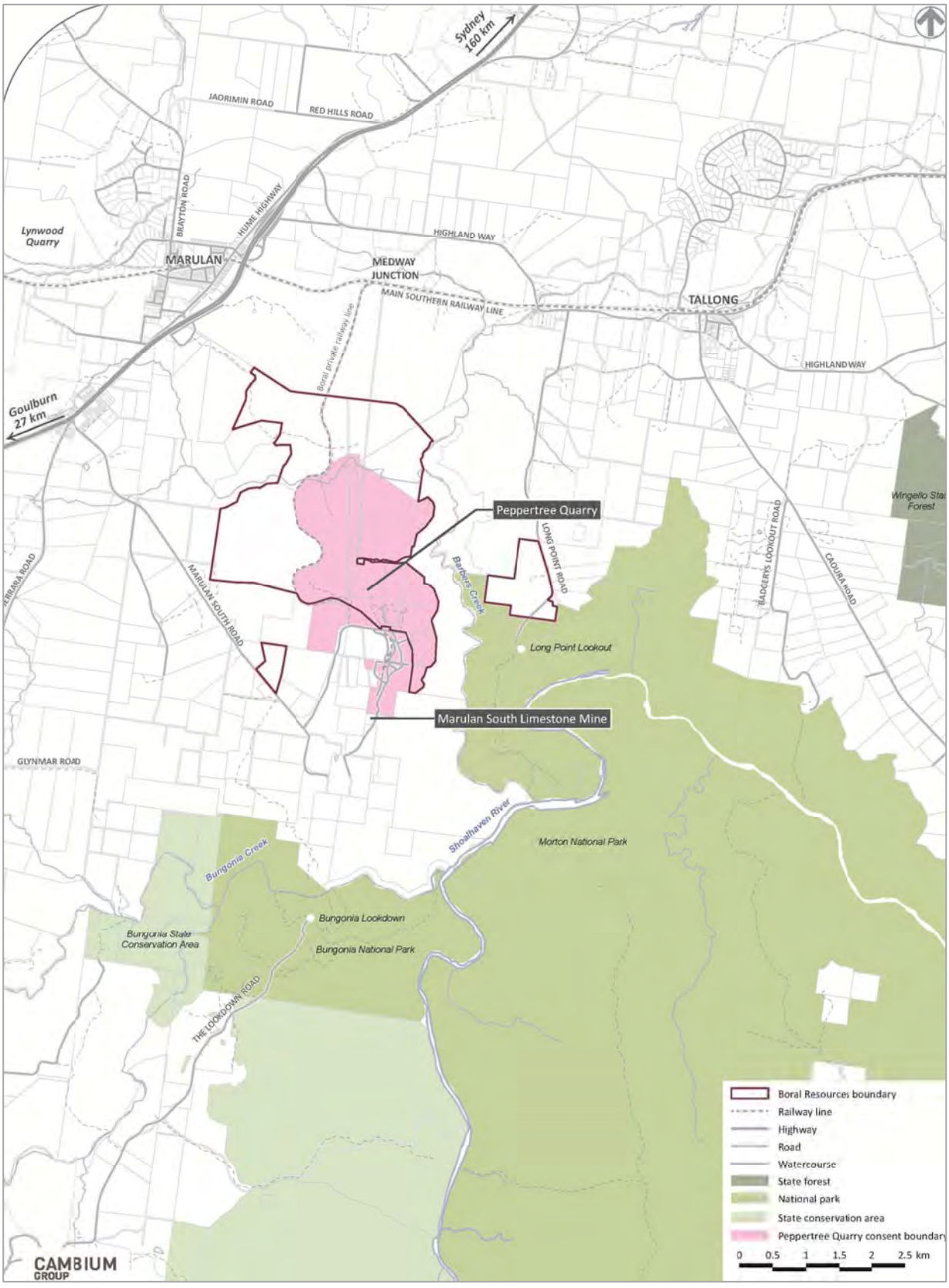

Figure 1.1: Local Context

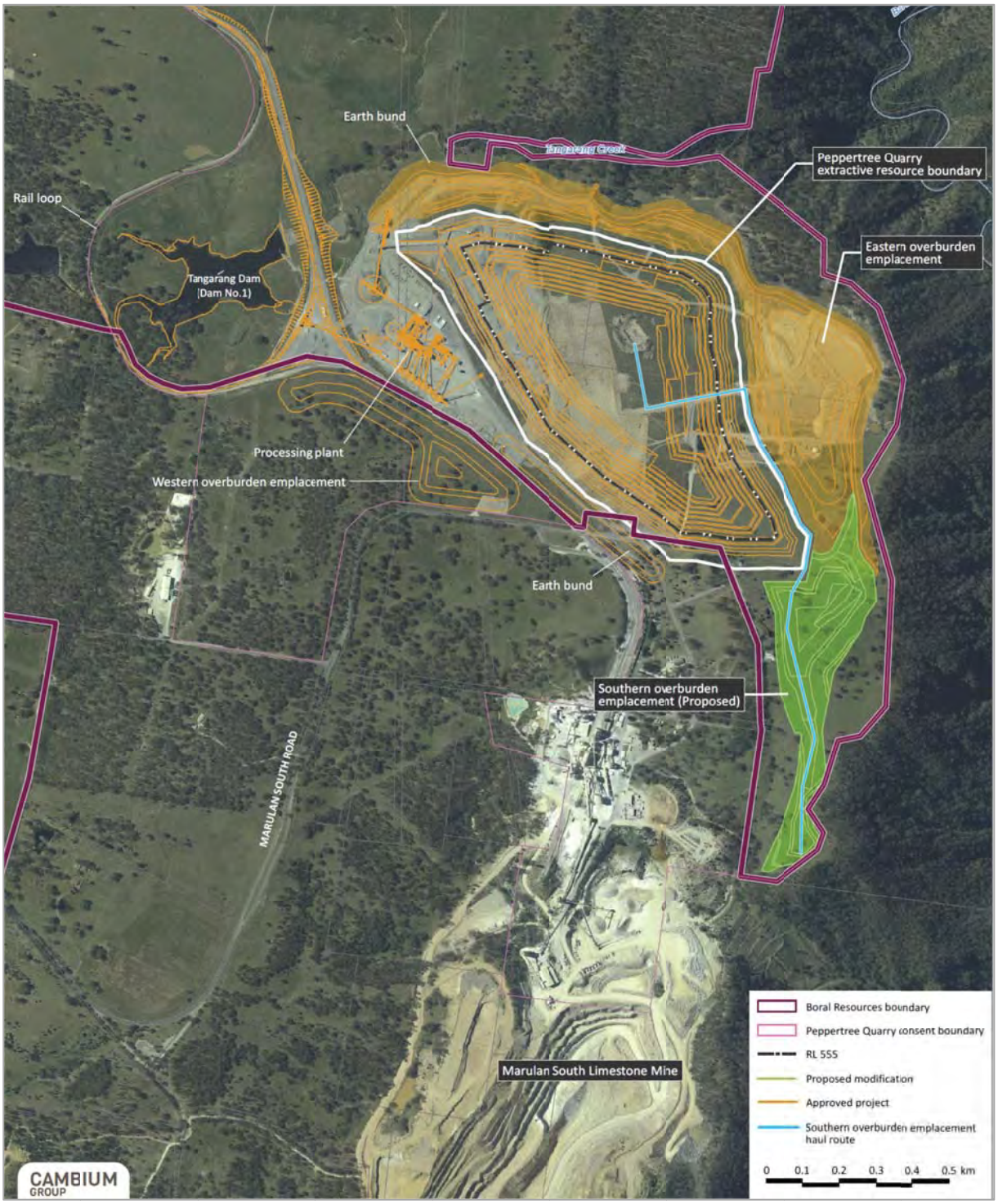

Figure 1.2: Peppertree Quarry Layout

1.3 Scope of this Report

This Surface Water Assessment (SWA) provides an assessment of the potential surface water impacts of the proposed Southern Overburden Emplacement (the emplacement) and documents the relevant mitigation measures. Specifically, this report:

- Identifies legislation, policy and guidelines relevant to the Project (Section 2);
- Documents the existing catchment conditions and water quality in the receiving waters (Section 3);
- Describes the proposed water management system for the Project (Section 4);
- Provides an assessment of the impacts of any changes in the flow and water quality resulting from the proposed Project, and the proposed mitigation; (Section 5); and
- Identifies monitoring and licensing requirements or other approvals that relate to water use, management and discharge (Section 6).

2 Relevant Legislation, Policy and Guidelines

A range of legislation, policies, regulations and guidelines contain relevant considerations for the assessment of the surface water related aspects for the Project. Key issues that have been considered in finalising the details of the Project are set out below.

2.1 Legislation

2.1.1 Water Management Act and Water Act

The aim of the *Water Management Act 2000* (WMA) is to provide for the sustainable and integrated management of the water sources of NSW for the benefit of both present and future generations and defines rules for management of surface water and groundwater in NSW. The *Water Act 1912* and the WMA contain provisions for the licensing of water capture and use. If any dams are proposed as part of the water management, consideration must be given to whether the dams need to be licensed.

Water sharing plans (WSPs) have been developed for rivers and groundwater systems under the WMA. The WSPs relevant to the Project are described in further detail in Section 2.2.5 below.

2.1.1.1 Harvestable rights

Harvestable rights orders made by the Minister under Section 54 of the WMA give a landholder the right to capture 10% of the average regional rainwater runoff on the land by means of a dam or dams having not more than the total capacity calculated in accordance with Schedule 1 of the orders, providing such structures are located on minor streams only (i.e. first and second order streams). This water can, in most cases, be used for any purpose.

Clause 91B of the WMA lists offences for constructing or using water supply work without, or otherwise than as authorised by, a water supply work approval. Clause 36 of the Water Management (General) Regulation 2011 provides exemptions for both construction and use of certain classes of water storage structures as set out in Schedule 1 of the Regulation.

Schedule 1(3) of the NSW Water Management (General) Regulation 2011 provides for the following exclusion; "*Dams solely for the capture, containment and recirculation of drainage and/or effluent, consistent with the best management practice or required by a public authority (other than Landcom or the Superannuation Administration Corporation or any of their subsidiaries) to prevent the contamination of a water source, that are located on a minor stream.*"

There is no restriction on the use of water from dams that comply with this provision. These provisions are applicable to any erosion and sediment control basins constructed to control runoff from emplacements until such time as the vegetation has established to the point when sediment runoff is minimal.

All sediment basins associated with the Project will be constructed and operated for the purposes of sediment control, and are therefore excluded from the requirements of the harvestable rights order and do not require licensing under the WMA.

2.1.2 Protection of the Environment Operations Act 1997

The NSW *Protection of the Environment Operations Act 1997* (PoEO Act) and the NSW *Protection of the Environment Operations (General) Regulation 2009* set out the general obligations for environmental protection. The PoEO Act is relevant to the Project as it contains requirements relating to the prevention of the pollution of waters.

The current Environmental Protection Licence (EPL No. 13088, version date 23 September 2013) does not currently specify any surface water requirements.

2.1.3 SEPP (Sydney Drinking Water Catchment) 2011

The Project is located within the Sydney Drinking Water Catchment. The *State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011* (SEPP (Sydney Drinking Water Catchment)) aims to provide for healthy water catchments, delivering high quality water while permitting development that is compatible with that goal. The Policy also aims to support the maintenance or achievement of the water quality objectives for the Sydney drinking water catchment and requires developments to demonstrate a neutral or beneficial effect (NorBE) on water quality.

The proposed sediment control basins that will collect runoff from the eastern side of the proposed Southern Overburden Emplacement (which will discharge to Barbers Creek) will be constructed and operated in accordance with the requirements for discharge to 'sensitive environments' as set out in *Managing Urban Stormwater: Soils & Construction, Volume 2E – Mines and Quarries* (DECC, 2008). Following construction the emplacement will be revegetated to a standard that minimises erosion. These management actions will ensure that the Project complies with the requirements of SEPP (Sydney Drinking Water Catchment).

2.2 Policies and Plans

Relevant issues related to NSW State Government natural resource management policies and guidelines that have been considered in relation to surface water management for the Project are set out below.

2.2.1 National Water Quality Management Strategy

The National Water Quality Management Strategy (NWQMS) is a joint national approach to improving water quality in Australian and New Zealand waterways. It was originally endorsed by the former Agriculture and Resources Management Council of Australia and New Zealand (ARMCANZ) and the former Australian and New Zealand Environment and Conservation Council (ANZECC). Since 1992 the NWQMS has been developed by the Australian and New Zealand Governments in cooperation with state and territory governments.

The NWQMS aims to protect the nation's water resources by improving water quality while supporting the businesses, industry, environment and communities that depend on water for their continued development. The main mechanism for promoting this aim has been the publication of a number of water quality guidelines, including the NSW Water Quality and River Flow Objectives and the ANZECC Guidelines. However, in the case of the Shoalhaven River catchment, the specific requirements of the *Independent Inquiry to Shoalhaven River System* (Healthy Rivers Commission, 1999 – see below) take precedence.

2.2.2 Healthy Rivers Commission

Barbers Creek is a sub-catchment of the Shoalhaven River. The Healthy Rivers Commission's (HRC) *Independent Inquiry into the Shoalhaven River System* (HRC, 1999) endorsed the following environmental values for the Shoalhaven River and its tributaries:

- Healthy waters – protection of aquatic ecosystems;
- Recreation – protection of primary and secondary recreation and visual amenity;
- Water supplies – protection of livestock, irrigation and farmstead water; and
- Protection of drinking water to be treated with coarse screening and disinfection, within sections of stream where water is extracted for use in urban water supply.

HRC (1999) recommended that the water quality criteria specified in the prevailing water quality guidelines published by NHMRC/ ARCANZ/ANZECC for primary and secondary contact recreation and for drinking water supplies should be adopted as water quality objectives (WQOs) throughout the Shoalhaven catchment. The ANZECC Guidelines provide the technical guidance to assess the water quality needed to protect the WQOs.

2.2.3 State Water Management Outcomes Plan

The *Water Management Act 2000* provides for the establishment of the *State Water Management Outcomes Plan* (SWMOP) to set out the over-arching policy context, targets and strategic outcomes for the development, conservation, management and control of the State's water sources.

The SWMOP promotes the objects of the WMA and its water management principles and seeks to give effect to the NSW Government's salinity management strategies. The SWMOP provides for the protection and enhancement of the environmental services provided by aquatic ecosystems while delivering a framework for the use of water to meet human needs, including more secure access licences. The SWMOP details the Government's commitment to manage the linkages between environment, human health, communities and industries.

The Project is consistent with the objectives of the SWMOP, both within the Project area and on downstream users, as avoidance and mitigation measures would be implemented to minimise potential impacts on the creeks and rivers associated with release of treated water.

2.2.4 Southern Rivers Catchment Action Plan

The *Southern Rivers Catchment Action Plan* (CAP) 2013–2023 is an overarching 10-year plan that has been developed to guide the implementation of natural resource management in the Southern Rivers region, in collaboration with a range of partners.

The Southern Rivers CAP 2023 lists a number of objectives and targets for the Southern Rivers region, which includes the Shoalhaven River catchment. This includes the following objectives pertaining to surface water:

- Private and public land and water managers make well-informed decisions about use and care of natural resources;
- Private and public land and water managers effectively respond and adapt to change;
- Diverse, healthy, connected and productive natural environments;
- Health and integrity of natural habitat supports people and the environment; and
- Fresh water, estuarine and marine assets support people and the environment.

The *Southern Rivers CAP 2023 Paper – Water* describes the desired state of rivers within the region that support water quality, quantity and movement:

- Good geomorphic condition, close to reference condition for the particular Riverstyle;
- Natural hydraulic function—balance for surface and base flows;
- Functional connectivity within stream, to adjacent floodplains, between surface and groundwater;
- Healthy and diverse native aquatic fauna;
- Water quality supports community uses and values suitable for human consumption that meet ANZECC guidelines 100% of the time; and
- Sufficient riparian buffers to manage pollution sources.

2.2.5 Surface Water Sharing Plans

Water Sharing Plans (WSPs) establish rules for sharing water between river environmental needs and water users. The Project is located within the area of the Greater Metropolitan Region Unregulated Area WSP and three surface water sources within the WSP as follows:

- Bungonia Creek Management Zone (commenced July 2011);
- Barbers Creek Management Zone (commenced July 2011); and
- Shoalhaven River Gorge Management Zone (commenced July 2011).

Peppertree Quarry is located within the Barbers Creek Management Zone and has a Water Access Licence for 145 ML/year (Licence 10SL056926).

3 Surface Water Environment

3.1 Overview

3.1.1 Location and Existing Topography

The Quarry is located within the catchment of the Shoalhaven River on a ridge line west of Barbers Creek Gorge, and generally at the eastern edge of a plateau above the Shoalhaven River. Tangarang Creek, a tributary of Barbers Creek drains along the northern boundary of the Quarry. Barbers Creek joins the Shoalhaven River about 6.5 km downstream of the Quarry.

Land elevations in the vicinity of the Quarry range from 590 m AHD to 610 m AHD. The proposed overburden emplacement is located on a north-south ridge with levels along the ridge line varying from about 610 m AHD at the northern end to about 590 m AHD at the southern end with a maximum of 612 m AHD near the centre of the emplacement.

The land is mainly open grassland with a few scattered clumps of trees. Slopes range from less than 1% on the ridge line to about 20% near the drainage lines.

3.1.2 Existing Surface Drainage

The area to be covered by the proposed Southern Overburden Emplacement currently drains as follows:

- A series of small catchments ranging in size from about 1 ha to 7 ha drain in an easterly direction into steep gullies that drain to Barbers Creek, which is located approximately 400 m east of the project approval boundary; and
- The western side of the ridge drains to a drainage line that flows in a southerly direction into the North Pit of the Limestone Mine. At a location adjacent to the southern end of the proposed emplacement, this drainage line has a catchment an area of about 20 ha.

All drainage lines on either side of the ridge are first order streams as per the Strahler Stream Order system.

Barbers Creek, into which much of the proposed emplacement drains, is a fifth order stream and has a catchment area of about 90 km^2.

3.2 Existing Quarry Water Management

Surface water within the Quarry site is managed in accordance with the *Peppertree Quarry Water Management Plan* (ERM, 2011). The surface water management system includes a number of sediment basins that capture stormwater runoff from disturbed areas (overburden emplacements, haul roads and processing plant) which is then directed northwards (through pumping or gravity flow) into Tangarang Dam.

Figure 3.2 shows the layout of the existing drainage system for the Quarry. Catchments shaded orange all drain to the Quarry pit from where water is either used for dust suppression purposes or pumped to Tangarang Dam. Tangarang Dam acts as a supplementary water supply dam for the Quarry and, as required by the Conditions of Consent, provides environmental flow downstream of the dam equivalent to at least 10% of the average daily flow.

Tangarang Dam is located on the main ephemeral creek, Tangarang Creek, which flows along the northern edge of the Quarry site to Barbers Creek approximately 500 m to the east of the Quarry. Upstream of the dam, Tangarang Creek is a fourth order stream with a catchment area of about 615 ha. Barbers Creek flows into the Shoalhaven River 6.5 km downstream of the Quarry and 30 km upstream of Tallowa Dam, which supplies raw water to the Sydney and Illawarra drinking water systems.

The catchments shaded green on Figure 3.2 all drain to a series of small sediment basins, mainly located on the outer edge of the northern noise bund or the eastern side of the Eastern Overburden Emplacement. These basins drain either to Tangarang Creek or Barbers Creek.

3.3 Rainfall

Collection of continuous weather records at the Quarry was commenced in 2005/6. However, the Bureau of Meteorology (BoM) daily rainfall records provide a more comprehensive records of the long term climate of the area. Table 3.1 provides the rainfall statistics for daily rainfall records (1883 – 2014), sourced primarily from the Bureau of Meteorology (BoM) weather station at Marulan (George St), while Figure 3.1 summarises the monthly statistics.

Table 3.1: Rainfall Statistics for Combined Rainfall Record

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average	70	70	69	53	51	63	48	45	47	59	59	63	696
Minimum	0	0	0	0	0	0	0	0	0	1	0	0	288
5%ile	8	3	4	3	4	6	7	5	14	8	5	2	418
Median	62	55	49	41	31	41	32	33	39	48	51	53	669
95%ile	172	178	190	142	148	189	146	132	105	142	126	160	1,065
Maximum	262	298	330	233	406	406	319	224	197	263	248	204	1,469

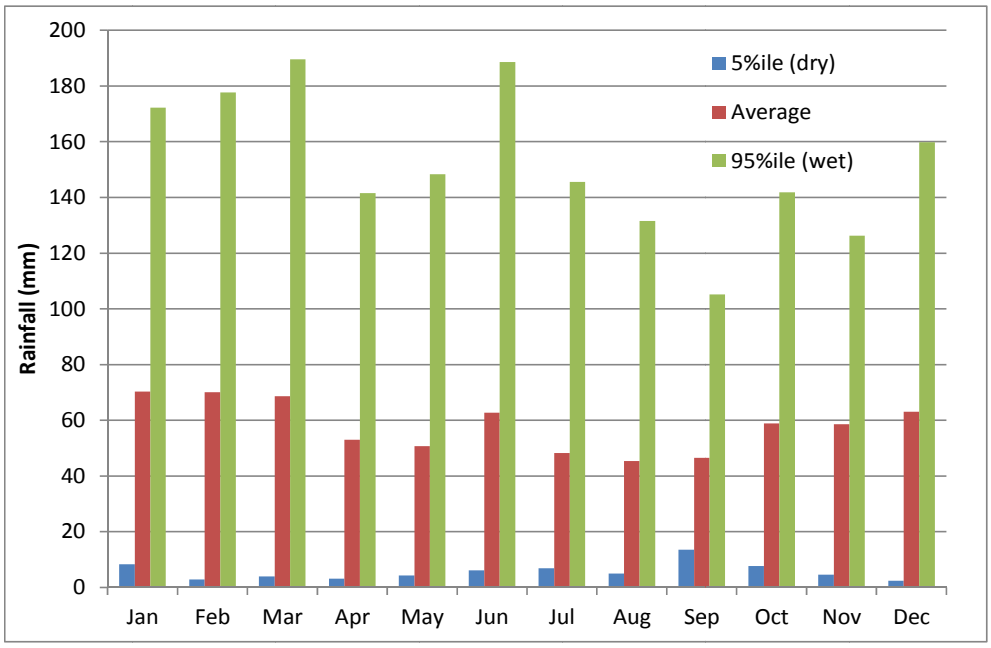

Figure 3.1: Monthly Rainfall Analysis (1883 - 2014)

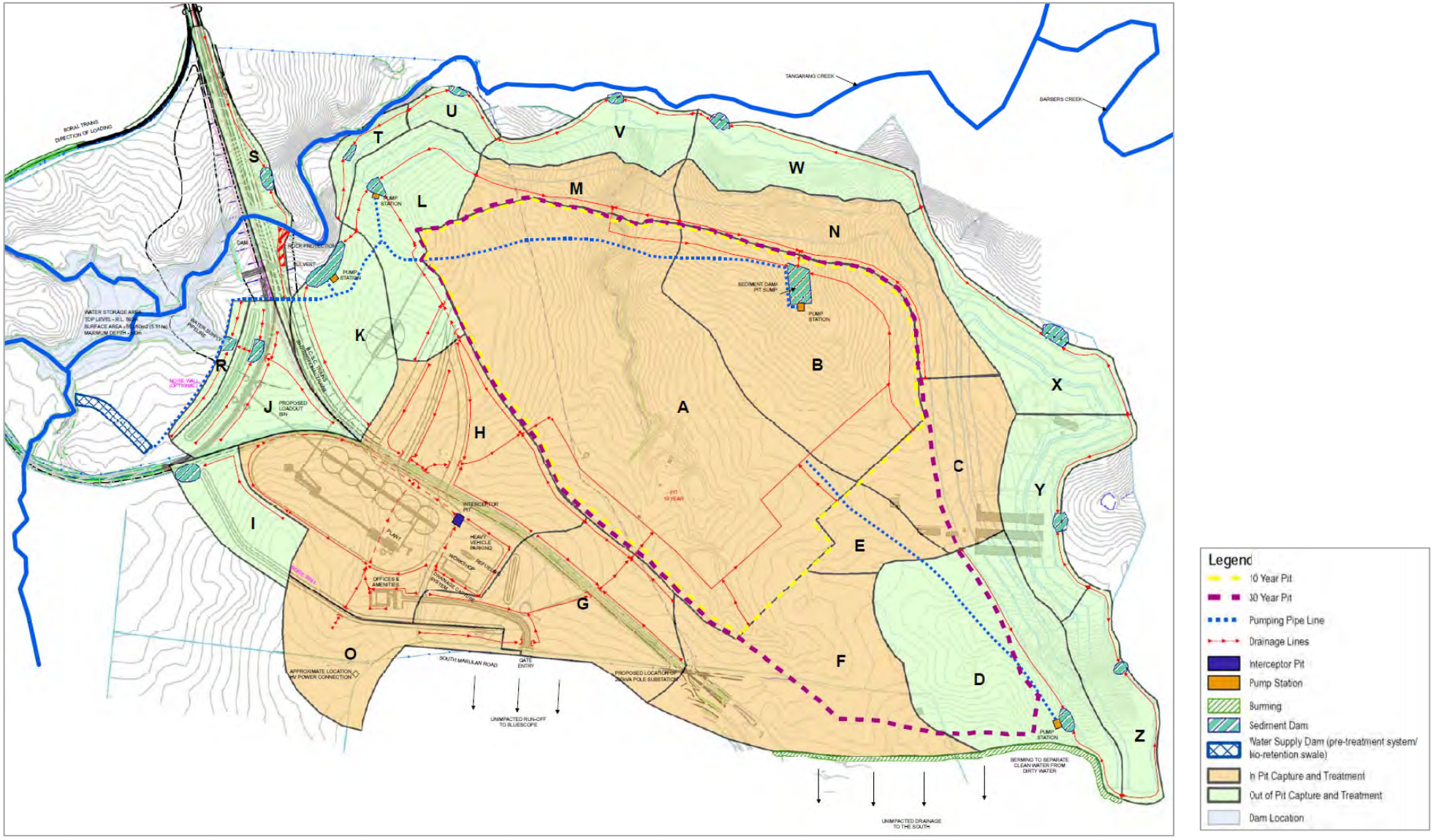

Figure 3.2: Peppertree Quarry Operational Drainage Plan
(Source: Peppertree Quarry Water Management Plan, Figure 3.2b)

The statistics show that average annual rainfall in the vicinity of Peppertree Quarry is approximately 696 mm. Peak precipitation occurs in the summer months, with lower rainfall in winter. On average, January and February are the wettest months of the year and August is the driest. In 95th percentile wet years the annual rainfall can be up to 1,065 mm while in a 5th percentile dry year it can be as low as 418 mm.

For purposes of this report, the key rainfall characteristics are:

- Rainfall intensity (for purposes of the design of water conveyance structures); and
- Five day rainfall as set out in Table 6.3 of *Managing Urban Stormwater: Soils & Construction – Volume 1* (Landcom 2004) (for purposes of designing the runoff storage capacity of sediments basins).

3.3.1 Rainfall Intensity

In 2013, BoM updated rainfall rainfall frequency- duration-depth data that was originally published in 1987. For purposes of assessing the required capacity of structures to convey peak flows, rainfall frequency- duration-depth data from the 2013 data has been used. Relevant aspects of this data applicable to the design of site water conveyance structures is summarised in Table 3.2.

Table 3.2: Rainfall Frequency / Duration / Depth (mm) Data for Marulan South

Duration	Annual Exceedance Probability (AEP)					
	0.5	0.2	0.1	0.1	0.02	0.01
5 min	6.3	8.5	10.1	11.7	13.8	15.5
10 min	9.9	13.6	16.3	19.0	22.7	25.6
15 min	12.2	16.9	20.2	23.6	28.2	31.9
30 min	16.4	22.4	26.7	31.0	36.9	41.5
1 hour	20.7	27.8	32.8	37.8	44.6	49.9
2 hour	25.9	34.2	40.0	45.8	53.6	59.8
3 hour	29.7	39.1	45.6	52.2	61.0	68.0

3.3.2 Five Day Rainfall

For purposes of determining the required capacity, the sediment basins have been provisionally sized to comply with the requirements for capture of fine and dispersive sediments as set out in Table 6.1 of *Managing Urban Stormwater: Soils and Construction: Volume 2E Mines and Quarries* (DECC, 2008). The table specifies the adoption of the 95th percentile rainfall as the basis for sizing sediment basins that would overflow into 'sensitive' environments. Table 3.3 lists the 95th percentile rainfall depths for various durations for Mittagong and Goulburn (as set out in Table 6.3 of *Managing Urban Stormwater: Soils & Construction – Volume 1*. The value for Marulan South has been derived on the basis of the relative proximity of the Quarry to Mittagong and Goulburn.

Table 3.3: 95th Percentile Rainfall Depths

Duration (days)	Mittagong (mm)	Goulburn (mm)	Marulan South (mm)
2	49.1	27.4	35.0
5	75.2	40.8	52.8
10	110.4	60.8	78.2
20	164.6	97.1	120.7

3.3.3 Climate Change

The NSW and ACT Regional Climate Modelling (NARCliM) Project (a multi-agency research partnership between the NSW and ACT governments and the University of NSW) has recently (2014) prepared high spatial resolution climate projections for NSW and the ACT. *The South-East and Tablelands Region Climate Change Snapshot* (OEH, 2014) provides the following information about predicted climate change in this region that includes Marulan.

The region currently experiences considerable spatial rainfall variability and from year-to-year. This variability is also reflected in the climate change projections set out in Table 3.4. The table shows the range of percentage change in seasonal and annual rainfall projections for the near future (2030) and far future (2070+) spanning both drying (-ve) and wetting (+ve) scenarios for the vicinity of Marulan. For the near future, the average annual projections range from 5% drier to no change. Conversely, for the far future the average annual projections range from zero to an increase of 5%

Table 3.4: Seasonal Climate Change Rainfall Projections for the Marulan Area

Season	Near Future	Far future
Summer	0% to +5%	+5% to +10%,
Autumn	+5% to +10%	+5% to +10%,
Winter	–10% to -5%.	–5% to 0%
Spring	–10% to -5%.	–5% to 0%
Year	–5% to 0%	0% to +5%

The construction of the Southern Overburden Emplacement is expected to occur over approximately one year and to be fully rehabilitated within 5 years, by which time the sediment basins will no longer be required. Accordingly, climate change effects have not been considered in this assessment.

3.4 Surface Water Quality

This section summarises the available surface water quality information in the vicinity of the Project area.

3.4.1 Monitoring Site Locations

Boral maintains a comprehensive environmental monitoring network within, and surrounding, the Quarry and the adjacent Limestone Mine. Water quality monitoring has occurred at Tangarang Creek since February 2012. Additionally, baseline creek surface water quality monitoring has been undertaken for the Limestone Mine since July 2014, on a monthly basis. The relevant sites for

purposes of this assessment are listed in Table 3.5 and include Marulan Creek which is a tributary of Barbers Creek located to the north (upstream) of Tangarang Creek and Barbers Creek downstream of the Tangarang Creek confluence. Marulan Creek provides additional data showing the typical runoff quality from the open grazing land on the plateau to the west of Barbers Creek from which both Marulan Creek and Barbers Creek drain. In addition, routine monthly monitoring has been undertaken at three locations in the Shoalhaven River (designated SR1, SR2 and SR3).

Table 3.5: Routine Creek Water Quality Monitoring Sites and Locations

Site	Description	Easting	Northing	Commencement of monitoring
U1	Tangarang Creek upstream of Tangarang Dam	226950	6149970	February 2012
T1	Tangarang Creek downstream of Tangarang Dam	228730	6150550	February 2012
Marulan Up	Marulan Creek upstream of proposed dam	225825	6151504	November 2014
Marulan Down	Marulan Creek downstream of proposed dam	228002	6151977	November 2014
Barbers Up	Barbers Creek upstream	229518	6148416	September 2014
Barbers Downn	Barbers Creek downstream	229542	6147306	September 2014
SR1	Shoalhaven River site 1	229183	6145620	July 2014
SR2	Shoalhaven River site 2	229940	6146335	July 2014
SR3	Shoalhaven River site 3	231172	6146891	July 2014

3.4.2 Creek Water Quality

Table 3.6 summarises the average data for key water quality analytes.

Table 3.6: Summary of Creek Water Quality Statistics

Analyte	Unit	Statistic	U1	T1	Marulan Up	Marulan Down	Barbers Up	Barbers Down	SR 1	SR 2	SR 3
pH	pH value	Count	1	22	10	10	11	11	13	13	13
		20%ile	7.9	7.6	7.7	8.0	7.9	8.0	7.2	7.1	7.1
		Median	7.9	8.2	7.8	8.1	8.0	8.1	7.4	7.4	7.4
		80%ile	7.9	8.3	7.9	8.2	8.1	8.1	7.5	7.5	7.5
Electrical Conductivity (EC) @ 25°C	µS/cm	Count	0	0	10	10	11	11	13	13	13
		20%ile			552	650	422	452	83	89	93
		Median			791	832	485	522	92	93	102
		80%ile			1,316	1,168	661	679	110	117	119
Total Dissolved Solids (TDS)	mg/L	Count	1	22	10	10	11	11	13	13	13
		20%ile	186	337	359	423	274	294	54	58	61
		Median	186	464	514	541	315	339	60	60	66
		80%ile	186	638	855	759	430	441	72	76	77

Analyte	Unit	Statistic	U1	T1	Marulan Up	Marulan Down	Barbers Up	Barbers Down	SR 1	SR 2	SR 3
Suspended Solids (SS)	mg/L	Count	1	22	1	1	1	1	1	1	1
		20%ile	<5	<5	7	<5	<5	<5	7	<5	<5
		Median	<5	6.3	7	<5	<5	<5	7	<5	<5
		80%ile	<5	54	7	<5	<5	<5	7	<5	<5
Total Nitrogen as N (TN)	mg/L	Count	0	0	10	10	11	11	13	13	13
		20%ile			0.56	0.38	0.40	0.30	0.30	0.20	0.30
		Median			0.80	0.55	0.40	0.50	0.50	0.40	0.50
		80%ile			0.94	0.70	0.60	0.90	0.70	0.50	0.56
Total Phosphorus as P (TP)	mg/L	Count	1	22	10	10	11	11	13	12	13
		20%ile	0.26	<0.01	0.02	0.01	<0.01	<0.01	<0.01	<0.01	0.01
		Median	0.26	0.01	0.04	0.02	<0.01	<0.01	0.01	0.01	0.01
		80%ile	0.26	0.03	0.10	0.03	0.04	0.03	0.03	0.02	0.03

Key water quality statistics from the various monitoring locations within the waterbodies in the vicinity of the Quarry are compared to the relevant ANZECC default trigger values for ecosystems in Table 3.7 and Table 3.8 below. The analysis indicates that 80th percentile water quality in Marulan, Tangarang and Bungonia Creeks generally does not meet the default trigger values for pH and EC, while the water quality in the Shoalhaven River does. The 80th percentile values for Total Nitrogen as N at all sites exceed the default trigger values while the 80th percentile values for Total Phosphorus as P are exceeded at all sites except one site in the Shoalhaven River.

Table 3.7: Creek Water Quality and Default ANZECC Trigger Values[1]

Analyte	Units	ANZECC Ecosystem[1] Default Trigger Values	No of samples	Median		80%ile		No of samples	Median		80%ile	
				Value	Complies	Value	Complies		Value	Complies	Value	Complies
			Marulan Creek Up					Marulan Creek Down				
pH	pH	6.5 - 7.5	10	7.8	N	7.9	N	10	8.1	N	8.2	N
EC	µs/cm	30 – 350	10	791	N	1316	N	10	832	N	1168	N
TN	mg/L	0.25	10	0.80	N	0.94	N	10	0.55	N	0.70	N
TP	mg/L	0.02	10	0.04	N	0.10	N	10	0.02	Y	0.03	N
			U1 (Tangarang Creek Up)					T1 (Tangarang Creek Down)				
pH	pH	6.5 - 7.5	1	7.9	N	7.9	N	22	8.2	N	8.3	N
EC	µs/cm	30 – 350	0					0				
TN	mg/L	0.25	0					0				
TP	mg/L	0.02	1	0.26	N	0.26	N	22	0.01	Y	0.03	N
			Barbers Creek Up					Barbers Creek Down				
pH	pH	6.5 - 7.5	11	8.0	N	8.1	N	11	8.1	N	8.1	N
EC	µs/cm	30 – 350	11	485	N	661	N	11	522	N	679	N
TN	mg/L	0.25	11	0.40	N	0.60	N	11	0.50	N	0.90	N
TP	mg/L	0.02	11	<0.01	Y	0.04	N	11	<0.01	Y	0.03	N

[1] South East Australia, slightly disturbed ecosystems, upland river

Table 3.8: Shoalhaven River Water Quality and Default ANZECC Trigger Values[1]

Analyte	Units	ANZECC Ecosystem[1] Default Trigger Values	SR1 No of samples	SR1 Median Value	SR1 Median Complies	SR1 80%ile Value	SR1 80%ile Complies	SR2 No of samples	SR2 Median Value	SR2 Median Complies	SR2 80%ile Value	SR2 80%ile Complies	SR3 No of samples	SR3 Median Value	SR3 Median Complies	SR3 80%ile Value	SR3 80%ile Complies
pH	pH	6.5 - 7.5	13	7.4	Y	7.5	Y	13	7.4	Y	7.5	Y	13	7.5	Y	7.6	N
EC	µs/cm	30 – 350	13	92	Y	110	Y	13	93	Y	117	Y	13	102	Y	119	Y
TN	mg/L	0.25	13	0.50	N	0.70	N	13	0.40	N	0.50	N	13	0.50	N	0.56	N
TP	mg/L	0.02	13	0.01	Y	0.03	N	13	0.01	Y	0.02	Y	13	0.01	Y	0.03	N

[1] South East Australia, slightly disturbed ecosystems, upland river

It can be seen that water quality downstream from the Quarry (two sites in Barbers Creek) is significantly better than the water quality upstream of the Quarry (Marulan Creek). It is therefore considered that there is no evidence that the Quarry is adversely impacting the water quality in Barbers Creek.

4 Water Management System

This section describes the water management system for the proposed Southern Overburden Emplacement area. The proposed system would follow the same general principles as those currently implemented at the Quarry as set out in the approved *Peppertree Quarry Water Management Plan* (ERM, 2011):

- Construct sediment basins at the locations on the eastern side of the emplacement where runoff would drain to Barbers Creek. These basins would be sized to comply with the requirements for basins that discharge to 'sensitive' receiving environments in accordance with Table 6.1 in *Managing Urban Stormwater: Soils & Construction, Volume 2E – Mines and Quarries* DECC (2008).
- Operation of the sediment basins to restore the 'capture capacity' of each basin within 5 days of the end of a storm either by re-use of the water for dust suppression or irrigation, or transfer of the water to the Quarry pit from where water would be managed in accordance with the existing *Peppertree Quarry Water Management Plan.*
- Sediment control fencing on the western side of the emplacement where runoff will drain to the northern pit of the adjacent Marulan South Limestone Mine.

4.1 Proposed Overburden Emplacement Drainage Scheme

The proposed drainage arrangements for the Southern Overburden Emplacement follow the same principles as currently employed at the Eastern Overburden Emplacement, which is nearing completion. As shown in Figure 4.1, runoff would be directed as follows:

- Catchments A, B and C would drain eastwards to three small sediment basins that would overflow to existing drainage lines that drain to Barbers Creek;
- Catchments D and E would drain overland to an existing drainage line that drains towards the North Pit of the Marulan South Limestone Mine; and
- Catchment F would drain overland towards the quarry pit.

Table 4.1 summarises the catchment areas and the provisional sizing of the sediment basins in accordance with the requirements of *Managing Urban Stormwater: Soils & Construction, Volume 2E – Mines and Quarries.* The required capacity of each basin is based on the 5 day rainfall of 52.8 mm (Table 3.3) and a volumetric runoff coefficient of 0.72 based on the data in Table F2 of *Managing Urban Stormwater: Soils & Construction* (Landcom, 2004). The required basin volume quoted in Table 4.1 includes an allowance for 50% additional storage for sediment. For purposes of providing indicative water storage areas, an average depth of 2 m has been assumed for the smaller basins and an average depth of 3 m has been assumed for the sediment basin capturing runoff from Catchment B.

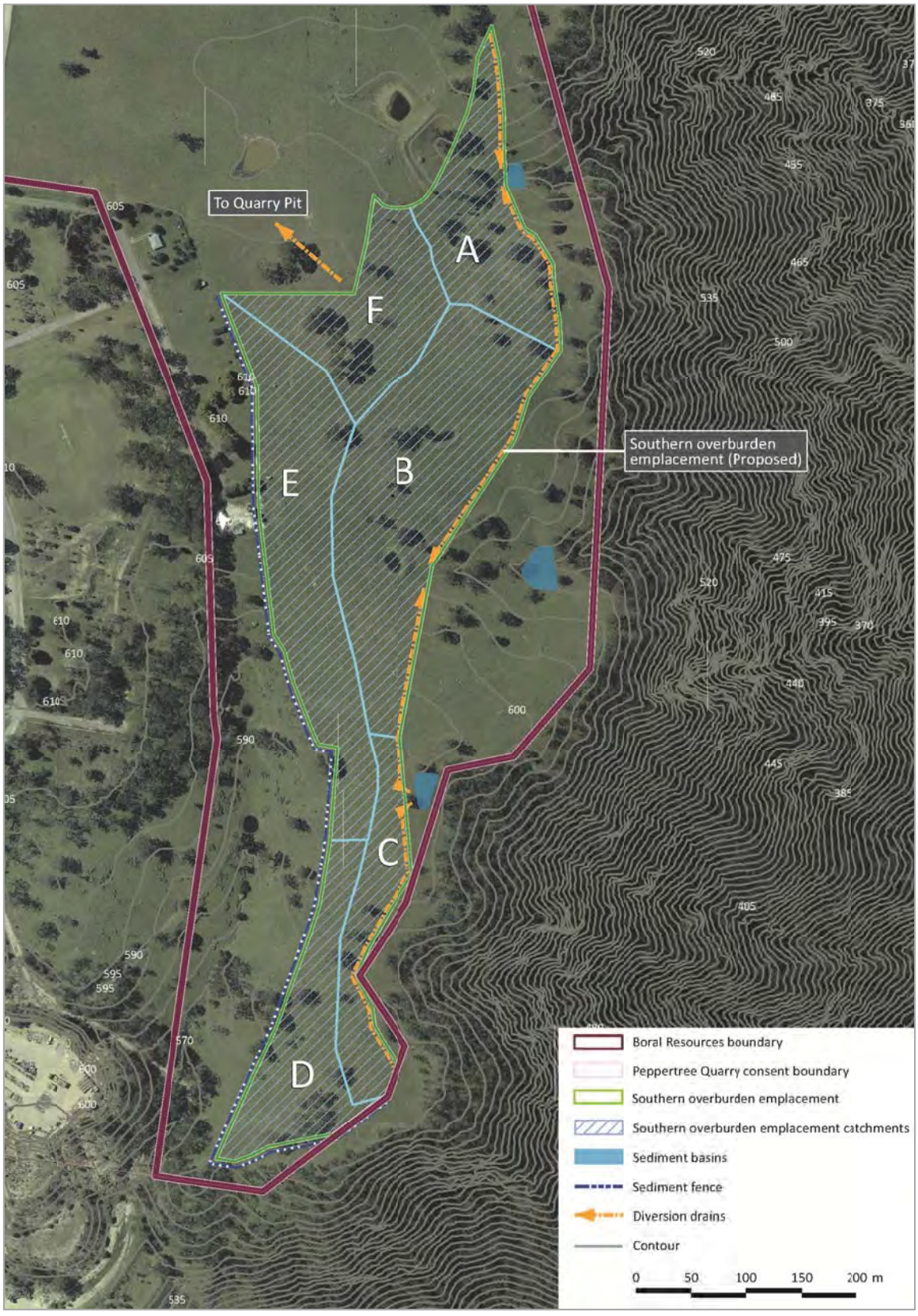

Figure 4.1: Proposed Overburden Emplacement Drainage Concept

Source: Cambium Group, 2016

Table 4.1: Sediment Basin Capacity Requirements

Catchment	Catchment Area (ha)	Basin Volume[1] (ML)	Average Depth (m)	Water Area (m^2)
A	1.7	0.8	2.0	400
B	3.8	1.8	3.0	600
C	1.2	0.6	2.0	280
D	1.6	-	-	-
E	2.8	-	-	-
F	1.7	-	-	-

As shown in Figure 4.1, the western side of the proposed Southern Overburden Emplacement would drain to a drainage line that currently discharges into the north pit of the Marulan South Limestone Mine. Because this drainage line discharges into the North Pit, there is no necessity for sediment basins at this location. As shown in Figure 4.1 a sediment fence would be provided along the toe of the emplacement and runoff would be allowed to drain as overland flow through the existing grass between the emplacement and the drainage line.

As shown in Figure 4.1 Catchment F would drain overland towards the quarry pit (consistent with the existing drainage arrangements for the quarry as shown on Figure 3.2.)

4.2 Runoff Diversion Channels and Spillways

All diversion channels and sediment basin spillways will be designed to be stable when carrying runoff from a 1 in 100 year average recurrence interval (ARI) storm for the time of concentration of each catchment (as specified in Table 6.1 of *Managing Urban Stormwater: Soils & Construction, Volume 2E – Mines and Quarries).*

Because of the natural topography along the alignment of the diversion drains shown on Figure 4.1, channel slopes range from 2.5% to 15% in places. Because of the relatively steep grades encountered along the alignment of the diversion drains, scour protection and drop structures may be required in some locations. Detailed design of the channel cross section and the areas requiring scour protection will be determined during detailed design in accordance with the requirements of *Managing Urban Stormwater: Soils & Construction – Volume 1* and included in a revision of the *Peppertree Quarry Water Managemnt Plan*.

4.3 Sediment Basin Operation

As required in *Managing Urban Stormwater: Soils & Construction, Volume 2E – Mines and Quarries,* sediment basins A, B and C will be operated so as to ensure that the runoff capture capacity of each basin is restored within 5 days of the end of a storm.

The runoff capture capacity of the basins will be restored by either:

- Re-use of water for dust suppression or irrigation to assist with vegetation establishment; or
- Transfer to the Quarry pit via a pipe laid under the emplacement.

In view of the fact that many areas on the outside of the Northern Noise Bund and the Eastern Overburden Emplacement are now fully rehabilitated, and no longer require active management of the associated sediment basins, the volume of water directed into the Quarry water management system from the sediment basins surrounding the Southern Overburden Emplacement (in addition to Catchment F, if required) would be within the operating bounds of the Quarry water management system as set out in the existing *Peppertree Quarry Water Management Plan*.

4.4 Land Disturbance

Land disturbance prior to the placement of overburden would be undertaken in accordance with the procedures set out in the *Peppertree Quarry Water Management Plan* and the *Peppertree Quarry Landscape and Rehabilitation Management Plan* (ERM, 2012). Principally this would involve progressive:

- Disturbance of the minimum area necessary for the proposed phase of work;
- Installation of sediment fencing down-slope of any proposed disturbance;
- Construction of diversion channels and sediment basins;
- Pre-clearance surveys and tree clearing in accordance with the procedures set out in the *Peppertree Quarry Landscape and Rehabilitation Management Plan*; and

4.5 Rehabilitation

Rehabilitation of the proposed Southern Overburden Emplacement would be undertaken progressively as each section of the emplacement is completed. The rehabilitation would be undertaken in accordance with the *Peppertree Quarry Landscape and Rehabilitation Management Plan*.

4.6 Decommissioning of Sediment Basins

Once vegetation establishment has achieved the required surface cover to reduce the erosion rate to negligible, active management of the sediment basins would no longer be required. Sediment basins could either be retained, and allowed to overflow after rainfall, or demolished and the storage area rehabilitated.

Because of the risk of further erosion as a result of runoff flowing through the area of the former sedimentbasins, retention of the sediment basins is preferred.

5 Surface Water Impacts

5.1 Surface Water Flow

The steep slopes and bare surface of the emplacement can be expected to lead to increased rates of runoff compared to the existing conditions. However, the flow downstream of the sediment basins will be moderated by the volume captured in the basins. As indicated in Table 6.2 of *Managing Urban Stormwater: Soils & Construction, Volume 2E – Mines and Quarries*, sediment basins designed to capture runoff from the 95th percentile 5 day rainfall can be expected to overflow 2 to 3 times per year. Therefore, the flow regime in the small creeks draining towards Barbers Creek can be expected to experience a more ephemeral flow regime than currently, while ever the sediment basins are actively managed.

Once the emplacement is fully rehabilitated and the sediment basins no longer actively managed, a relatively normal flow regime would be restored.

5.2 Water Quality

The diversion drains and sediment basins would be constructed and operated in accordance with the requirements for basins that discharge to 'sensitive' downstream environments. Relatively few overflow events can be expected each year on average and these would only occur after particularly heavy rainfall that exceeds the design capacity of the basins, when significant runoff can be expected from other parts of the landscape.

Once the overburden emplacement has been re-vegetated the erosion rate would be small and the sediment discharge into the downstream creeks can be expected to be better than or comparable to the existing landscape. This has been the experience on site to date.

Therefore, no adverse water quality impacts are expected.

The proposed design and operating standard for the sediment basins is consistent with the objective of achieving neutral or beneficial effect of water quality (NorBE) as required under *State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011*.

5.3 Cumulative Impacts

The water quality data in Section 3.4 shows that the existing operations of the Quarry are not having any adverse impact on the water quality downstream in Tangarang Creek or Barbers Creek.

Based on the information provided above, the proposed Southern Overburden Emplacement would have no impact on surface water quality and flow in the surrounding drainage systems.

6 Monitoring, Licencing and Reporting Procedures

All activities associated with the proposed Southern Overburden Emplacement would be carried out and monitored in accordance with the existing *Peppertree Quarry Water Management* and the *Peppertree Quarry Landscape and Rehabilitation Management Plan*. These Plans will be amended where necessary to reflect specific management measures associated with the proposed Southern Overburden Emplacement.

Meteorological monitoring would continue at the Quarry monitoring station and routine surface water quality monitoring would continue at sites U1 and T1 listed in Table 3.5.

6.1 Licensing and Approvals

The project would not require any amendment to the Environmental Protection Licence (EPL No. 13088) or to the existing Water Access Licence (10SL056926).

7 Conclusions

The proposed Southern Overburden Emplacement would cover an area of about 12.8 ha along a ridge line to the south of the approved Peppertree Quarry Eastern Overburden Emplacement.

All activities associated with the proposed emplacement would be carried out in accordance with the procedures and management measures set out in the following existing management plans for the Quarry operations, or subsequent revisions:

- *Peppertree Quarry Water Management* Plan (ERM, 2011); and
- *Peppertree Quarry Landscape and Rehabilitation Management Plan* (ERM, 2012).

Sediment basins constructed at discharge points on the eastern side of the emplacement are likely to lead to a temporary change in the flow regime in three small creeks during construction and rehabilitation. Once rehabilitation is complete, the flow regime in these creeks is expected to return to conditions similar to current.

The proposed design and operating standard for the proposed sediment basins is consistent with the objective of achieving neutral or beneficial effect of water quality (NorBE) as required under *State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011*. No adverse impacts are expected on the water quality in Barbers Creek or the Shoalhaven River.

8 References

ANZECC (2000). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.

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Southern Rivers Catchment Management Authority (2013). *Southern Rivers Catchment Action Plan 2013-2023*.

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1:25,000 topographic maps: Wingello 8928-4S, Caoura 8928-3N, Bungonia 8828-2N.

APPENDIX G

VISUAL IMPACT ASSESSMENT

APPENDIX G

Peppertree Quarry MOD 4 Environmental Assessment

Visual Impact Assessment

Prepared for: Boral Resources (NSW) Pty Ltd

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January, 2016

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richard lamb & associates

Table of Contents

richard lamb & associates

Table of Contents

EXECUTIVE SUMMARY

Purpose of this report

- This report by Richard Lamb and Associates (RLA) is an assessment of the visual impacts of Boral Resources (NSW) Pty Ltd (Boral) application to modify the existing Project Approval (PA 06_0074) for Peppertree Quarry, Marulan South (the Modification).
- The report consists of an assessment of the likely nature, extent and significance of the visual impacts of the Modification, considered with regard to the range of public and private places that could be affected, primarily the visual impacts of the proposed Southern Overburden Emplacement.

Visual context of existing quarry

- The Quarry is situated on the edge of a dissected plateau of the Southern Tablelands of NSW, which is locally drained to the south and east by the Shoalhaven River and its tributaries, Bungonia and Barbers Creeks.
- Land use to the west and north is rural, while to the east, the landscape is dominated by the natural topography and vegetation of Morton National Park (NP) in the Barbers Creek gorge.
- The Quarry is in a secluded area and is not exposed to high intensity public domain features with large numbers of potential viewers such as main roads or urban areas.
- Access to the Quarry is provided by Marulan South Road, which is a public but a dead-end road leading to the Quarry, Aglime Fertiliser plant and Marulan South Limestone Mine.

Visual exposure of proposed modification

- Overall, the Quarry is of very low visual exposure to the public and private domain, other than its exposure to adjacent natural landscape in part of Morton NP.
- Visual exposure is low to the adjacent rural land to the south west, west and north, as the current operations are below the horizons of view.
- Detailed analysis of the likely changes in visual exposure caused by the proposed Southern Overburden Emplacement show that the overall low visual exposure will remain low.
- The visual exposure of the proposed Southern Overburden Emplacement will be to a slightly larger area than that of the existing Quarry operations because of the proposed location of overburden to the south east of the Pit.
- In some views from the landscape to the south-west, north and east, the topography of the intermediate horizon will be slightly changed as the overburden emplacement is constructed, elevating newly formed topography into views.

Visual effects of the modification

- The height and visual exposure of the proposed Southern Overburden Emplacement will not significantly alter the composition of the view.
- A minor change will occur in the mid-ground horizon of the view in the most exposed view, caused by increase in the height of the landscape caused by the Southern Overburden Emplacement.
- In the long range views from the Bungonia Lookdown area the proposed Southern Overburden Emplacement will be of minor visibility.

Field analysis of effects on viewing locations

- A detailed field assessment was carried out. 14 publicly accessible viewing places and views from 8 residential and commercial receivers were analysed and assessed.
- The potential for views from 17 residential receivers, 4 Boral-owned residences and 3 commercial receivers (See Figure 9), were analysed using 3D graphics based on a digital terrain model.
- Of the 17 residential receivers, 11 do not have any potential views of the proposed Southern Overburden Emplacement from the dwellings. Of the remaining 6, with the exception of Receiver R7, access to which could not be secured, the views were documented and compared to the views predicted by 3D modelling.
- It was determined after analysis of the 3D graphics and interpretation of the on-site photographs that Receivers R5 and R7 are unlikely to have a view of the proposed Southern Overburden Emplacement and that R8 has no potential view.
- Two remaining residential receivers (R10 and R15) were considered to have potential for view of some part of the proposed Southern Overburden Emplacement, the most substantial of which was predicted to be from R15 (see photomontage in Appendix 3).
- The photomontage for R15 shows that the worst-case effects of the proposal on residential views are low.
- The scenic quality of the proposed site of the Southern Overburden Emplacement site is moderate. The base-line for scenic quality is significantly modified by the existing and long history of limestone mining directly adjacent to the Peppertree Quarry.
- The moderate scenic quality base-line means that subject to other considerations, the landscape has a higher potential to absorb visual impacts than one of higher scenic quality.

Visual sensitivity

- The place of highest view place sensitivity is confined to the immediate streetscape of Marulan South Road, essentially a private road.
- View place sensitivity was rated as medium for views between 500-3000m from the proposed Southern Overburden Emplacement site. Three viewing places fall into this category which have potential views to the proposed Southern Overburden Emplacement; VP2, VP21 and R15.
- Five viewing places are in the low sensitivity class, being beyond 3000m; VP14, VP15, VP18, VP 19 and VP 20.
- Viewer sensitivity is rated medium for residential dwellings between 500m and 3000m. One residence in this category, Receiver R15, has potential views to the proposed Southern Overburden Emplacement. R8 is in the same sensitivity category but does not have any affected views.
- Viewer sensitivity is rated low for dwellings at distances greater than 3000m. Residences R10 and R13 (Glenrock) are in this category.
- The proposed Southern Overburden Emplacement is therefore generally exposed to views from locations of medium to low sensitivity to the likely visual effects.

Accessibility to the public domain

- The proposed Southern Overburden Emplacement has low accessibility to the public and no significant exposure to roads with high viewer numbers in the public domain, or to close views from residential receivers.

- With the exception of views from off-track sites accessed from part of the Long Point Track in Morton NP to the east, there would overall be low, or no effects on view composition.
- With regard to the effect of viewing period, which would increase viewer sensitivity, the proposed Southern Overburden Emplacement has very low overall exposure to views from residential receivers and the effect of viewing period for residential receivers is therefore only increased for Receiver R15.

View loss

- The planning principles in *Tenacity* and *Rose Bay* were considered in relation to view loss or blocking in Section 4.2.2.
- No views from residences of the public domain call for the application of the *Tenacity* principles or those in *Rose Bay* as no scenic features of the views are lost. The proposed Southern Overburden Emplacement will not cause significant view loss or view blocking effects.

Night time lighting

- No change is proposed in the Modification to the amount or purpose of night-time lighting. Three types of lighting were considered, i.e. general and security lighting, lighting for safe quarrying activities including extended hours of operation and vehicle and machinery lighting.
- Existing general and security lighting will remain unchanged and will continue to have the same visual effects. It is unlikely that extending hours of operation of in-pit operations will significantly change the existing visual effects of night-time lighting.

Overall visual effects ratings

- The overall visual effects of the proposed Southern Overburden Emplacement on its total visual catchment is assessed as low for all but four viewing places, two of which are at or inside the boundary of the Quarry.
- The physical absorption capacity (PAC) for the proposed Southern Overburden Emplacement would be high for all but three viewing places in the visual catchment, two of which are at or inside the boundary of the Quarry.
- The visual compatibility of the proposed Southern Overburden Emplacement with quarrying/ industrial features would be high for all viewing locations.
- The proposed Southern Overburden Emplacement is considered to be of medium visual compatibility with the rural and natural features of the landscape.

Overall visual impacts ratings

- The overall visual impacts rating of the Modification on its total visual catchment was assessed to be low, with initial medium impacts on VP 21 (off-tracks site accessed from the Long Point Track).
- The medium rating for the latter primarily results from the visual exposure of the initial stages of the proposed Southern Overburden Emplacement to daytime views only. Night time lighting is not considered to be a significant impact.
- Taking into account the impacts on different visual sensitivity zones did not significantly change the ratings for overall visual impacts.
- The highest sensitivity applies to a short section of Marulan South Road but is an artefact of the methodology as a result of the interaction of distance class and public exposure. This part of the road is effectively private.

- The medium to low sensitivity zone applies to the remainder of viewing places assessed. As no significant impacts can occur for the low sensitivity zone, this was not analysed with regard to the need for mitigation measures.

- The visual impacts on the medium sensitivity zone is analysed against the relevant mitigation measures in Section 4.5, to determine whether the proposed controls adequately mitigate the impacts.

Assessment of mitigation measures

- Assessment of the proposed visual impact mitigation measures considers proposed landform, rehabilitation and lighting. Specific recommendations are made in relation to each of the mitigation measures.

Conclusion

- This assessment finds that while there are some residual visual impacts, assuming compliance with the recommendations for impact mitigation, that these are minor in significance.

1.0 INTRODUCTION

Boral Resources (NSW) Pty Ltd (Boral) owns and operates the Peppertree Quarry (the Quarry), a hard rock quarry located in Marulan South, New South Wales.

Boral is seeking to modify the current Project Approval (PA 06_0074) under Section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act), to provide for the following (hereafter referred to as the Project):

- Extend daily in-pit operating hours at the Quarry by 6 hours; and
- Develop a new overburden emplacement area.

The modification proposed above will constitute Modification 4 to the current Project Approval.

The Minister for Planning is the consent authority for the proposed modification.

The purpose of this report by Richard Lamb and Associates (RLA) is to assist in the assessment of the proposed Modification by the NSW Department of Planning and Environment (DP&E).

The report consists of an assessment of the likely nature, extent and significance of the visual impacts of the Modification as part of the Environmental Assessment (EA), considered with regard to the range of public and private places that could be affected. The visual impacts of extending in-pit operating hours are likely to be limited to indirect effects of some kinds of night-time lighting. This report is therefore focussed primarily on the visual impacts of the proposed Southern Overburden Emplacement.

1.1 Existing Environment and Quarry Operations

1.1.1 Site Description and Existing Environment

The Quarry is located in Marulan South, 10 kilometres (km) southeast of Marulan, 35 km east of Goulburn and approximately 175 km south-west of Sydney, within the Goulburn Mulwaree Local Government Area (LGA) in the Southern Tablelands of NSW (**Figure 1**). Access is via Marulan South Road, which connects the Quarry and Boral's Marulan South Limestone Mine with the Hume Highway approximately 9 km to the northwest (**Figure 2**). Boral's private rail line connects the Quarry and Limestone Mine with the Main Southern Railway approximately 6 km to the north (**Figure 2**).

The Quarry is located on Boral owned land approximately 650 hectares (ha) in size, which includes the Quarry site, approximately 70ha in size, additional granodiorite resources to the south and surrounding land (**Figures 3** and **4**). The site is zoned RU1 - Primary Production zone under the Goulburn Mulwaree Local Environmental Plan (LEP) 2009 (**Figure 5**). Mining and extractive industries are permissible in this zone with consent.

The Quarry is bordered to the south by the Limestone Mine, to the east by Morton National Park and by rural properties to the north and west. Surrounding land uses include mining, grazing, rural properties including an agricultural lime manufacturing facility, fireworks storage facility, turkey farm and rural residential. The main access for these properties is via Marulan South Road. Rural residential properties are also located to the northeast of the Quarry along Long Point Road. These properties are separated from the Quarry by the deep Barbers Creek gorge.

FIGURE 1
Regional context
VISUAL IMPACT ASSESSMENT

PEPPERTREE QUARRY MODIFICATION 4

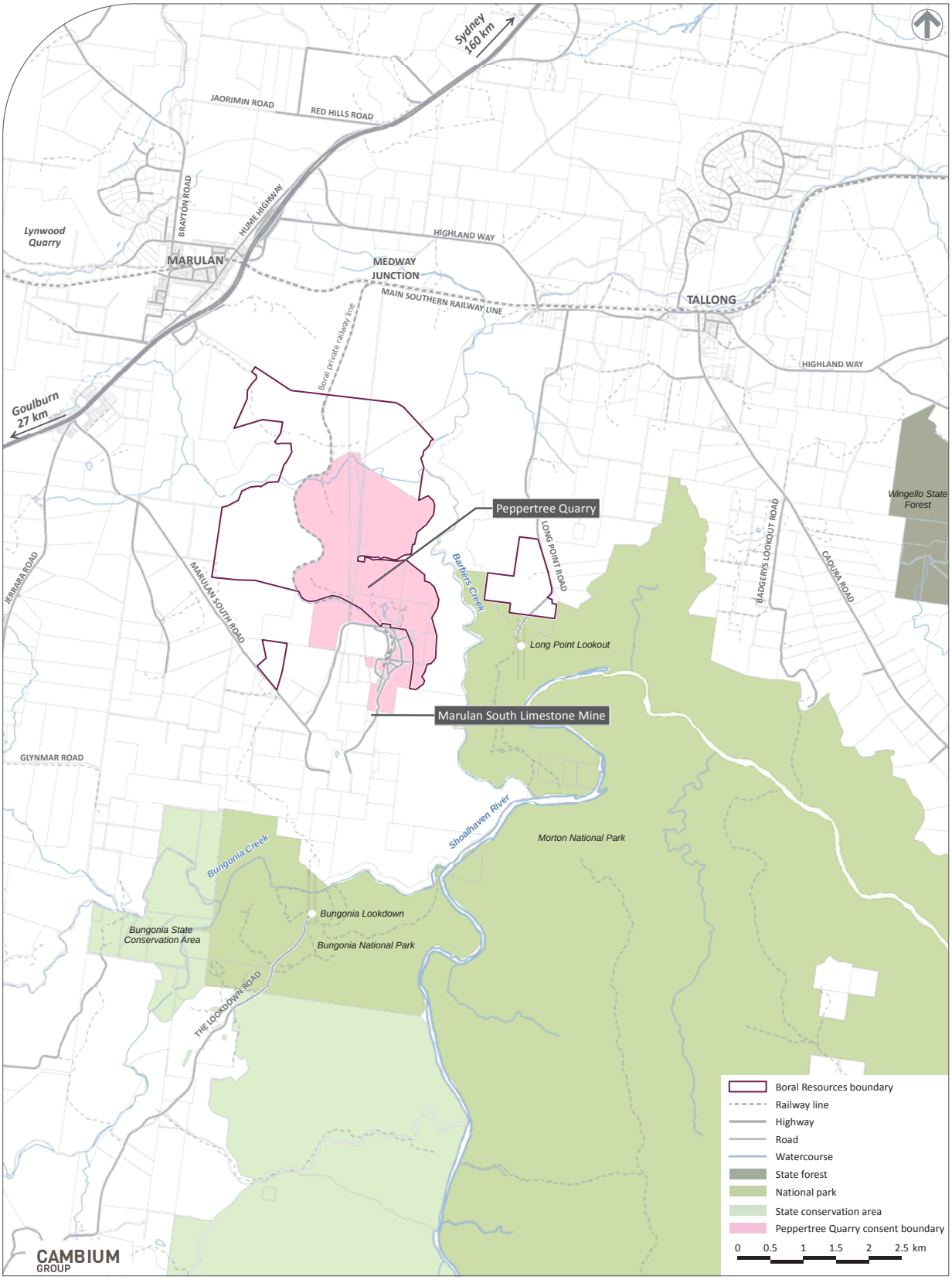

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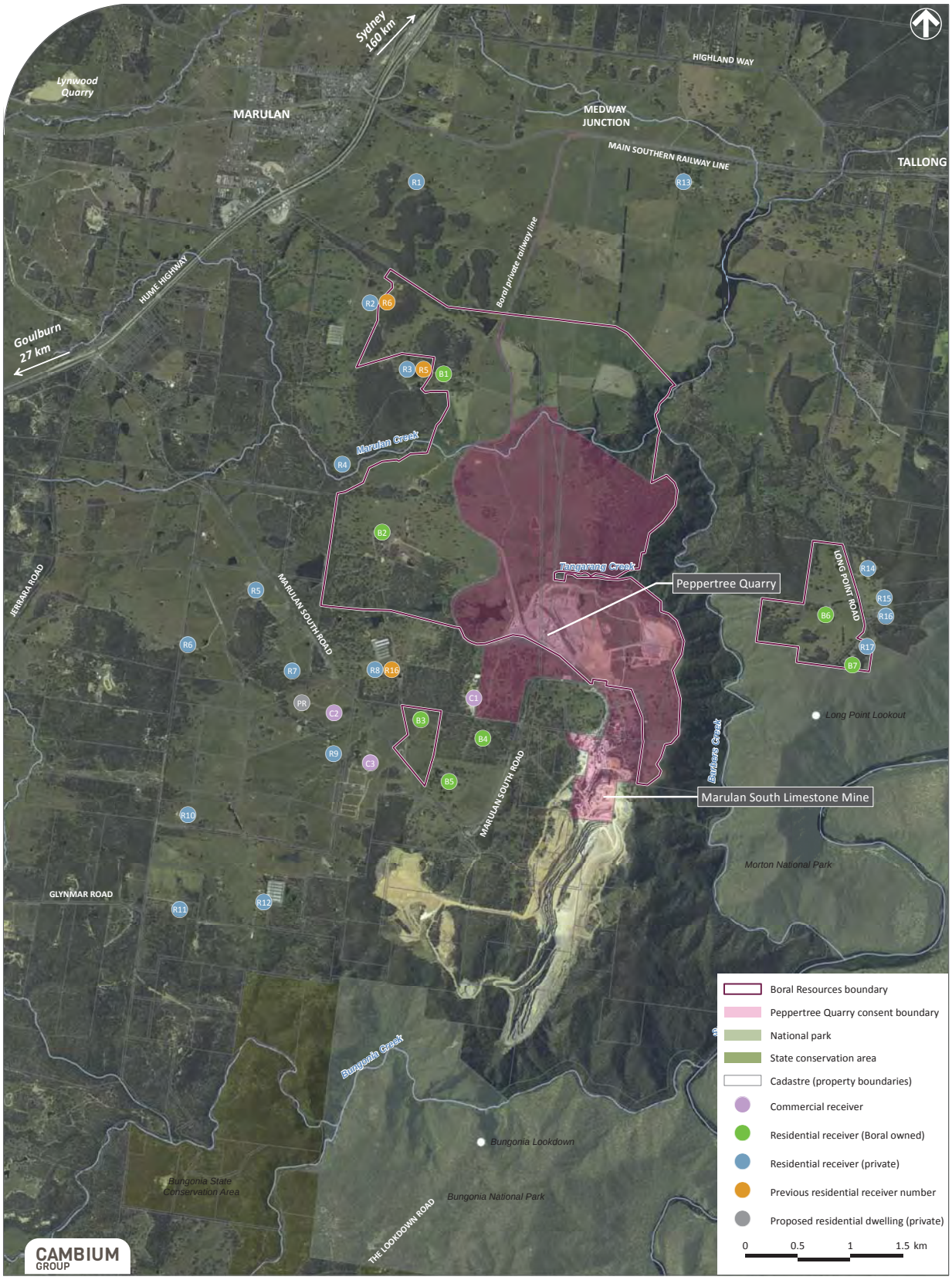
FIGURE 2
Local context
VISUAL IMPACT ASSESSMENT

PEPPERTREE QUARRY MODIFICATION 4



CAMBIUM GROUP

031060_EA-V_160208_v02

The site of the former village of Marulan South is located between the Quarry and the Limestone Mine on Boral owned land. The village was established principally to service the Limestone Mine but has been uninhabited since the late 1990's. The majority of the village's infrastructure has been removed and only a village hall and former bowling club remains. The bowling club has been converted into administration offices for the Limestone Mine.

1.2 Approved Project

The current operations of Peppertree Quarry are approved under Project Approval PA06_0074 as modified.

1.2.1 Quarry Activities and Infrastructure

The approved quarrying activities are for extraction of 105 million tonnes of granodiorite over 30 years at an initial rate of 1 - 2 million tonnes per annum (Mtpa) and a maximum rate of 3.5 Mtpa. Granodiorite is an intrusive igneous rock suitable for use as a construction and building material. The hard rock aggregates produced at the site are a range of different shapes and sizes for different purposes. Primary production is of concrete and asphalt aggregates (10 mm) and railway ballast (28 - 50 mm) with capacity to produce larger aggregates (>100 mm) for rock armour and gabion baskets. Fines (generally <5 mm) produced during crushing of product are blended with limestone sand from Boral's adjacent Limestone Mine or Penrose Quarry to produce a marketable manufactured sand.

Infrastructure at the Quarry includes a processing plant, rail loop and loading facilities, two water storage dams, an in-pit mobile crushing plant, overburden emplacement areas, noise and visual bunding, product stockpiles, and staff facilities. The location of infrastructure at the Quarry is shown on **Figure 7**.

Work to establish the Quarry commenced in July 2011. Production commenced early in 2014 following a lengthy commissioning and proving phase. The Quarry has approval to operate until the end of 2038.

Transport of Product

Product from the Quarry is transported entirely by rail except in an emergency where it would be transported by road with the written approval of the Secretary of DP&E. The Quarry has approval to transport up to 3.5 Mtpa of product from the site. At full production the Quarry will operate up to four trains per day which will transport product north to the Sydney market and other customers. In addition, the Limestone Mine currently operates up to six trains per day transporting product north to Berrima and Maldon and east to Port Kembla.

Trains to the Quarry and the Limestone Mine access Boral's private rail line from the Main Southern Railway at the Medway Junction (**Figure 2**). The rail line is mostly single track with a 1 km length of triple line track used for shunting and train loading. A rail loop has been constructed at the Quarry for separation of rail movements on the rail line between the two Boral sites. Rail loading facilities were also established on the rail loop adjacent to the Quarry's processing plant.

Loading of product from the Quarry onto trains and train movements occur 24 hours, seven days a week. This enables train trips on the Main Southern Railway to be scheduled away from peak commuter times.

Operating Hours and Workforce

The Quarry operates 24 hours, 7 days a week with in-pit activities restricted to the hours of 7am to 7pm. Approved operating hours are outlined in detail in **Table 1**.

Table 1: Approved Operating Hours

Activity	Day	Time
Construction works	Monday-Friday	7.00am to 6.00pm
	Saturday	8.00am to 1.00pm
	Sunday and public holidays	None
Topsoil/overburden removal/emplacement	Any day	7.00am to 7.00pm
Blasting	Monday-Saturday	9.00am to 5.00pm
	Sunday and public holidays	None
In-pit activities (including drilling, extraction, processing, and transfer of material out of the pit)	Any day	7.00am to 7.00pm
Out-of-pit activities (including processing, stockpiling, train loading and distribution, and maintenance)	Any day	24 hours

1.3 Proposed Modification

1.3.1 Description of the Proposed Modifications

Boral is seeking to modify the current Project Approval to:

- Extend in-pit operating hours at the Quarry by 6 hours; and
- Develop a new overburden emplacement area.

1.3.2 Extension of in-pit Operating Hours

Peppertree Quarry currently has approval to operate in-pit activities for 12 hours per day between 7am and 7pm. In-pit activities include:

- Drilling and blasting;
- Extraction;
- Delivering blast rock to the mobile crusher;
- Crushing of rock;
- Conveying crushed rock out of the pit.

Boral is seeking to extend these in-pit operating hours by 6 hours per day in order to account for scalping of overburden material in early phases of pit development and meet annual production volumes up to the approved limit of 3.5 million tonnes per annum. Boral are proposing to extend the approved 7am - 7pm in-pit operating hours to 5am - 11pm.

Blasting will however continue within the current approved blasting hours of 9am - 5pm Monday to Saturday.

FIGURE 3
Land ownership
VISUAL IMPACT ASSESSMENT

PEPPERTREE QUARRY MODIFICATION 4

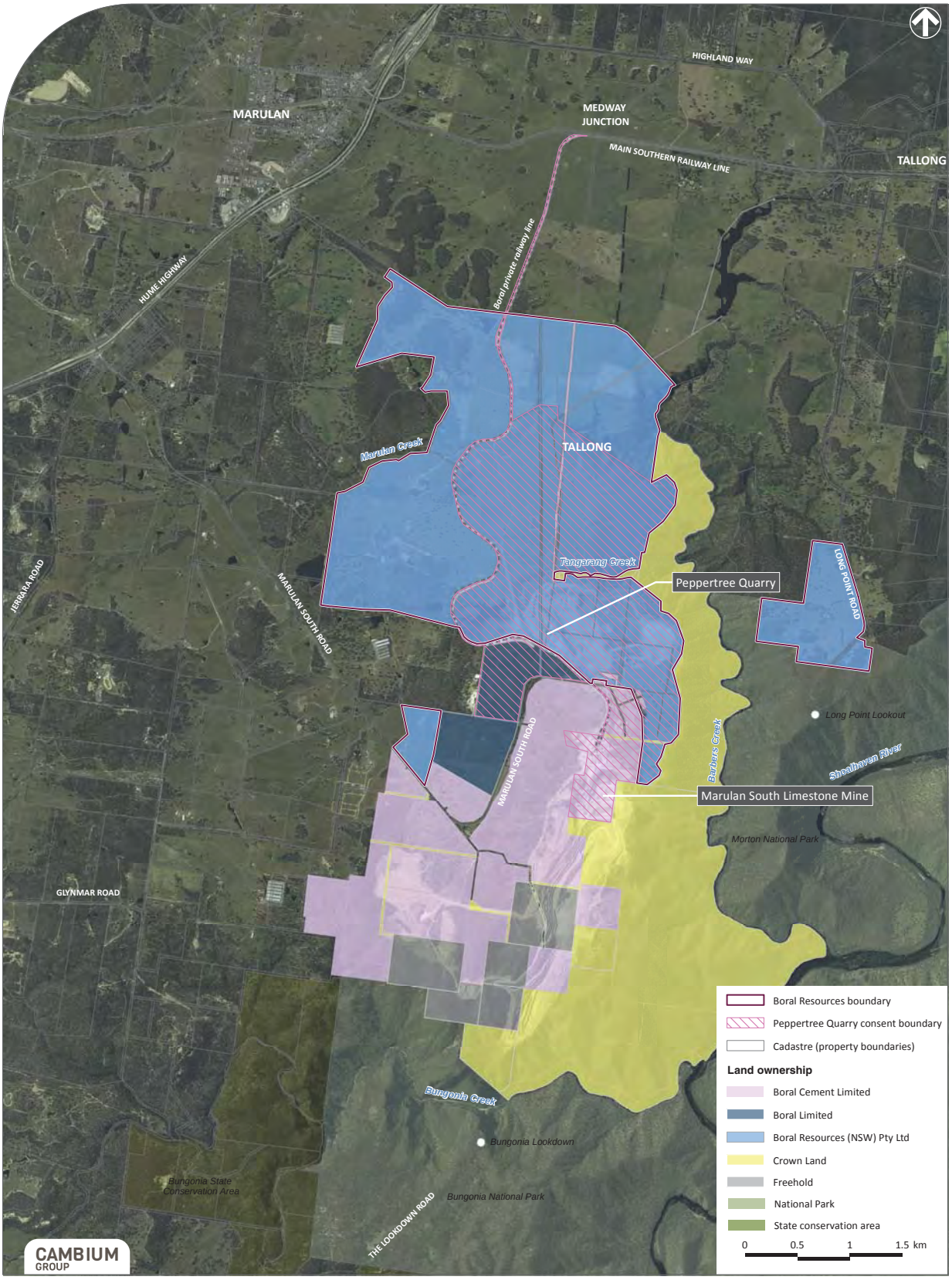


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FIGURE 4
Landuse
VISUAL IMPACT ASSESSMENT

PEPPERTREE QUARRY MODIFICATION 4

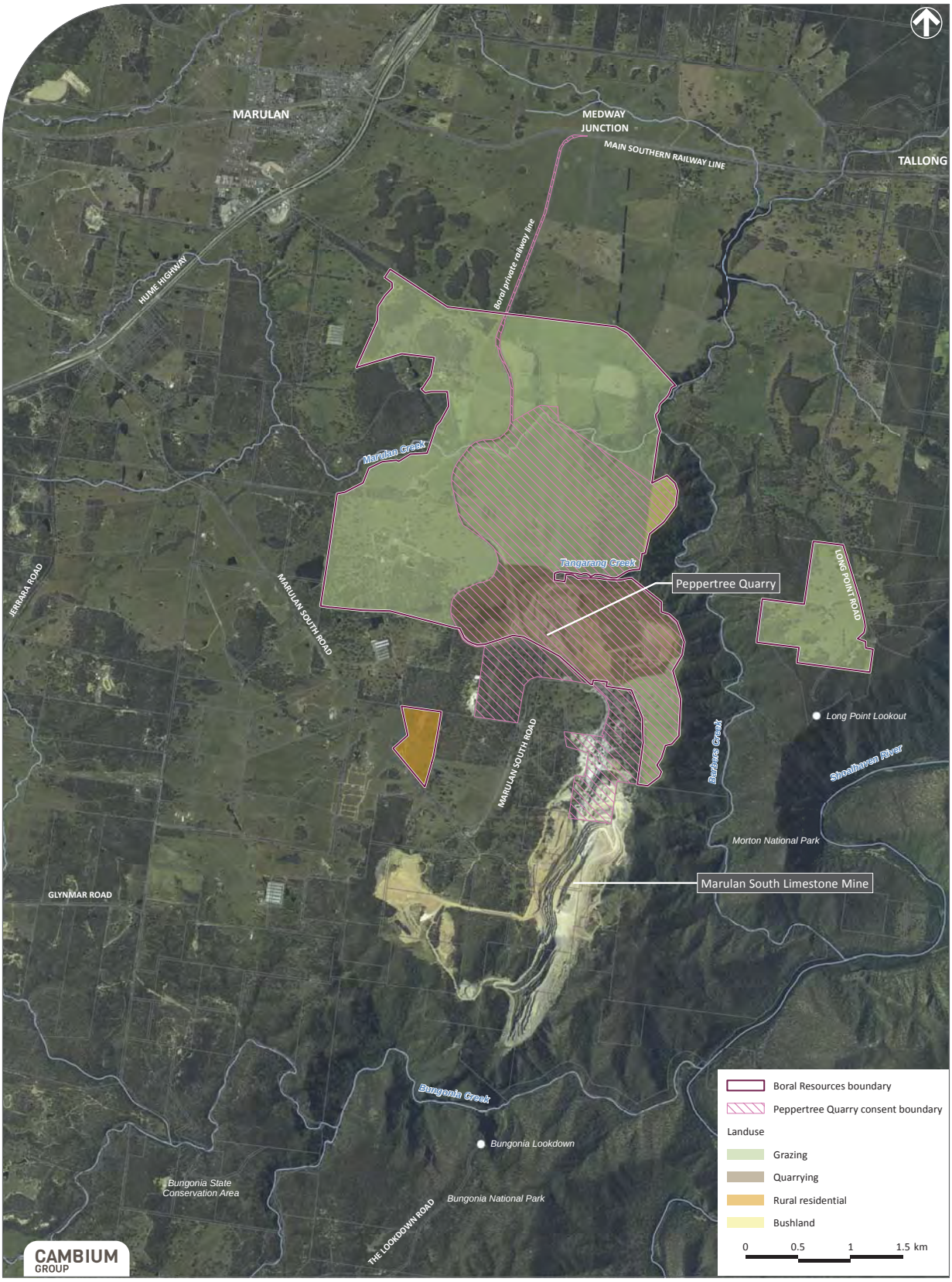

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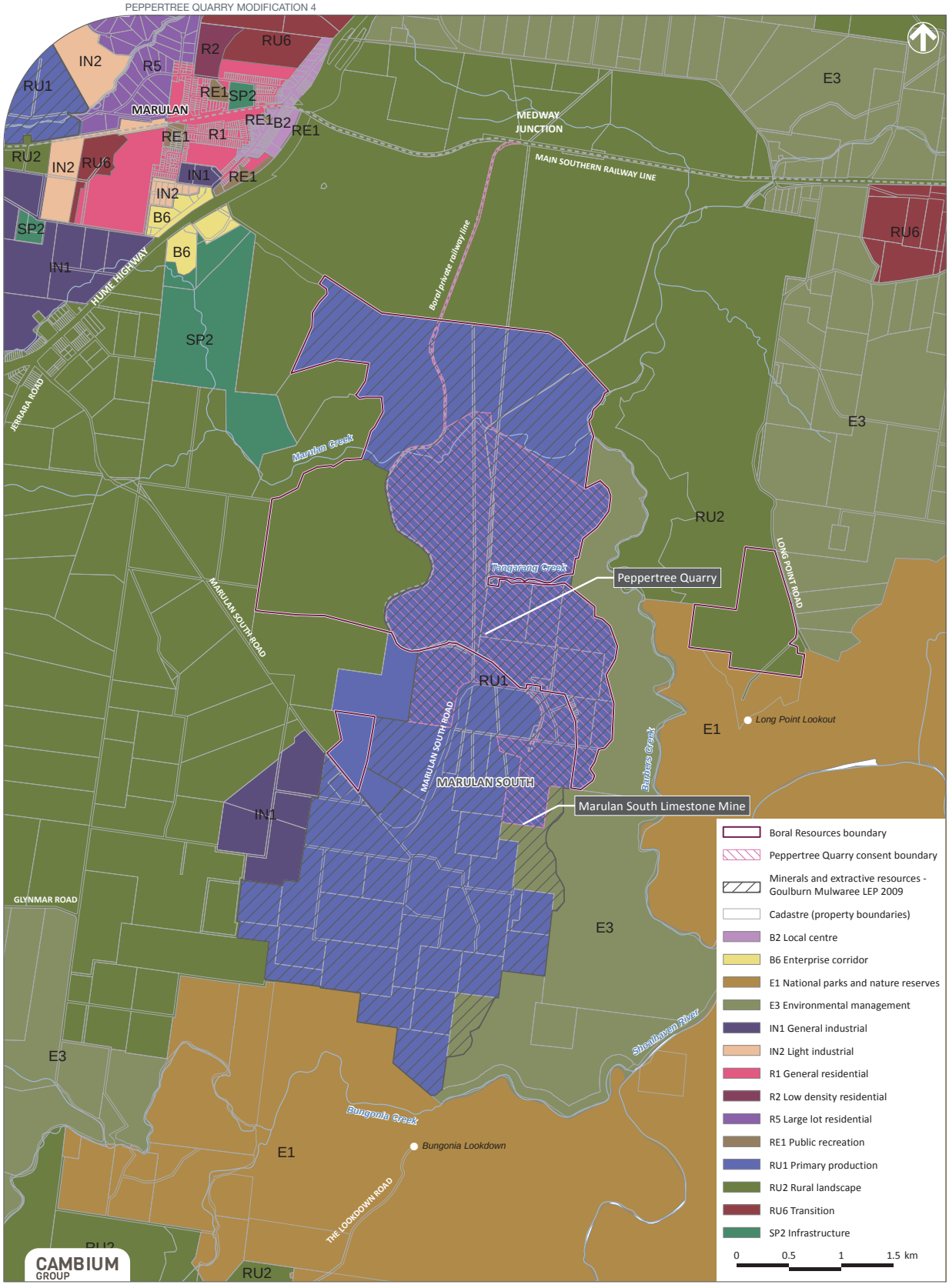
FIGURE 5
Land zoning
VISUAL IMPACT ASSESSMENT

PEPPERTREE QUARRY MODIFICATION 4



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1.3.3 New Southern Overburden Emplacement

Overburden emplacement at the Quarry is currently approved within noise bunds located along the northern and eastern boundaries of the site, an emplacement area to the east of the approved quarry pit and a western emplacement area and noise bund to the west of the Quarry across Boral's private railway line. Current environmental monitoring locations are shown on **Figure 6**. Remaining overburden was proposed to be emplaced within the south pit of Boral's adjoining Limestone Mine.

The noise bunds were completed during construction of the Quarry, and the eastern overburden emplacement area will reach capacity in early 2016. Mine planning for the Limestone Mine has ruled out emplacement within the south pit. The Limestone Mine, under its forthcoming development application, is seeking to hold 5 million m^3 (approximately 13 Mt) of overburden for the Quarry, however, this will not be approved until late 2016. As an interim measure, Boral is seeking to place approximately 1 million m^3 of overburden within a new overburden emplacement south of the approved 30 year quarry pit (**refer to Figure 7)**. Overburden stripped from the pit will be transported by trucks along the most direct haul route possible (refer to **Figure 7**). This new overburden emplacement area will be needed in early 2016 and will take approximately 12 months to establish.

The proposed new overburden emplacement will be located within the south-eastern extent of the future hard rock (granodiorite) resource, which extends south from the existing Quarry pit, to the northern end of the Limestone Mine's north pit. A significant granodiorite resource also exists on Boral's lands to the north of the existing Quarry pit, extending northwards from Tangarang Creek. The proposed southern overburden emplacement will not sterilise resource as Boral will relocate this southern emplacement in the future if the southern granodiorite resource needs to be accessed. Although the southern overburden emplacement may be relocated in the future, this is unlikely to be required for at least the next 25 years. The proposed emplacement will therefore be landscaped and rehabilitated in accordance with the existing Peppertree Quarry Landscape and Rehabilitation Management Plan.

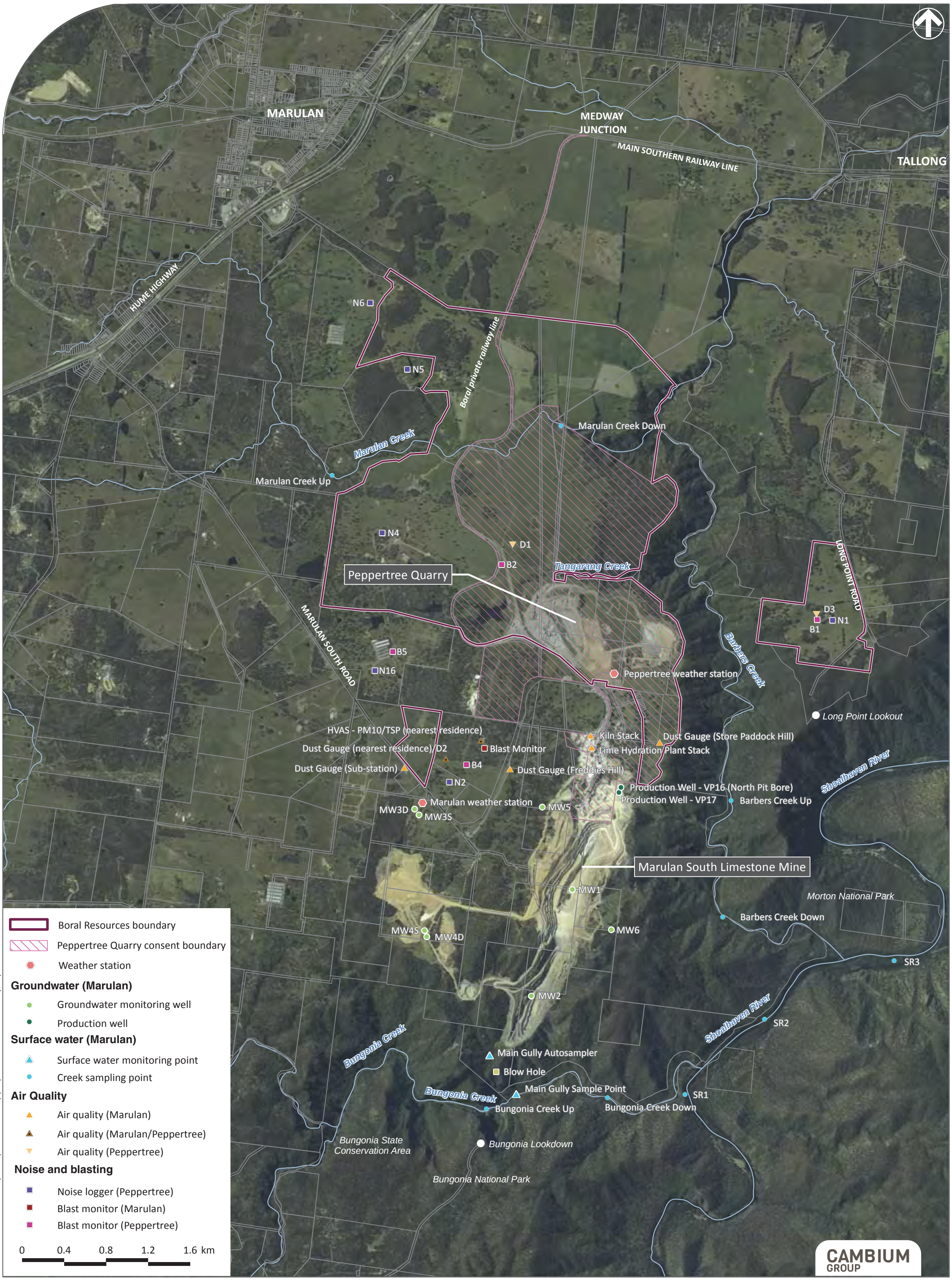
1.4 Documents Consulted

In preparing this report, RLA consulted the following documents:

1. Marulan South Quarry Environmental Assessment Report (EAR), prepared by ERM for Boral Resources (NSW) Pty Ltd, October, 2006.
2. Marulan South Quarry Submissions Report, prepared by ERM for Boral Resources (NSW) Pty Ltd, December, 2006
3. Major Project Assessment: Marulan South Quarry Project, NSW Department of Planning: Director General's Environmental Assessment Report, February, 2007.
4. Project Approval 06_0074, 2007.
5. Peppertree Quarry Landscape and Rehabilitation Plan, prepared by ERM for Boral Resources (NSW) Pty Ltd, August, 2012.

FIGURE 6
Current environmental monitoring locations
VISUAL IMPACT ASSESSMENT

PEPPERTREE QUARRY MODIFICATION 4



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1.5 Context for the Development

1.5.1 The Regional and Local Visual Context

The regional and local visual context of the Quarry is described in detail in the original EA and summarised in this EA for the proposed Modification (See also Figure 1, Regional Context). The Quarry is situated on the edge of a dissected plateau of the Southern Tablelands of NSW, which is locally drained to the east by Barbers Creek (a tributary of the Shoalhaven River) and to the north by Tangarang Creek (a tributary of Barbers Creek) south and east by the Shoalhaven River and its tributaries, Bungonia and Barbers Creeks (see Figure 2, Local Context). The Quarry is bordered to the south by the Marulan South Limestone Mine (Limestone Mine), to the east by Morton National Park (NP) and by rural properties to the north and west. Surrounding land uses include mining, grazing, rural properties including an agricultural lime manufacturing facility, fireworks storage facility, turkey farm and rural residential. Rural residential properties are also located to the northeast of the mine along Long Point Road. These properties are separated from the mine by the deep Barbers Creek gorge. The Bungonia NP and Bungonia State Conservation Area (SCA) are located to the south of the Limestone Mine, across the deep Bungonia Creek Gorge. (see Figure 3, Land ownership and Figure 4, Land use).

The Quarry is in a secluded area and not exposed to high intensity public domain features with large numbers of potential viewers such as main roads or urban areas. It is a significant distance (greater than six kilometres) from the nearest highway (Hume Highway) and the nearest urban settlement (Marulan) and is not significantly exposed to either.

Access to the Quarry is provide by Marulan South Road, which is a public but a dead-end road leading to the Limestone Mine, the Quarry and Aglime Fertiliser plant. It is a minor rural road that provides access to a small number of private properties and commercial enterprises before entering what is predominantly Boral-owned land. There is no other public access to the immediate environment of the Quarry. East of the Quarry and across the Barbers Creek valley is Long Point Road, a minor dead-end rural road that terminates in the carpark of the Long Point Lookout. It provides access to a small number of rural properties. Other rural roads that provide potential viewing places of the proposed Southern Overburden Emplacement from isolated locations are Jerrara Road, which leads to Bungonia to the south west and Glynmar Road and Government Roads, both dead-end rural roads.

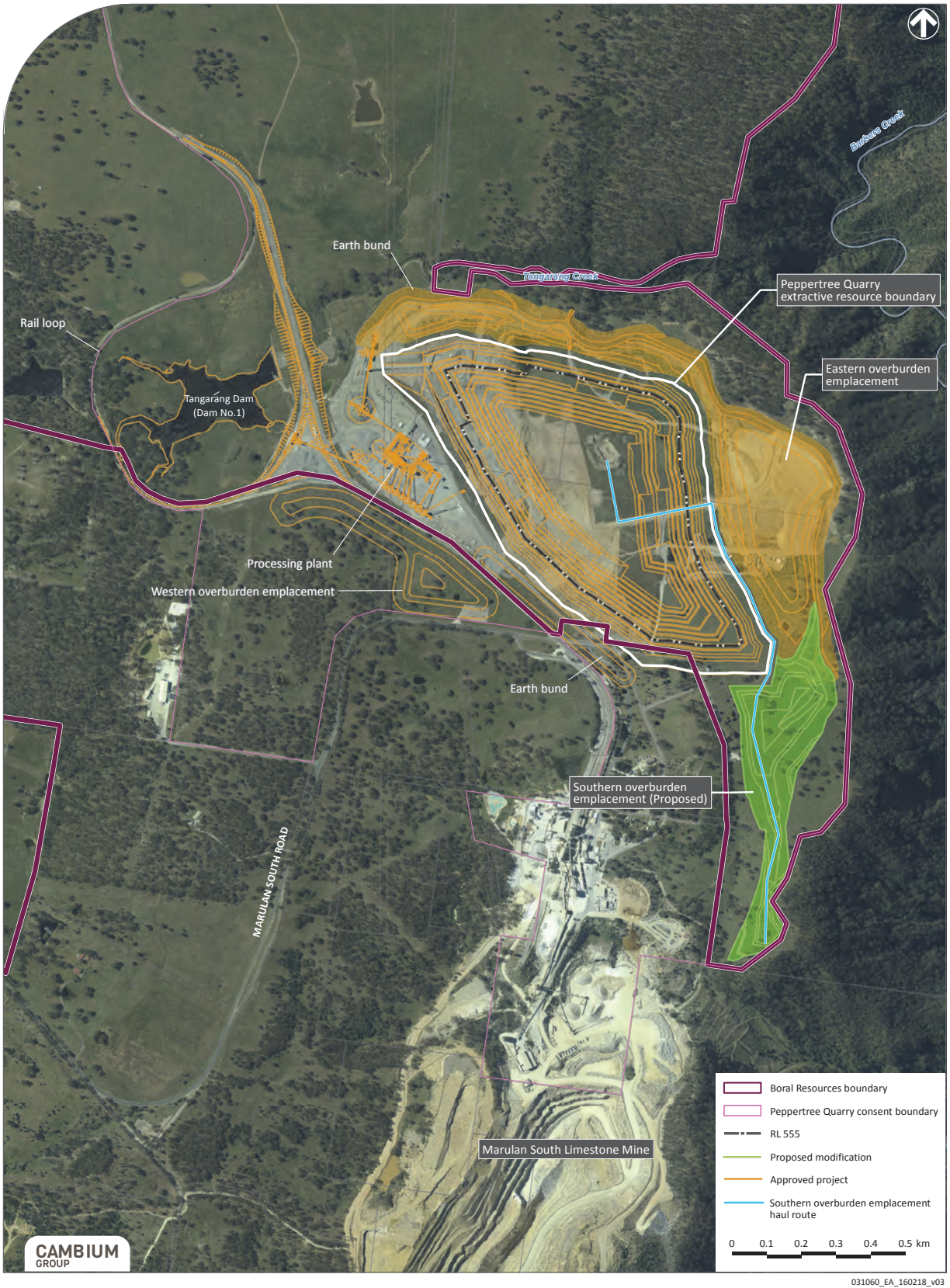
To the east and south the landscape is undeveloped and in a natural state in the Morton NP and Bungonia NP and SCA (see Figure 4, Land Use). In Bungonia NP to the south, is the Bungonia Lookdown area and lookouts. To the east a track from the Long Point Lookout runs for a short distance south, after which it turns east to descend into the Shoalhaven River gorge. The Quarry is partly visible from the informal viewing places west of the established track.

Overall, the Quarry and sites of the proposed Modification are of very low visual exposure to the public domain, other than its exposure to adjacent natural landscape in part of Morton NP to its east.

1.5.2 Existing Scenic Resources

FIGURE 7
The Project
VISUAL IMPACT ASSESSMENT

PEPPERTREE QUARRY MODIFICATION 4



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The existing Quarry occupies land formerly used for agriculture and which is relatively flat. Aerial imagery shows that the area was essentially devoid of any wooded vegetation before the development of the Quarry.

The recent history of utilisation of the granodiorite resource, construction of earth bunding to the north of the pit and emplacement of overburden to the north east and east of the pit has resulted in changes to the existing topography, form, line, colour and textures of the landscape. However, other than in the view from Marulan South Road, those visual effects are highly localised.

In all, the existing scenic resources are minor. The area proposed for the Southern Overburden Emplacement is of the same intrinsic character as land currently being utilised in the Quarry. That character is widespread in the immediate locality and the Southern Tablelands and is neither rare nor under threat.

2.0 ASSESSMENT METHODOLOGY

The assessment of visual impacts is a field that requires a degree of subjective judgement and cannot be made fully objective. It is therefore necessary to limit the subjectivity of the work by adopting a systematic, explicit and comprehensive approach. This has the aim of separating aspects that can be more objective, for example the physical setting, visual character, visibility and visual qualities of a project, from more subjective elements, such as visual absorption capacity and the compatibility of the Modification with the setting.

The methodology used in this assessment has been developed over several years and uses relevant aspects of methods accepted in landscape assessment, extended and modified to adapt to extractive industry and rural environments. The modifications introduced are informed by visual perception research that has been carried out by RLA and others in both natural and extractive industry contexts.

2.1 Assessment Methodology Flow Chart

The flow chart at Figure 8 below indicates the relationships among the components of the visual impact assessment methodology and the logic of the process of analysis and assessment.

2.2 Components of the Methodology

Overall, the major components of the visual impact assessment are determining the concept for the Modification and general strategic planning principles, view analysis, visual effects analysis, visual impact evaluation and assessment of significance of residual visual impacts. This assessment is also supplemented with an assessment of the merits and compliance of the proposed Modification (Figure 7) with the relevant Planning Principles in relation to view loss and the mitigation measures that have been undertaken to reduce or eliminate residual impacts.

2.2.1 The Components of the View Analysis

The proposed Modification and detailed field assessment

This component of the view analysis includes gaining a thorough understanding of the proposed Modification including its location and extent to understand its scale and spatial arrangement. The next step is to carry out a detailed field assessment by identifying the potential viewing locations (see Figure 9), visiting the representative locations, documenting the proposed Southern Overburden Emplacement's approximate location on a base map, photographing representative locations and filling out an evaluation sheet for each, which contains separate and overall assessment of the visual effects and relative visual impacts factors. View points analysed include Residences (numbered and prefixed by R on Figure 9, eg. Receiver R10), Commercial Receivers (eg. C2) and external View Points (prefixed VP, eg. VP1).

The analysis also utilises objective aids to visualising the likely visual effects of the proposed Modification such as 3D modelling of the terrain of the site and its surroundings and the simulation of views from a series of representative viewing locations, including sensitive residential receivers (refer to Appendix 2). The 3D model's simulated views are cross-checked by observations on site to confirm or modify the models.

At each documented viewing location or situation, an analysis sheet is prepared on which observations are recorded along with a log of photograph locations, image numbers, GPS coordinates and the bearing

of photographs as indicated on the camera's electronic compass. Representative images are presented in the Photographic Plates, (see Appendix 2 of this report).

Examples of the analysis sheets are in Appendix 4. The assessment factors are explained in Section 2.2.2 and 2.2.3. The analysis sheet that was filled out for each viewing location rated the assessment on each factor in three qualitative ranges; Low, Medium and High.

Identifying viewing locations and viewing situations

A viewing location is considered to be a fixed place from which a view can be experienced. The period of view (how long that view is likely to be sustained) is also a criterion of assessment that gives greater or lesser weight to the effect of the proposed Southern Overburden Emplacement on the view. A viewing situation is the circumstance in which the view can be experienced. For example, a view from a road may be of a single, or of many different aspects of what is a view, may also be fleeting, but may be repeated regularly by local users, whereas a view from a National Park may be part of a relatively sustained view over a longer period, but not be regularly repeated. Different viewing situations have different view and viewer sensitivities.

To represent all of the kinds of viewing locations which could be affected by each of these factors and variations among them, a view point analysis is conducted. This is carried out as part of the ground-truthing exercise associated with mapping the visual exposure of the Quarry operations and proposed Modification. Viewing places are chosen to represent the full range of possible view experiences, situations, distances and intervening land uses, in the effective visual catchment, as required by good visual impact assessment practice (see Figure 9).

The effective visual catchment is the area within which there is sufficient detail including view of the surrounding visual context, for the proposed changes to the environment to be perceived as either positive or negative impacts.

The viewing locations fall into two categories, a) Public domain locations and b) Private domain locations. Public domain locations are major and minor roads, public reserves and recreation areas. The private domain viewing locations are predominantly residences and their settings.

It was possible for views to be assessed from most of the relatively few residences from which the proposed Southern Overburden Emplacement may be visible. It was also possible to interpret the likely effects of the proposed Southern Overburden Emplacement based on views taken toward the site from roads and reserves in the vicinity of residences that could not be visited and assessed and also by observing the locations of windows and outdoor areas which would or may provide views.

The viewing places visited and analysed therefore represent views from both the public and the private domain. Significant vantage points from which the site can be viewed and from which views are publicly available were also assessed. A sample of the large number of general viewing places assessed, which represents examples of each relevant kind of viewing place, was abstracted from the total number of places assessed, for detailed analysis.

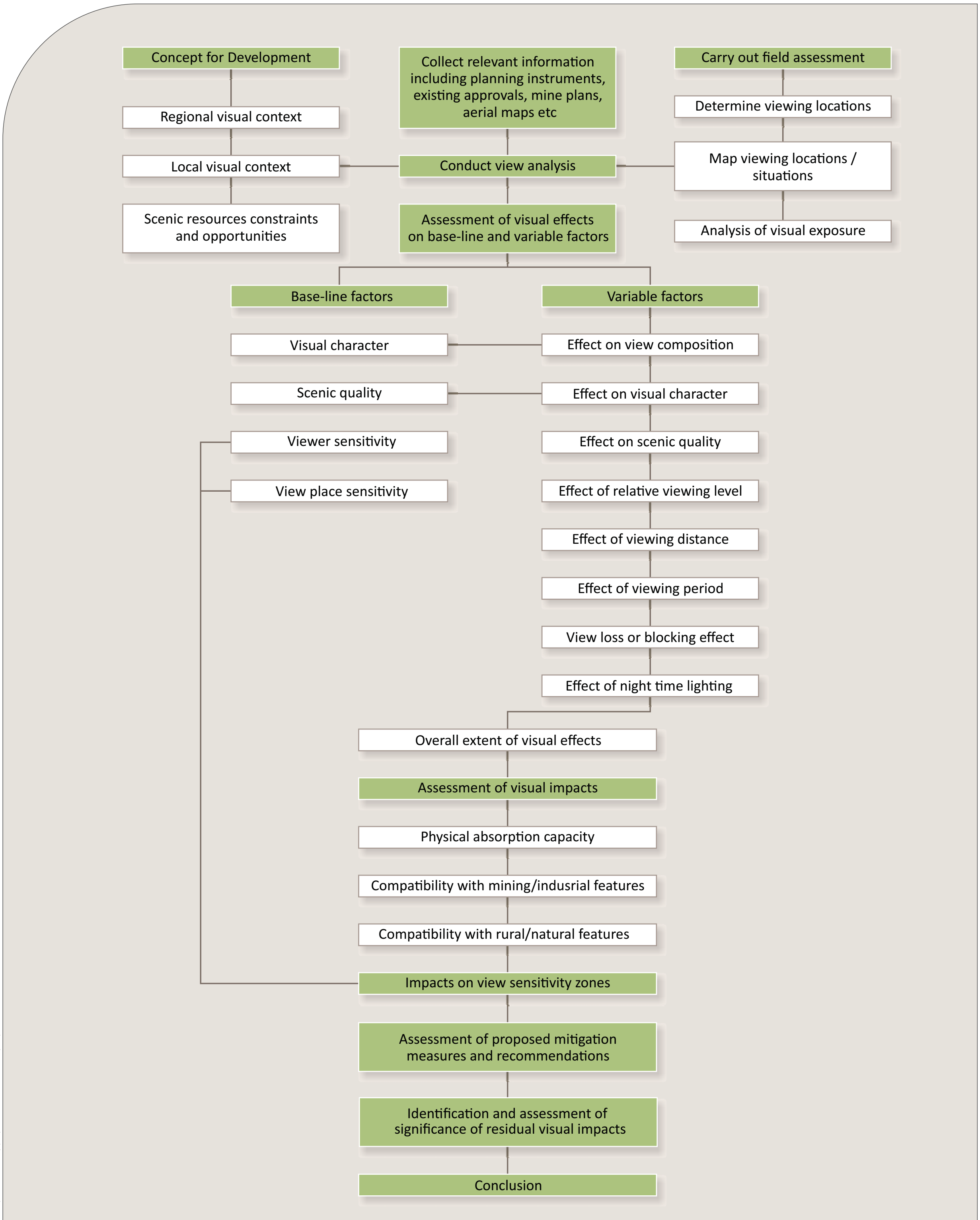
There are large numbers of potential viewing locations in areas such as the National Parks, from which views of some kind may be possible, from informally accessible locations. However, increasing the number of such viewing places assessed does not lead to greater accuracy of the assessment process. This is because increasing the sampling frequency of low usage or largely inaccessible places would skew the results in favour of low sensitivity places and situations, which would tend to minimise the overall level of visual effects and impacts.

FIGURE 8

Richard Lamb and Associates visual assessment flow chart

VISUAL IMPACT ASSESSMENT

PEPPERTREE QUARRY MODIFICATION 4



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Mapping viewing locations and situations

The representative viewing locations and situations analysed during the field assessment are mapped including the ones for which photomontages have been prepared to represent the future appearance of the proposed Southern Overburden Emplacement in the existing context.

Identification of the potential visual catchment

Visibility means the extent to which the Modification would be physically visible, and identified, for example, as a new, novel, contrasting or alternatively a familiar, recognisable but compatible feature. Features such as vegetation, buildings and intervening topography can affect the degree of visibility. RLA first locate the area within which the Modification would be identifiable and where it could cause visual impacts by assessing its visibility.

The potential visual catchment means the physical area within which the Modification would be visible and identifiable.

2.2.2 The Components of the Visual Effect Analysis

2.2.2.1 Base-Line Factors

The criteria that remain predominantly constant and independent of the nature of viewing locations and factors which condition the viewing situation, are known as base-line factors.

Visual character

The visual character of the locality is the setting in which the Modification would be seen and is identified. It consists of identification of the physical and biological components of the area and the setting of the proposed Southern Overburden Emplacement that contribute to its visual character. The character elements include topography, vegetation, natural systems, land use, settlement pattern, rural, industrial and infrastructure elements.

Visual character is a base-line factor against which the level of change caused by the proposed Southern Overburden Emplacement is assessed. The future character of the locality and the effect that the proposed Southern Overburden Emplacement is intended to make to the setting is also relevant to assessing the extent of acceptable change to visual character.

Scenic quality

Scenic quality is a measure of the ranking which the setting of the proposed Southern Overburden Emplacement would be predicted to have, on the basis of empirical research carried out on scenic beauty, attractiveness, preference, or other criteria of landscape perception. Scenic quality is another base-line factor against which the visual impacts caused by the proposed Southern Overburden Emplacement are assessed.

View place sensitivity (public domain sensitivity)

View place sensitivity means a measure of the public interest in the view. The public interest is considered to be reflected in the relative number of viewers in publicly accessible locations that are likely to experience the view, their expectations for the viewing experience and the public significance of the viewing location.

The public significance of viewing places is considered to increase from low to high in the following order: roads, general lookouts, reserves. Places from which there would be close or middle distance views available to large numbers of viewers from public places such as roads, or to either large or smaller numbers of viewers over a sustained period of viewing time in places such as lookouts and reserves, are considered to be more sensitive viewing locations.

Viewer sensitivity (private domain sensitivity)

Viewer sensitivity means a measure of the private interests in the effects of the proposed Southern Overburden Emplacement on views. The private interest is considered to be reflected in the extent to which viewers, predominantly viewing from private residences, would perceive the effects of the proposed Southern Overburden Emplacement. Residences from which there would be close or medium distance range views affected, particularly those which are available over extended periods from places such as living rooms and outdoor recreational spaces, are considered to be places of medium and high viewer sensitivity, respectively.

Viewing places that are of low sensitivity that are not individually assessed include commercial receivers, receivers owned by Boral and roads that carry predominantly industrial traffic, such as the section of Marulan South Road beyond (east of) the entry to the Aglime Fertiliser facility.

2.2.2.2 Variable Factors

The assessment factors that vary between viewing places with respect to the extent of visual effects, are known as variable factors.

View composition type

View composition type means the spatial situation of the proposed Southern Overburden Emplacement with regard to the organisation of the view when it is considered in formal pictorial terms. The types of view composition identified are:

1. Expansive (an angle of view unrestricted other than by features behind the viewer, such as a hillside, vegetation and buildings.)
2. Restricted (a view which is restricted, either at close range, or some other distance, by features between or to the sides of the viewer and the view such as vegetation, buildings and topography (form elements.))
3. Panoramic (a 360 degree angle of view unrestricted by any features close to the viewer who is surrounded by space elements.)

4. Focal (a view that is focused and directed toward the proposed Southern Overburden Emplacement by lateral features close to the viewer, such as road corridors, roadside vegetation, buildings, etc.)
5. Feature (a view where the proposed Southern Overburden Emplacement is the form element that dominates the view, for example a topography feature, building or structure isolated in close range views.)

It is considered that the extent of the visual effects of the proposed Southern Overburden Emplacement is related to its situation in the composition of the view. The visual effect of the proposed Southern Overburden Emplacement on the composition of the view is considered to be greater on a focal or a feature view, cognisant of the distance effect, compared to a restricted, panoramic or expansive view.

Relative viewing level

Relative viewing level means the location of the viewer in relative relief, compared to the location of the proposed Southern Overburden Emplacement. It is conventional in landscape assessment to assess views from locations above, level with and below the relative location of the proposed Southern Overburden Emplacement.

It is considered that the visual effects of a project are related to both the relative viewing level and distance. Viewing levels above the proposed Southern Overburden Emplacement, where views are possible over and beyond it, commonly decrease the visual effects, whereas views from level with and close to the proposed Southern Overburden Emplacement, dependent on viewing distance, may experience higher effects, particularly if it intrudes into horizons.

Viewing period

Viewing period in this assessment means the influence on the visual effects of the proposed Southern Overburden Emplacement which is caused by the time available for a viewer to experience the view. It is assumed that the longer the potential viewing period, experienced either from fixed or moving viewing places such as dwellings, roads or reserves, the higher the potential for a viewer to perceive the visual effects of the proposed Southern Overburden Emplacement. Repeated viewing period events, for example views repeatedly experienced from roads as a result of regular travelling or from residences, are considered to increase perception of the visual effects of the proposed Southern Overburden Emplacement.

Viewing distance

Viewing distance means the influence on the perception of the visual effects of the proposed Southern Overburden Emplacement which is caused by the distance between the viewer and the proposed Southern Overburden Emplacement. It is assumed that the viewing distance is inversely proportional to the perception of visual effects. The greater the potential viewing distance, experienced either from fixed or moving viewing places, the lower the potential for a viewer to perceive and respond to the visual effects of the proposed Southern Overburden Emplacement.

This also acknowledges the relationship between distance and the size of the retinal image of a viewed item in the eye. While the relationship is proportional, it is not direct, as there is an inverse exponential relationship between the retinal size of the image and the distance from the viewer. As an example, doubling the distance

FIGURE 9
View point location plan
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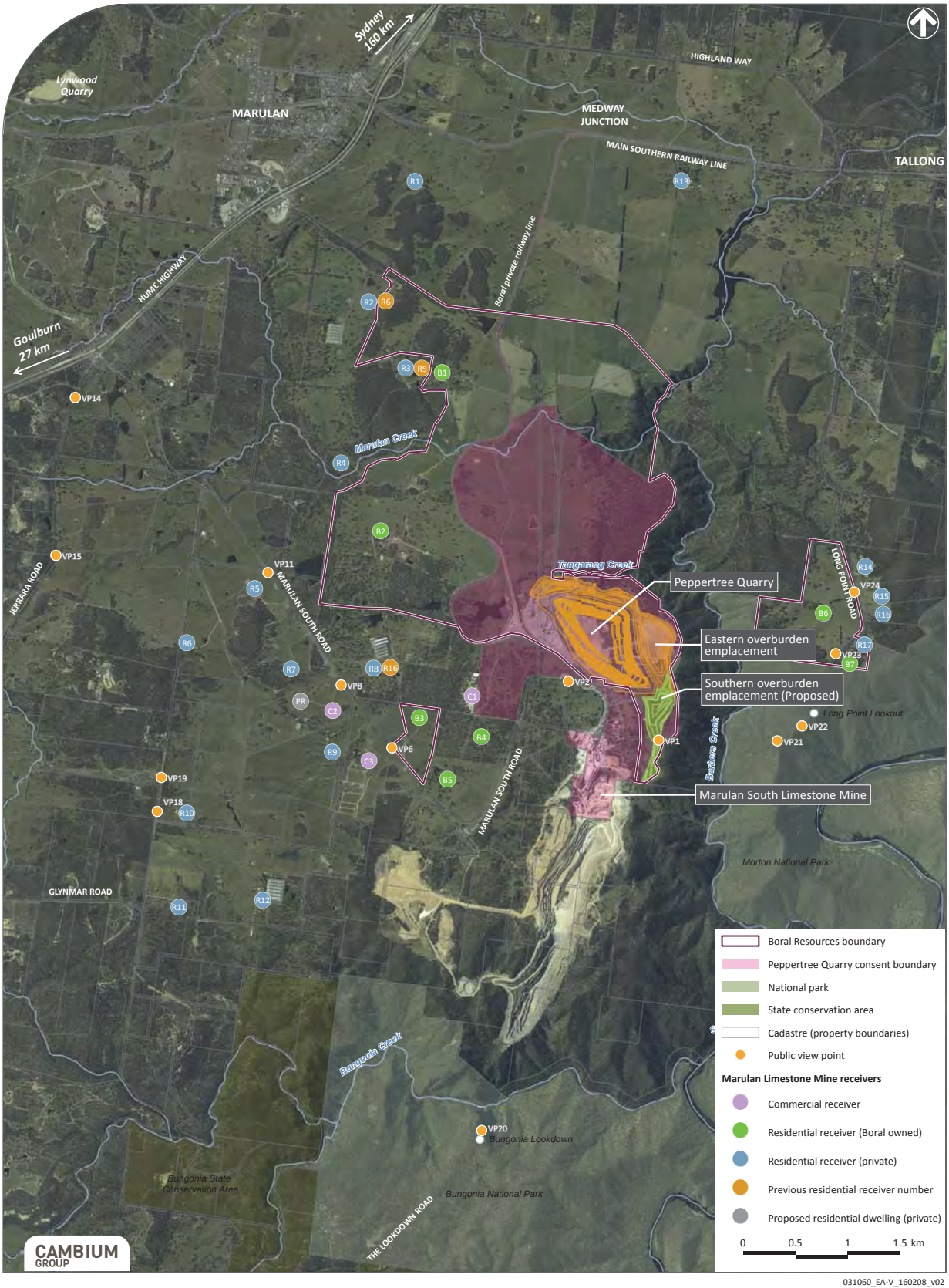

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between a viewer and an item of a given size leads to the image appearing to be one quarter of its former size (by the inverse square of the distance). It is therefore conventional to use an exponential scaling between the effects on close range views and middle range views to acknowledge the rapid decrease in apparent size that occurs in closer range views compared to distant views. For small items such as buildings, classes of <100m, 100m-1000m and >1000m are conventionally used in our methodology.

However, for large infrastructure items such as open cut mines, wind farms, etc. which cover significant horizontal areas, larger distance ranges are necessary. RLA have adopted the following range classes: close range (<500m), medium range (500-3000m) and distant (>3000m).

View loss or blocking effects

View loss or blocking effects in this assessment means a measure of the extent to which the Modification, in this case the proposed Southern Overburden Emplacement, is responsible for view loss or blocking the visibility of items in the view. View loss is considered in relation to the two relevant planning principles enunciated in the Land and Environment Court of NSW by Roseth SC in *Tenacity Consulting v Warringah [2004] NSWLEC 140* and by Moore SC in *Rose Bay Marina Pty Limited v Woollahra Municipal Council and anor. [2013] NSWLEC 1046 (Rose Bay Marina)*. *Tenacity* concerned view losses from residential properties only, but the matter of what could be construed to be a valuable feature of the view which could be lost, e.g. specific features of views such as whole views and iconic elements are of relevance to the public domain.

The planning principles in *Rose Bay Marina* have extended *Tenacity* to considering view loss from the public domain.

View loss and blocking effects would increase the perception of the visual effects of the proposed Southern Overburden Emplacement if they occurred. View loss and view blocking can be important matters for consideration in regard to short range views from the public domain of roads and lookouts and potentially from nearby adjacent residences. View loss and blocking effects are only related to the proposed Southern Overburden Emplacement component of the Modification.

2.2.2.3 Overall Extent of Visual Effect

Based on the inspection of the pattern of the assessment ratings for the above factors on the relevant analysis sheet for each viewing location an overall rating is arrived at which represents an overall extent of visual effects for a viewing location.

2.2.3 The Components of the Visual Impact Analysis

The criteria in Section 4.2 concern assessment of the extent of the visual effects of the proposed Southern Overburden Emplacement when seen from specific viewing places. The extent of the visual effects is the base-line assessment against which to judge the visual impacts. The viewing places analysed and documented are shown on Figure 9.

Whether or not a visual effect is an impact of potential significance however, cannot be equated directly to the extent of the visual effect. A high visual effect can be quite acceptable, whereas a small one can be unacceptable. For example, in the context of the existing Project Approval to change the topography of the site and for a final landform that includes the almost completed Eastern Overburden Emplacement and other features that presently do not exist in the visual catchment, there are high levels of acceptable change.

To distinguish between the extent of change and the significance of the impact, it is necessary to give a weighting to the assessed levels of effects to arrive at an assessment of the impact.

This method therefore does not equate visual effects directly to visual impacts. The approach is to assess visual effects as in Section 2.2.2 to arrive at an overall level of visual effect of the Modification for each kind of viewing place and then to assess the level of impact, if any, by giving differential weighting criteria to the level of effect determined. This means that the relative importance of impacts are distinguished from the size of the effect. RLA consider that two weighting criteria are appropriate to the overall assessment of visual impacts; Physical Absorption Capacity and Visual Compatibility (see Section 4.3). Two kinds of compatibility are evaluated (i.e. Compatibility with quarrying/industrial and compatibility with rural/natural features). Each of these addressed the primary question of the acceptability of the visual effects and changes caused by the Modification and how much weight ought to be given to them.

2.2.3.1 Physical Absorption Capacity

Physical Absorption Capacity (PAC) means the extent to which the existing visual environment can reduce or eliminate the perception of the visibility of the proposed Southern Overburden Emplacement.

PAC includes the ability of existing elements of the landscape to physically hide, screen or disguise the proposed Southern Overburden Emplacement. It also includes the extent to which the colours, textures, line and form and the scale and character of these allows them to blend with or reduce contrast with others of the same or closely similar kinds of items, to the extent that they cannot easily be distinguished.

Prominence is also an attribute with relevance to PAC. It is assumed in the assessment that higher PAC can only occur where there is low to moderate prominence of the proposed Southern Overburden Emplacement in the scene.

Low to moderate prominence means:

1. Low: The proposed Southern Overburden Emplacement has either no visual effect on the landscape or is evident but subordinate to other elements in the scene by virtue of its small scale, screening by intervening elements, or difficulty of being identified.
2. Moderate: The proposed Southern Overburden Emplacement is either evident or identifiable in the scene, but is less prominent, makes a smaller contribution to the overall scene, or does not contrast substantially with other elements or is a substantial element, but is equivalent in prominence to other elements and landscape alterations in the scene.

Design and mitigation factors are also important to determining the PAC. Appropriate colours, materials, building forms, line, geometry, textures, scale, character, lighting and appearance of extraction areas, overburden emplacements and infrastructure are relevant to increasing PAC and decreasing prominence.

PAC is related to but distinct from Visual Compatibility.

2.2.3.2 Visual Compatibility

Visual Compatibility is not a measure of whether the proposed Southern Overburden Emplacement can be seen or distinguished from its surroundings. The relevant parameters for Visual Compatibility are whether

it can be constructed and utilised without the intrinsic scenic character of the locality being unacceptably changed. It assumes that there is a moderate to high visibility of the proposed Southern Overburden Emplacement to some viewing places. It further assumes that novel elements which presently do not exist in the immediate context can be perceived as visually compatible with that context provided that they do not result in the loss of or excessive modification of the visual character of the locality.

Because the proposed Southern Overburden Emplacement proposed is on the interface between rural–residential and natural land, with components on each, the question of its visual impacts also depends on its perception both as an entity and in regard to its compatibility with the major scenic character attributes. In this regard, both the quarrying/industrial environment and the rural-residential /natural environment are attributes of relevance. Hence, it is considered that there are two relevant measures of Visual Compatibility, i.e. compatibility with quarrying/industrial features, and compatibility with rural/natural features.

Visual compatibility with quarrying/industrial features

This assessment is a measure of the extent to which the visual effects of the Modification are compatible with existing quarrying and industrial features. It is assumed that in some views the proposed Southern Overburden Emplacement can be seen and clearly distinguished from its surroundings. Compatibility does not require that identical or closely similar features to those which are proposed exist in the immediate surroundings.

Compatibility with quarrying/industrial features means that the proposed Southern Overburden Emplacement responds positively to or borrows from within the range of features of character, scale, form, colours, textures, materials and geometrical arrangements of quarrying and industrial features of the surrounding area or of areas of the locality which have the same or similar existing visual character.

The features of the proposed Southern Overburden Emplacement are located within the Peppertree Quarry consent boundary, in the immediate vicinity of the existing Quarry operations. The Quarry is also located adjacent to the Limestone Mine which has seen mining activity since 1875 and major limestone mining since the 1920s, or nearly 100 years. Therefore, the compatibility of the visual effects of the proposed Southern Overburden Emplacement has to also be considered in relation to an existing environment, the scenic resources of which have been fundamentally and in many ways irreversibly changed in a variety of ways (see 1.3.2 above).

The proposed Southern Overburden Emplacement where it is visible will be seen as a continuation of the existing Eastern Overburden Emplacement with which it will be visually compatible.

Visual compatibility with rural-residential /natural features

This assessment is a measure of the extent to which the visual effects of the proposed Southern Overburden Emplacement are compatible with the adjacent semi-rural and natural features. The proposed Southern Overburden Emplacement may be able to be seen and clearly distinguished from its surroundings. Compatibility does not require that identical or closely similar features to those which are proposed, exist in the immediate surroundings.

Compatibility with rural/residential and natural features means that the proposed Southern Overburden Emplacement responds positively to or borrows from within the range of features of character, scale, form, colours, materials, vegetation and geometrical arrangements of the surrounding area or of areas of the locality which have the same, similar or compatible existing visual character.

2.2.3.3 Overall Extent of Visual Impact

Based on the inspection of the pattern of the assessment ratings for the above factors on the relevant analysis sheet for each viewing location an overall rating is arrived at which represents an overall extent of visual impacts for a viewing location.

2.2.4 Visual Sensitivity Zones

Three visual sensitivity zones are identified which are based on the view place sensitivity or viewer sensitivity as explained in 2.2.2.1. These are related to the distance zones from the proposed Southern Overburden Emplacement site and whether views are from significant public domain or private viewing locations. Viewing places within the high or medium visual sensitivity zones are further assessed as explained below.

Impact assessment for each zone

An overall impact rating for each of the three visual sensitivity zones is arrived at by inspecting the pattern of the assessment ratings for the visual impacts factors (as given in Section 2.2.3) on the relevant analysis sheet for each viewing location in that zone. It is generally found that the close range visual sensitivity zone is most affected by any project as it may form part of the foreground views from the viewing locations within this zone.

Planning principles relevant to view sharing

The Modification and its overall impacts is analysed in relation to relevant information concerning visual impacts in the following Land and Environment Court of New South Wales planning principles specifically related to view sharing:

1. *Tenacity Consulting v Warringah [2004] NSWLEC 140 - Principles of view sharing: the impact on neighbours* and
2. *Rose Bay Marina Pty Limited v Woollahra Municipal Council and anor. [2013] NSWLEC 1046 (Rose Bay Marina)*.

Assessment of the mitigation measures proposed

The mitigation measures that are proposed as part of the Modification are then assessed in terms of their capability to overcome the visual effects and impacts of the Modification on each of the visual sensitivity zones. Other mitigation recommendations and management guidelines may be formulated to overcome possible negative visual effects or potential residual visual impacts.

Significance of residual visual impacts

Finally and subsequent to the visual effects of the mitigation factors being assessed, a relevant question is whether there are any residual visual impacts of the Modification itself, and whether they are acceptable in the circumstances. These residual impacts are predominantly related to the extent of visual change independent of the history of permanent and irreversible change that has occurred, with consent, in the past.

The significance of these residual impacts is assessed on the basis of the relative sensitivity of viewers and viewing places that may experience these impacts. Whether overcoming these impacts would result in undermining of the potential capacity of the proposed Modification to economically support the intended use is not the focus of a visual impacts assessment such as this.

3.0 ASSESSMENT OF VISUAL EFFECTS

Summary of Visual Exposure

Below is a summary of the likely future visual exposure of the Modification. This is considered in more detail in relation to individual viewing locations and situations in Sections 4.2 and 4.3.

There are two aspects of the Modification proposed, of which only the proposed Southern Overburden Emplacement has a physical presence, in visual impact terms. The other is the extension of in-pit working hours taking place within the pit, below natural ground level and out of direct sight from any receivers. There will be no significant visibility of this activity. Visible evidence of the extended working hours will be limited to effects on night-time lighting and occur only if that lighting is visible as a more significant 'glow' reflecting off the atmosphere, to an extent different from the existing approved situation.

Quantitatively, the only in-pit change will be light associated with the Primary Crusher, Excavator, Front End Loader and in the short-term, two trucks, operating for longer hours in the early morning (5am - 7am) and at night from 7pm - 11pm. The remainder of the existing lighting including the Processing Plant, which operates as approved 24/7, will continue to have its existing visual effects. Qualitatively, as the Modification does not propose change to the kind or purpose of lighting, there will be minimal difference between the existing approved lighting and that associated with extending the working hours in-pit.

As a result it is considered unlikely that this aspect of the Modification will cause any significant change to the perception of night-time lighting and as a result, the remainder of this report concentrates on the visual effects and impacts of the proposed Southern Overburden Emplacement.

Visual exposure of the existing quarrying operations is low to the adjacent rural land to the south west, west and north, as the current operations are predominantly below the horizons of view, with the exception of the crest of the approved Eastern Overburden Emplacement. This is of minor visibility to some medium to distant range views. By comparison, the proposed Southern Overburden Emplacement will be of very limited visibility.

The visual exposure of the proposed Southern Overburden Emplacement (see Figure 9) would be to only a slightly larger area than that of the Project Approval. No roads or residences would be significantly exposed to views of the proposed Southern Overburden Emplacement. A consequence of the proposed Southern Overburden Emplacement is that in some views from the landscape to the south and east the topography of the intermediate horizon will be slightly changed as the emplacement is constructed, potentially increasing the visual exposure of newly formed topography to views. However, the overall visibility of the proposed Southern Overburden Emplacement will be minor.

Parts of the proposed location of the Southern Overburden Emplacement are exposed to medium range views from the east (part of the area accessible from the Long Point Lookout Track in the Morton NP (VP21) and the highest part of the Southern Overburden Emplacement may barely be visible from the Bungonia Lookdown northern lookout (VP20). A minor change will occur in the mid-ground horizon of the view caused by increase in the height of the landscape caused by the Southern Overburden Emplacement.

In the medium range views from the east, from the only residence in the Long Point Road locality with any potential view, Receiver R15, the visual exposure of the Southern Overburden Emplacement will not significantly alter the composition of the view.

3.1 Field Assessment

A detailed field assessment was undertaken on 30 June, 2014 and 1 and 6 July, 2015.

3.1.1 Viewing Locations and Viewing Situations

To assess the visual impacts that would be experienced by viewers, a view point analysis was conducted. This consisted of analysing the likely visual exposure of the proposed Southern Overburden Emplacement using topographic, cadastral and aerial images, then visiting the site and locality to ground-truth potential viewing places and situations. A selection of places was abstracted from the total number of potential viewing locations and situations for individual documentation and assessment. The key viewing locations included a number of public domain locations including those on roads, recreational areas and lookouts, as well as the vicinity of a number of residential receivers. The location of the receivers and selected public view points are shown on Figure 9.

The locations were selected to represent the kinds of viewers' experience of the proposed Southern Overburden Emplacement that would exist in the immediate area. Locations that represent the main kinds of viewing areas that would be affected were visited and photographed. The photographs were taken with an EOS 5D Mark 3 full-frame digital SLR camera with a fixed 35mm focal length lens, to approximate the correct proportions of the elements of views as experienced by the human eye. A GPS unit attached to the camera wrote the coordinates and compass bearing of each photograph onto the electronic meta-data of each electronic image file. In this way, the locations could be accurately determined for the purpose of 3D modelling of the likely visual effects of the proposed Southern Overburden Emplacement and so viewing locations can be accurately located in the future, if necessary, for monitoring purposes.

At each viewing place a series of observations and assessments were made, as documented in the Photographic Plates in Appendix 1 and in the assessment sheets in Appendix 4. A variety of other locations were also visited to ascertain the extent of the visual catchment and the characteristics of the views.

3.1.2 Visual Catchment

The potential total visual catchment of the proposed Southern Overburden Emplacement is small. The visual exposure to the private domain is limited to a small number of residential receivers, and the maximum area of potential public domain exposure, although larger, contains few locations with potential views. The theoretic visual catchment extends toward the east to a medium range part of Morton NP on the crest of a ridge that runs south for a short distance from the terminus of Long Point Road and to the south to the Bungonia Lookdown in Bungonia NP.

Visibility is strongly influenced by the undulating topography, vegetation and clearing pattern and by the low exposure to formalised viewing situations such as roads, lookouts and public recreation areas. Although the potential area over which views may be possible in the Morton NP is large, the number of places that would offer practical access to the views of the proposed Southern Overburden Emplacement would be small and typically restricted to small numbers of viewers, predominantly pursuing environmental tourism and recreational activities.

Visibility of the proposed Southern Overburden Emplacement would also be constrained by distance, perspective effects, and by intervening elements such as topography and vegetation. In general, other than medium distance parts of Morton NP to the east at similar elevations, such as informal viewing places accessible from the Long Point Track, views would be from locations significantly below the site in relative elevation. The situation of the existing and proposed disturbed areas of the Quarry being below the horizon of the views means that there would be few opportunities to perceive significant visual effects of the proposed Southern Overburden Emplacement from the Morton NP.

Table 4.2: Summary table of overall extent of visual effects and impacts

				Impact Weighting factors				
View Point or Receiver number	Direct visibility (any part of existing Quarry site) Y/N	Distance class	Overall level of visual effects	Physical Absorption Capacity	Compatibility mining and industrial features)	Compatibility rural and natural features)	Sensitivity	Overall Visual Impact
VP1	Y	Close*	High	Medium	High	High	N/A*	Low*
VP2	Y	Medium*	High	Medium	High	High	Medium	Low*
VP6	N	Medium	Low	High	High	High	Medium	Low
VP8	N	Medium	Low	High	High	High	Low	Low
VP11	N	Distant	Low	High	High	High	Low	Low
VP14	Y^	Distant	Low	High	High	Medium	Low	Low
VP15	Y^	Distant	Low	High	High	Medium	Low	Low
VP18	Y	Distant	Low	High	High	High	Low	Low
VP19	Y	Distant	Low	High	High	High	Low	Low
VP20	Y	Distant	Medium	High	High	Medium	Low	Low
VP21	Y	Medium	Medium	Medium	High	Medium	Medium	Medium
VP22	N	Medium	Low	High	High	High	Medium	Low
VP23	N	Medium	Low	High	High	High	Medium	Low
VP24	N	Medium	Low	High	High	High	Medium	Low
R5	N	Distant	Low	High	High	Medium	Low	Low
R8	N	Medium	Low	High	High	High	Medium	Low
R10	Y	Distant	Low	High	High	High	Low	Low
R13+	Y^	Distant	Low	High	High	High	Low	Low
R14	N	Medium	Low	High	High	Medium	Medium	Low
R15	Y^	Medium	Low	High	High	Medium	Medium	Low
C2	N	Distant	Low	High	High	Medium	Low	Low#
C3	N	Medium	Low	High	High	High	Low#	Low#

* View Point at or inside Project site

Commercial receiver (potential residence site assessed for C2)

+ Heritage item

^ View of part of existing Eastern Overburden Emplacement

The visibility of the proposed Southern Overburden Emplacement is largely confined to the following public and private domain viewing locations:

Public Domain locations:

The proposed Southern Overburden Emplacement is of overall low exposure to the public domain.

The few areas of the public domain (roads) that are exposed to views of any part of the existing Quarry are:

1. Close range views from part of Marulan South Road immediately adjacent to the Peppertree Quarry.
2. Distant range views from a short section of Glynmar/Government Road to the west of the proposed Southern Overburden Emplacement.
3. Distant range views from an isolated section of Jerrara Road to the north west of the proposed Southern Overburden Emplacement.

Distant range views above are of parts of the existing Eastern Overburden Emplacement. 3D graphics and observations indicate that there would be no significant view of the proposed Southern Overburden Emplacement in these views.

Other areas of the public domain that are exposed to views are confined to the Morton NP to the east and Bungonia NP to the south, from which there is a distant view to the crest of the southern extent of the proposed Southern Overburden Emplacement. There are no other views from formal viewing locations (formed lookouts).

Informal lookouts and viewing places associated with tracks into or out of Morton NP include:

4. The track from the Long Point Lookout area to the east, in Morton NP. The lookout itself has a view to the south east which does not include the Quarry. The track itself runs south along the eastern side slope of a spur, from the carpark near the lookout to a point where it turns north and descends into the Shoalhaven River Gorge. The track provides access to locations off the track to its west from which some partial views are available.

Private Locations:

Private locations identified as potential sensitive receivers include 17 non-involved residences on rural land (see residential receiver locations marked with blue circles and corresponding numbers beginning with R on Figure 9). Of the 17, only 4 are likely to have views of any part of the proposed Southern Overburden Emplacement. RLA's visual impact assessment methodology places some residential receivers in the category of medium sensitivity primarily based on the associated distance class of the dwelling. However as discussed below in Section 4.1.3 despite a medium rating for distance and sensitivity on those criteria, residential receivers may not be exposed to direct or potential views of the Modification site. An example is Receiver R8. In this case based on the medium distance viewing class of the dwelling and initial 3D modelling, a potential view from R8 was identified based on preliminary 3D analysis ignoring the presence of vegetation. Potential visual impacts on this dwelling were discounted after ground-truthing during fieldwork, which confirmed that no physical view is available from the dwelling.

Commercial Receiver Locations:

Two of the closest commercial receivers C2 and C3 were visited and the views photographed, documented and compared to the 3D modelling. A potential future dwelling site proposed on the same property as Receiver C2 was also assessed.

Boral Owned Receivers:

Seven residences owned by Boral are identified by green circles and numbers with the prefix B on Figures 2 and 7. As the residences are associated with Boral's Marulan South operations, they were not visited and the views have not been documented. However 3D graphics were prepared for a selection of them and show that with the exception of receiver B2, these residences would typically also have low visual exposure to the proposed Southern Overburden Emplacement.

3.1.3 3D Modelling to Represent Views

Cambium Group were commissioned to prepare a 3D terrain model of the site and surrounding environment using 1m contour survey data acquired in 2014. The topography of the proposed Southern Overburden Emplacement at its maximum final landform height was added to the model. To represent views from individual sensitive receiver locations, a virtual camera was located at each receiver and the view was simulated in 3D graphics (see Appendix 2). A georeferenced and orthorectified aerial photograph was draped over the topography model. As an aid to predicting the likely effect of vegetation on the views, the vegetation plotted in the view cone from each virtual camera was added to the model. The model was then rendered with the same colour coding for the overburden emplacement areas as in the key plan at the first page of Appendix 2. This is intended to identify and differentiate the individual emplacement structures and not to represent the likely visual effects of the proposed Southern Overburden Emplacement.

Following initial site visits, photography and ground-truthing of the visual exposure predicted by the models, the height and density of the vegetation was amended to better reflect the evidence in the photographs (see Appendix 1).

3D modelling of the composition of the views from each of 17 residential, 4 Boral-owned and three commercial receivers (see examples in Appendix 2) was carried out as a first stage of assessment of the likely visual exposure of the proposed Southern Overburden Emplacement to views from the dwellings. This was assisted by interpretation of aerial images and topographic information on which feature such as buildings, vegetation and topography that could affect visual exposure was identified, using ortho-rectified high resolution aerial imagery captured on 2 November, 2014.

The views from Receivers were modelled in 3D with topography, but initially with no representation of vegetation, to demonstrate the theoretical visibility of the proposed Southern Overburden Emplacement. The 3D model was then populated with vegetation plotted from the aerial imagery so as to predict the likely effect of the vegetation on visibility.

Of the 17 residential receivers, it was determined that 11 do not have potential views of the proposed Southern Overburden Emplacement from the dwellings (see Table 4.2). Of the remaining six, the owners were contacted by Boral staff and visited by RLA, with the exception of R7, access to which could not be secured. The views from the receivers with potential views of the proposed Southern Overburden Emplacement were photographed and the views were documented and compared to the views predicted by initial 3D modelling. The actual views are included in the photographic plates in Appendix 1 and in the analytical 3D graphics (for selected Receivers) in Appendix 2.

Following analysis and documentation at this stage, it was evident that the 3D modelling had been too conservative as regards the representation of the height, density and range of tree forms and vegetation height that had been adopted in the rendering of the models. The initial tree height and density for vegetation interpreted from the aerial imagery registered to the topography used to prepare the 3D models had been set at 15m height and open woodland density. Examination of photographs taken from the commercial site and the receiver dwellings and compared to the 3D model predictions of the visibility of the overburden emplacement areas showed that the vegetation was on average up to approximately 5m too low. The open woodland vegetation form adopted was also incorrect, leading to a higher predicted view through or below vegetation canopy than would occur in reality.

The models in Appendix 2 which show the likely effect on views of the vegetation were adjusted to better reflect the correct vegetation height and density shown in representative photographs taken from the same locations as the 3D cameras. This cross check assists in predicting the likely visual exposure of the proposed Southern Overburden Emplacement from the dwelling not assessed (Receiver R7). It is likely, based on the experience and observations of the other five dwellings visited and analysed, the topography and its setting among significant areas of vegetation, that Receiver R7 does not have a significant view of the proposed Southern Overburden Emplacement from the dwelling.

3.1.4 Rendered Photomontages to Represent Views

Three locations were identified for the preparation of fully rendered photorealistic montages, i.e. the Bungonia Lookdown lookout (VP20) and two dwellings (R10 and R15). The photomontages are shown in Appendix 3.

The technology of production of the photomontages, prepared by Cambium Group using photographs taken by and geotagged by RLA was as follows:

View point camera locations used to prepare photomontages were obtained by a GPS mounted to a Canon EOS 5D Mark III camera using a Canon EF 35mm F1.4L USM lens with co-ordinates and elevation data recorded in World Geodetic System (WGS84). The geotagged images were captured by RLA. Co-ordinates were exported to a MS Excel data file and imported to ArcGIS then re-projected to the local co-ordinate system, being Map Grid of Australia (MGA94). These co-ordinates were exported from ArcGIS as a DWG file and opened in AutoCAD 2014. Using AutoCAD, view point elevation was cross checked with the elevation recorded by the GPS and compared with LiDAR contour data and ortho-rectified aerial photography. Photographs with a focal length of 35mm were then selected for the purposes of photomontage and corrected for distortion using specific camera and lens profiles for the Canon EOS 5D in Adobe Photoshop. Camera co-ordinates were then merged with the 3D model of the approved Quarry plan including the proposed Southern Overburden Emplacement design and virtual cameras were setup using these locations and adjusted for elevation based on earlier findings. Camera matching was then undertaken using a combination of the existing 3D infrastructure survey, 3D terrain model and virtual views, setup as part of the desktop study. Final photomontages were rendered with foreground and background vegetation adjusted using aerial photography and virtual views as an indicator.

3.2 Visual Effects Analysis

3.2.1 Base-Line Factors

3.2.1.1 Visual character

The landscape setting of the Quarry (see Figure 2, Local Context) is within an area of intermediate character between the rural and semi-rural landscapes of the nearby tablelands to the west and north and the natural gorges and undeveloped landscapes of the Morton NP to the east.

The existing scenic resources have been identified in Section 1.4.2. The existing visual character of the approved Quarry and the underlying character of the area proposed for the Southern Overburden Emplacement are base-line factors to be taken into account in considering the visual effects and impacts of the proposed Southern Overburden Emplacement. This is because critical factors in establishing the importance of visual impacts are physical absorption capacity and compatibility (see Section 4.3). Visual character is a base-line criterion which allows an assessment to be made of the extent to which the existing visual character will either absorb or be compatible with the proposed Southern Overburden Emplacement. The visual character is also important in assessing the appropriate strategies for increasing physical absorption capacity and compatibility by means of mitigation measures.

The rural landscape underlying the Quarry and the location of the proposed Southern Overburden Emplacement is largely cleared and of rolling topography and supports livestock grazing.

The formal aesthetic qualities of the Quarry bunds and overburden emplacements in terms of their line, form, texture and colour are the most prominent visual features in views from outside the Quarry. These cause some contrasts with the rural and semi-natural adjacent landscape.

3.2.1.2 Scenic quality

Scenic quality is a second base-line against which the effects of changes to the physical environment can be predicted to impact either positively or negatively on the perceptions and emotional reactions of viewers. There is an extensive empirical research literature concerning general relationships between aspects of the physical environment and predicted judgments of scenic quality or other expressions of this, such as scenic beauty or scenic preference. In general, a location of lower scenic quality has a greater intrinsic capability to absorb change than one of higher quality.

This research would predict that the rural setting of the Quarry and its locality would be of low-moderate scenic quality. While it shows the presence in many views of slightly varied topography, managed landscape and vegetation, it does not contain significant water bodies, diversity, or areas of high scenic integrity (naturalness). It also exhibits factors which decrease scenic quality, such as vegetation clearing, lack of prominent topography and presence of large scale industrial structures.

By comparison, the views from inside the natural reserves of Morton NP and Bungonia NP of the unmodified landscapes which are probably the main motivation for their visitation would be predicted to be moderate-high in scenic quality, as they contain significant topographic variation, naturalness, complexity, diversity of forms and vegetation and also some limited water bodies.

As is noted above with regard to scenic character, the base-line for scenic quality is also significantly modified by the existing and long history of adjacent limestone mining and recent granodiorite quarrying. This has to some extent irreversibly changed the scenic quality of the setting. In this context it would be unrealistic and unreasonable to take the theoretical, past moderate-high scenic quality of the landscape, pre-quarrying and mining, as the base-line against which to judge the effects of the proposed Southern Overburden Emplacement.

It is therefore reasonable to determine that the visual quality of the Quarry in the context of its setting, which is composed of both moderate and moderate-high quality landscape, but has been significantly degraded in the past, is at best of moderate scenic quality.

A moderate scenic quality base-line means that subject to other considerations, the landscape has a higher potential to absorb visual impacts than one of higher scenic quality.

3.2.1.3 View place sensitivity (public domain sensitivity)

The public domain viewing locations are constituted by roads, lookouts and reserves. The view place sensitivity for public domain viewing locations is rated as high for locations with a clear view that is less than 500m from the proposed Southern Overburden Emplacement site. Places of high sensitivity are confined to the immediate streetscape of Marulan South Road, or inside the development site (VP1 and VP2), as no other receivers exist within the close range category (Refer to Photographic Plates in Appendix 1).

Medium view place sensitivity ranking was determined for public domain views from VP21; off-track sites accessed from the Long Point Track).

The view place sensitivity was rated medium for most other locations in the private and public domain between 500-3000m from the proposed Southern Overburden Emplacement site. Almost all viewing places fall into this distance category. Two isolated viewing places on Jerrara Road (VP14 and VP15) two residence (R10 and Glenrock, R13) and The Lookdown (VP20) are viewing places in the low sensitivity class, being beyond 3000m (at approximately 5.6, 5.7, 4.2, 4.9km and 3.5km distance, respectively).

3.2.1.4 Viewer sensitivity (private domain sensitivity)

The viewer sensitivity is rated high in the methodology for any dwellings within 500m of the proposed Southern Overburden Emplacement. No residential receivers are in this category. Viewer sensitivity is rated medium for dwellings between 500m and 3000m. One residential receiver in this category (R15) may have a minor view of part of the proposed Southern Overburden Emplacement. All other potentially affected residential receivers (R10 and R13) are in the distant category.

It is to be noted from the results in relation to variable factors that the proposed Southern Overburden Emplacement has low visual accessibility to the public, has no significant exposure to roads with high viewer numbers in the public domain or to close views from residential receivers. It is therefore exposed to generally medium to low sensitivity viewing places.

3.2.2 Variable Factors

Effect on view composition

With the exception of views from off-track locations to the east, in the Long Point Track area, where there would be a medium effect on view composition, it was found that there would overall be low effects on view composition caused by the proposed Southern Overburden Emplacement. No residential receivers would experience significant change to view compositions.

3D modelling, confirmation by on-site photography and the photomontage (Appendix 3) show that there would be no perceptible change to the composition of the view from the residential receiver R15, which potentially has the highest residential exposure to views of the proposed Southern Overburden Emplacement.

Effect of relative viewing level

The topography of the rural land that dominates the setting to the south-west, west and north of the proposed Southern Overburden Emplacement is relatively uniform in topography. It has no major ridge systems to interrupt view lines, other than an area of low hills between the Quarry and the majority of Jerrara Road that is to its west north-west and another of more pronounced and separate hills between the site and Marulan township to the north north-west (see Figures 1 and 2).

However as outlined previously, these areas of low hills are predominantly vegetated with open forest and woodland, with varied understorey. Significant areas of either uncleared or regrowth vegetation also occur on some private landholdings. The combination of rolling topography and significant areas of tall, woody vegetation, means that there are very few locations that are elevated above the surrounding countryside that provide significant viewing opportunities of the proposed Southern Overburden Emplacement.

Effect of viewing distance

With the exception of view places in or immediately adjacent to the Quarry, all viewing places are in the medium range or the distant range category at greater than 3000m from the nearest part of the disturbance footprint of the proposed Southern Overburden Emplacement. In the private domain, Receivers R14 and R15 to the east and Receiver R8 to the west are the only residential receivers not in the distant viewing category above 3000m. Receiver R8 has no view toward the proposed Southern Overburden Emplacement site and R14 and R15 have minimal and screened views. Receiver R13 has a distant view of the crest of the existing Eastern Overburden Emplacement from a distance of approximately 4.2-4.9km. Although initial 3D modelling indicated that a view of part of the proposed Southern Overburden Emplacement may be possible from R13 and R14, it was later confirmed that neither has a view that is affected.

In summary, for residential receivers, the effect of viewing distance does not change the extent of visual effects.

In the public domain, VP21 (off-track site accessible from the Long Point track) is the only viewing place that has clear views of parts of the disturbance footprint of the proposed Southern Overburden Emplacement. It has views from a distance of approximately 1.5km.

VP 20 (Bungonia Lookdown) has a distant view (3.5km) to the closest part of the proposed Southern Overburden Emplacement, which would be barely visible over foreground topography. The effect of viewing distance is therefore rated as medium to low on all viewing places and situations. Overall, viewing distance has either a neutral effect on the rating for the extent of visual effects, or decreases it.

Effect of viewing period

The effect of viewing period is a base-line factor that acknowledges that greater visual effects occur for places from which there are potential sustained individual views, either from fixed locations such as dwellings or moving (dynamic) locations, such as roads.

The proposed Southern Overburden Emplacement has very low overall exposure to views from residences. 3D modelling confirmed by documentation and photography of representative views showed that of the 17 potential residential receivers, only Receiver R10 and Receiver R15 may experience sustained views of some part of the final landform of the proposed Southern Overburden Emplacement, with minimal views of part of the crest of the Southern Overburden Emplacement. Receiver R13 has an existing view of part of the Eastern Overburden Emplacement, but will not see the proposed Southern Overburden Emplacement behind this. Photomontages of the likely views from R10 and R15 are in Appendix 3. The effect of viewing period for residential receivers is therefore only relevant for R10 and R15.

The proposed Southern Overburden Emplacement has very low exposure to roads and no areas from which there are sustained views. A fleeting view of the existing Eastern Overburden Emplacement is possible from VP14 and VP15 on Jerrara Road, between areas of elevated topography and vegetation, which block views from the majority of the roads. Views from Marulan South Road west and north west of the site are blocked in the foreground and middle distance by vegetation in the road reserve and on properties to the north east and east of the road. Views of the proposed Southern Overburden Emplacement would be confined to an area almost immediately in the vicinity of the entry to the Quarry (VP2). Views of the proposed Southern Overburden Emplacement would be possible over a short distance between VP2 and approximately the entrance to the Limestone Mine.

The effect of viewing period for views from roads is therefore only increased for the view from this part of Marulan South Road. It is noted below that this part of the road is considered to be in a practical sense of low sensitivity as a viewing situation for a unique reason, as it essentially leads only to land of existing industrial, mining or quarrying uses under Boral ownership.

Areas from which short term but sustained views are possible include VP20 (the Bungonia Lookdown lookouts), VP21 (off-track sites accessible from the Long Point track) and areas to the east and south east in the Morton NP. The effect of viewing period for views from lookouts and reserves is therefore increased for these public viewing places.

View loss or blocking effects

As the proposed Southern Overburden Emplacement has overall low visual exposure, the landform structures with a vertical component that are proposed to be constructed i.e. the proposed Southern Overburden Emplacement would not cause significant view loss or view blocking effects.

This assessment of view loss considered the planning principles in *Tenacity and in Rose Bay Marina. It is RLA's opinion that the threshold test in Tenacity is not met in the visual effects of the proposed Southern Overburden Emplacement. That is, there is no significant loss of views to residences and it is not considered necessary to go through the four-step process of the planning principle in Tenacity.*

The planning principles in Rose Bay extended Tenacity to considering view loss from the public domain which includes roads, lookouts and reserves. Rose Bay does not concern general changes in the character or quality of the view.

The extent of view loss is negligible from roads and is minor from lookouts and reserves and it is therefore RLA's opinion that the extent of view loss to the public domain is minor. It is therefore considered that the Rose Bay planning principles are also not relevant in this case.

Night time lighting

Three kinds of lighting are potentially relevant to visual impacts. These are:

1. General and security lighting, that is of low luminance;
2. Lighting for safe working in the Quarry environment, including lighting associated with the existing processing area, which is of higher luminance and may not only be perceived directly, but may also cause a "glow" effect, by reflected or direct light causing illumination of the adjacent atmosphere; and
3. Lighting associated with machinery and vehicles working in the pit at night.

High luminance lighting of type 2 can be reflected off surfaces even if not directly visible and cause illumination of secondary features adjacent to the source. It can also cause a glow effect by illuminating dust or water vapour in the atmosphere in certain circumstances. The glowing effect can be visible above the location of the light source and therefore the visual catchment of the light is increased.

The lighting has several specific functions as an essential health, safety and security feature of the existing processing plant and associated facilities. This lighting is a feature approved in the existing operations. For the reasons outlined above in relation to visual exposure of the existing operations, most of the security lighting would not be visible as it is on structures that are below the horizons of the views.

With regard to perception of night lighting generally, there is no proposed change to lighting types and each of the three types of lighting are approved and exist as part of the current operations. It is unlikely that extending working hours as proposed, or the use of a small number of machines working below ground level in the pit, will have any significant impact on the existing night-time light levels perceived.

The only view point identified as having line of sight to sources of light at night, is land in the Morton NP to the east (VP21), from which lighting types 1 and 2 would be directly visible, until the proposed Southern Overburden Emplacement screens the view as it rises into the view line. In addition, as the tracks are predominantly used for daytime activities, the visibility of night time lighting from the Morton NP is not considered to be an issue that increases the sensitivity rating of that viewing place.

As a result it is considered unlikely that the proposed extended in-pit working hours, would have a significant effect on perception of night-time lighting effects.

3.2.3 Overall Extent of Visual Effects

The overall extent of visual effects of the Modification was established through an evaluation of all of the impact factors for each viewing location as presented in Table 4.2. In summary, the overall visual effects rating of the Modification on its total visual catchment has been assessed as low.

3.3 Visual Impact Analysis

3.3.1 Physical Absorption Capacity

The physical absorption capacity (PAC) for the Modification would be high for the majority of the visual catchment, with the exception of the one off-track viewing location in Morton NP (VP21), which would experience medium PAC. VP20 (the Bungonia Lookdown lookout) would experience high PAC.

3.3.2 Visual Compatibility

Visual compatibility with quarrying/industrial features

The visual compatibility of the Modification with quarrying/industrial features would be high for all viewing locations as:

1. The Modification does not include changes to any of the existing infrastructure, machinery used, methods of quarrying, means of construction of overburden emplacements or overall rehabilitation strategies;

2. The shapes, form, line, colours and textures of landform structures proposed i.e. Southern Overburden Emplacement would be of high compatibility with the existing quarrying landscape, being located immediately adjacent to and constructed as a continuation of the approved Eastern Overburden Emplacement; and
3. The contribution of the proposed extended operating hours of in-pit works to the effects of the existing night lighting will be minor.

Visual compatibility with rural and natural features

There is no proposed change to the built components of the Quarry, which in the context of a Quarry provide the built fabric. The Modification is therefore of high compatibility with the built fabric of the Quarry.

With regard to rural and natural features, notwithstanding the natural character and moderate quality of adjacent land to the east of the Modification, the proposed Southern Overburden Emplacement site and land to its west and north, including land outside the proposed disturbance footprint, demonstrate a significant history of disturbance. The proposed Southern Overburden Emplacement is therefore of high visual compatibility with these features of historic disturbance.

3.3.3 Overall Extent of Visual Impact

The overall extent of visual impacts was established through an evaluation of all of the impact factors for each viewing location presented in the Data Sheets in Appendix 4. These overall assessments of the visual impacts of the Modification are shown in summary in Table 4.2. The overall visual impacts rating of the Modification on its total visual catchment has been assessed as low with initial medium impacts of the proposed Southern Overburden Emplacement on VP21 (off–track sites accessed from the Long Point Track). The medium rating for VP21 primarily results from the visual exposure of the proposed Southern Overburden Emplacement to daytime views only, as the Morton NP is likely to be primarily used for day-time recreation and the Modification is unlikely to result in any noticeable change in existing night time lighting experienced from the Quarry.

3.4 Visual Sensitivity Zones

3.4.1 Impact Ratings Summary

The medium or low sensitivity zone applies to all viewing places and situations assessed.

The overall visual effects rating for the highest view sensitivity zone in the public domain (VP2) was assessed to be high. This zone is confined to the last section of Marulan South Road, between the entrances to the Quarry and the Limestone Mine. Although this section of Marulan South Road is rated as being of existing medium sensitivity as a road with close views, it is effectively a private road (largely unused by the general public). Boral has received in principle agreement from Goulburn Mulwaree Council (in discussions around the proposed Marulan South Limestone Mine Continued Operations – State Significant Development Application) for deregistration of the section of Marulan South Road, east of the entrance to the Aglime Fertiliser facility. As a result, the overall visual impacts on this view point are considered to be low.

The overall visual effects rating for the medium sensitivity zone was assessed to be low. As no locations in this category except VP2 (discussed above), VP21 and R15 have any views of the proposed Southern Overburden Emplacement, the visual impacts are considered to be low.

The overall visual effects rating for the low sensitivity zone was assessed to be low. The zone applies to 12 locations analysed, six of which have a view of part of the existing Eastern Overburden Emplacement, but none of which are likely to have significant views of the proposed Southern Overburden Emplacement. The visual impacts on this zone are considered to be low.

The visual impacts on the medium sensitivity zone are then analysed against the relevant mitigation measures in Section 4.5 to determine whether the proposed controls adequately mitigate the impacts. The effects on low sensitivity zones were not analysed as it was considered that no significant impacts would occur for these locations.

3.5 Assessment of the proposed Mitigation Measures

This part of the assessment considers whether specific mitigation measures will satisfactorily mitigate direct visual effects and impacts. It is acknowledged that indirect visual impacts can be caused by factors such as attention attracted by noise and the visibility of dust and machinery, all of which are in a sense evidence of the Modification. Indirect visual impacts may be associated with some kind of visual experience. It is outside of RLA's expertise to comment on these indirect technical aspects which are the subject of individual specialist studies.

3.5.1 Proposed Landform

Notwithstanding the low overall visibility of the proposed Southern Overburden Emplacement to most of the visual catchment, the compatibility of this constructed landform to existing and future landform has been carefully considered in regard to mitigation of visual impacts.

In most of the visual catchment, the visual character of the proposed overburden emplacement will not cause any visual impacts. However, in views from the natural settings in the Long Point track areas (VP21), the visual effects of the proposed overburden emplacement will be evident to varying degrees as a result of initial contrasts with the colour, line, form and texture of the existing environment. These changes will be seen in the context of the existing Eastern Overburden Emplacement at the Quarry and the Limestone Mine, both of which are located immediately adjacent to the proposed Southern Overburden Emplacement.

The proposed landform is compatible with the existing and natural topography, to the extent that is reasonably possible. The side slopes are compatible with the gradients of natural precedents in the vicinity i.e. Barbers Creek Gorge and there is opportunity for minor variations in the topography of the faces so as to create a natural appearance. The Southern Overburden Emplacement will be progressively rehabilitated in accordance with the Peppertree Quarry Landscape and Rehabilitation Management Plan (ERM, 2012) and will therefore blend in with the adjacent naturally vegetated landscape of the adjacent Barbers Creek Gorge over time. The main objectives of the Peppertree Quarry Landscape and Rehabilitation Management Plan as stated by ERM are to:

> *…prevent erosion on bunds and overburden, establish self-sustaining native vegetation and native habitats and ensure natural regeneration of the endangered ecological community of Box-Gum Grassy Woodland.*

3.5.1.1 Specific recommendations

While the final landform is considered satisfactory with regards to visibility and character, there may be some visibility and visual impacts associated with the construction of the Southern Overburden Emplacement. The 3D graphics (Appendix 2) indicate that the only two residential receivers identified that might have views of some part of the proposed Southern Overburden Emplacement, Receiver R10 to the south west and Receiver R15 to the east, will not have significant views of the Southern Overburden Emplacement.

So as to minimise the visibility of construction of the overburden emplacement in view from the south east in the Morton NP it is recommended that the final embankments of the Southern Overburden Emplacement, especially the western and southern faces, are rehabilitated progressively and as soon as practically possible, following final embankment shaping.

3.5.2 Rehabilitation

The Southern Overburden Emplacement will be of low overall visibility, however the crest will become partly visible as it approaches final landform height in views from the south west and earlier in views from the east. There would potentially be contrasts between the Southern Overburden Emplacement and the adjacent Eastern Overburden Emplacement unless similar rehabilitation strategies are adopted for both.

The greatest visual exposure is to the east, where there are minimal views from residences, but exposure to recreational land in the Morton NP. Rehabilitation has other objectives than visual impact mitigation alone, such as positive ecological and water quality outcomes. As a result, rehabilitation of the Southern Overburden Emplacement would be required, even though the overall visual impacts on views from the east are minor.

Initially, landscape structures for the stabilisation and drainage of the outer slopes of the Southern Overburden Emplacement may be visible by way of their line and form, such as graded drains and rock-lined water drop structures. Their visibility will decrease to zero as vegetation establishes through successful rehabilitation. Because of shadows cast by even small individual plants, the visibility of surfaces and of linear drainage structures will significantly decrease well before maturity of any of the planted canopy (tree) species.

3.5.2.1 Specific recommendations

As much of the footprint of the proposed Southern Overburden Emplacement is comprised of disturbed Box-Gum Grassy Woodland and in accordance with the main objectives of the Peppertree Quarry Landscape and Rehabilitation Management Plan, stabilisation of the batters and progressive rehabilitation to Box-Gum Grassy Woodland is intended to result in:

1. A stable landform with minimal erosion;
2. A net improvement in the ecological value of the rehabilitated final landform; and
3. The creation of a final landform of appropriate colour, texture and scenic quality, by providing a vegetation cover that is compatible with the existing and adjacent natural environment. In this way, the major contrasts of existing overburden emplacements with the surrounding environment will be minimised.

3.5.3 Lighting

While visiting each of the residential receivers documented, the owners were asked by RLA whether they could perceive night lighting from the Quarry. Each receiver had the opportunity, without prompting, to express whether that lighting, if perceivable, was considered to be obtrusive, or otherwise. Some of the residents reported seeing light at night in some contexts, primarily as glimpses of processing area lights, seen while driving in the area. None of the residents expressed concern about brightness, glare or nuisance caused by night lighting. Two residents, one to the west of the Quarry and one to the east reported sometimes seeing a “glow” at night in the general vicinity of the Quarry site as distinct from individual lights visible at times associated with the processing area. This “glow” is presumably a reference to reflected light or the illumination of the atmosphere by type 2 lighting from the processing plant area. A distinction was made between the perceived colour of the “glow” that was visible in the vicinity of the Limestone Mine and the Quarry. Light from the Limestone Mine appeared yellow to orange, while the Quarry light appeared bluish or white by comparison. Notwithstanding, the residents also reported being generally unconcerned by lighting associated with the Quarry.

As noted above, there is no proposed change to the existing Quarry lighting as a result of the proposed Modification, other than for the potential for any ‘glow’ created by light in the Pit to be extended in time as a result of increased working hours. The current ‘glow’ experienced by a small number of receivers is from the lighting associated with the out-of-pit works, primarily the processing plant and surrounds, which is the main light source from the Quarry. Therefore the light that is likely to be generated by the extended hours of in-pit works, by select pieces of machinery including the Primary Crusher, Excavator, Front End Loader, two trucks and possibly some “daymaker” lighting, is unlikely to result in a significant or even noticeable change to the ‘glow’ created by the existing night time operations. Lighting from the existing night time operations is far greater in scale, extent and intensity than the in-pit operations proposed in the Modification.

There would therefore be no significant change to the effects of lighting compared to the current approved operations which are subject to compliance with Australian Standard AS 4282-1997, Control of Obtrusive Effects of Outdoor Lighting.

4.5.3.1 Specific recommendations

Prior to and immediately following the commencement of extended in-pit operations, it is recommended that a night-time audit is undertaken from a number of the potentially most effected view points, to ascertain whether the introduction of night time in-pit works results in any visible lighting or in any change to the ‘glow’ created above the existing Quarry. If the ‘glow’ effect was found to noticeably increase by the light from extended in-pit operations, reasonable and feasible measures will be investigated and implemented to mitigate the change in the ‘glow’ resulting from the in-pit works.

This may involve gradual replacement of luminaires and lamps for type 2 lighting that may produce obtrusive light. Those that produce light in the blue spectrum such as metal halide floodlights could be replaced by more efficient lamps that produce light in the yellow to red spectrum such as sodium vapour or more efficient LED lights.

4.0 RESIDUAL VISUAL IMPACTS AND CONCLUSIONS

The proposed Southern Overburden Emplacement has a low overall visual exposure to its visual catchment. Despite there being a number of rural properties and commercial operations within 3km of the closest part of the Modification, (medium viewing distance and sensitivity classes) there is low visual exposure of the proposed Southern Overburden Emplacement to those receivers and most have no views of it.

The proposed Southern Overburden Emplacement is not exposed to view from roads that carry either through traffic or significant numbers of viewers and is not in a destination that would attract visitation by tourists. The road to the Quarry, Marulan South Road, reaches a dead-end in the vicinity of the Boral-owned Quarry and Limestone Mine entrances and is proposed to be de-proclaimed as a public road.

With the assistance of current rehabilitation methods, the proposed Southern Overburden Emplacement will have only minor effects and impacts on the visual environment.

However, the proposed Southern Overburden Emplacement is exposed to views from part of the Morton NP to its east and south. The greatest visual exposure is to off-track informal viewing locations accessed from the Long Point Track (VP21) and are of low visibility to the Bungonia Lookdown lookout (VP20).

VP21 is the only viewing location assessed that has a substantial view of the proposed Southern Overburden Emplacement. The existing processing plant and the east face of the Eastern Overburden Emplacement are visible from this location. The proposed Southern Overburden Emplacement will screen views of the processing plant area and direct views of night time lighting.

In relation to night-time lighting there is no proposed change to the existing Quarry lighting, other than for the potential for any 'glow' created by light in the Pit to be extended in time as a result of increased working hours. The current 'glow' experienced by a few receivers is from the lighting associated with the out-of-pit works, primarily the processing plant and surrounds, which is the main light source from the Quarry. Therefore the light that is likely to be generated by the extended hours of in-pit works is unlikely to result in a significant or even noticeable change to the 'glow' created by the existing night time operations as lighting from the existing night time operations is far greater in scale, extent and luminance than the in-pit operations proposed in the Modification.

Any change in night time lighting associated with in-pit works would be most visible from the Morton NP (e.g. VP21), however as the NP is used primarily for recreational activities, night time use of the tracks would be minimal. As a result, the impacts of night lighting on such viewing locations is considered to be minor and not significant.

However it has still been recommended that a night time audit is undertaken from a number of the potentially most effected view points, prior to and immediately following the commencement of extended in-pit operations. This will ascertain whether the introduction of night time in-pit works results in any visible lighting or change to the 'glow' created above the existing Quarry, allowing reasonable and feasible measures to be investigated and implemented to significantly reduce or entirely eliminate the change in the 'glow' resulting from the in-pit works.

This visual assessment finds that while there are some residual visual impacts, these are minor in significance. The visual impacts have also been considered in relation to the extensive and to some extent permanent changes to the visual environment that have been approved and occurred in the past. The residual impacts that will occur are considered compatible with both the quarrying/industrial and the rural/natural visual environment.

APPENDIX 1: PHOTOGRAPHIC PLATES

Plate 1/1

VP1, approximately 400m south of the existing Peppertree Quarry Eastern Overburden Emplacement, looking north

Plate 1/2

VP1, approximately 400m south of the existing Peppertree Quarry Eastern Overburden Emplacement, looking south towards the Marulan Limestone Mine

Plate 1/3

VP2, Marulan South Road, west of entrance to Peppertree Quarry, looking north east with existing Eastern Overburden Emplacement and bund visible

Plate 1/4

VP6, Marulan South Road, looking north east

Plate 1/5

VP8, View of C2 from Marulan South Road, opposite the entrance to R8, which is on the north side of the road. There is no view of the Modification from the commercial receiver. A potential residential site west of the commercial buildings was also assessed on the C2 property (Plate 1/23) and used for 3D analysis in Appendix 2. The analysis shows that there would be no view from the potential residential site.

Plate 1/6

VP8, View of entrance to R8 from Marulan South Road. The residence faces the road (away from the Quarry site)

Plate 1/7

VP11, View of R5 from Marulan South Road. The residence faces north toward the road and away from the Modification site. Pine tree belts, one visible in this photograph and another along the access road to the residence on the right of the photograph, are likely to confine views to the north west in the future

Plate 1/8

VP11, Marulan South Road. Vegetation in properties and undulating topography combine to block views toward the Quarry site

Plate 1/9

VP14, Jerrara Road. Part of the existing Eastern Overburden Emplacement area is distantly visible. Vegetation in this view will prevent views of the proposed Southern Overburden Emplacement from this location.

Plate 1/10

VP15, Jerrara Road. Part of the Eastern Overburden Emplacement at Peppertree Qarry is distantly visible from this isolated location. It is likely based on 3D modelling that mid-ground topography and vegetation will block views of most of the proposed Southern Overburden Emplacement from this location.

Plate 1/11

VP18, Glynmar/Government Road near the entry to R10. Part of the Eastern Overburden Emplacement at Peppertree Quarry is distantly visible from this location. It is likely based on 3D modelling that mid-ground topography and vegetation will block most of the views of the proposed Southern Overburden Emplacement from this location.

Plate 1/12

VP19, Glynmar/Government Road. Part of the Eastern Overburden Emplacement at Peppertree Quarry is distantly visible from this location. It is likely that mid-ground topography and vegetation will block most of the views of the proposed Southern Overburden Emplacament from this location

Plate 1/13

VP20, The Lookdown northern lookout, Bungonia National Park, afternoon view in winter.

Plate 1/14

VP20, The Lookdown northern lookout, Bungonia National Park morning view in winter. This view has been used as the base for a photomontage in Appendix 3. The proposed Southern Overburden Emplacement would be partly visible in the distance on the right.

Plate 1/15

VP20, The Lookdown northern lookout, Bungonia National Park, looking east toward the Shoalhaven River gorges in Morton NP. Views like this and the karst landscapes of the Bungonia National Park and SCA are likely to be the primary reasons for visitation.

Plate 1/16

VP20, The Lookdown northern lookout, Bungonia National Park, looking south east. The landscape in the foreground is similar to the character intended in rehabilitation of the Modification.

Plate 1/17

VP21, View from a site west of the track, south of Long Point Lookout. The Peppertree Quarry processing and materials handling area and part of the existing Eastern Overburden Emplacement are visible on the right. The Modification would be visible as an extension of the existing overburden landform to the south, but would also screen views of the processing and materials handling area and also have the effect of reducing visibility of night time lighting.

Plate 1/18

VP21, View toward part of the Marulan Limestone Mine, looking south west.

Plate 1/19

VP22, Long Point Lookout, View from the lookout to the east into Shoalhaven River gorge. The lookout has no view of the Modification.

Plate 1/20

VP22, View toward the Modification from the parking area at Long Point lookout. Intervening topography blocks the view

Plate 1/21

VP23, Long Point Road, View of R17. The residence does not have views of the proposed Southern Overburden Emplacement.

Plate 1/22

VP24, View of R15 and the location of R16 from Long Point Road. R15 in the centre is a location a view from which has been used to prepare a photomontage in Appendix 3. R16 is out of sight over the foreground dam wall to the right, but it has no view of the proposed Southern Overburden Emplacement because of a dense and high screen of trees, visible on the right.

Plate 1/23

C2, view from a potential future residence site to the north west of the commercial receiver location on the land. 3D graphics indicate that the site would not have views of the proposed Southern Overburden Emplacement as a result of blocking of the view by foreground topography and by vegetation in the middle distance.

Plate 1/24

C2, view from a potential future residence site to the north west of the commercial receiver location on the land, looking south toward the more scenic views available from the potential residence.

Plate 1/25

C3, Foti Fireworks, view from the commercial office. 3D graphics indicate that the site would not have views of the proposed Southern Overburden Emplacement as a result of blocking of the view by foreground topography and by vegetation in the middle distance.

Plate 1/26

R5, 359 Glynmar Road

View from the south east corner of the veranda of the residence. 3D graphics indicate that the site would not have significant views of the proposed Southern Overburden Emplacement as a result of blocking of the view by foreground topography and by vegetation in the middle distance. The avenue planting of pine trees along the driveway, partly grown, is likely in time to form a substantial vegetative screen.

Plate 1/27

R5, view in the same direction as Plate 1/34, from the veranda and near the front door of the residence. The same observations made above are relevant to this view.

Plate 1/28

R8, 381 Marulan South Road

View of the east side of the residence, which faces the Quarry site. The shadow on the left of the photograph is that of a large shed, which blocks most of the view north east. The formal orientation of the residence is to the entrance drive and the road, on the south west, or other, side.

Plate 1/29

R8, view toward the Peppertree Quarry site from land east of the shed. 3D graphics and the evident height of open to dense vegetation in the view line show that there will not be any direct views of the proposed Southern Overburden Emplacement.

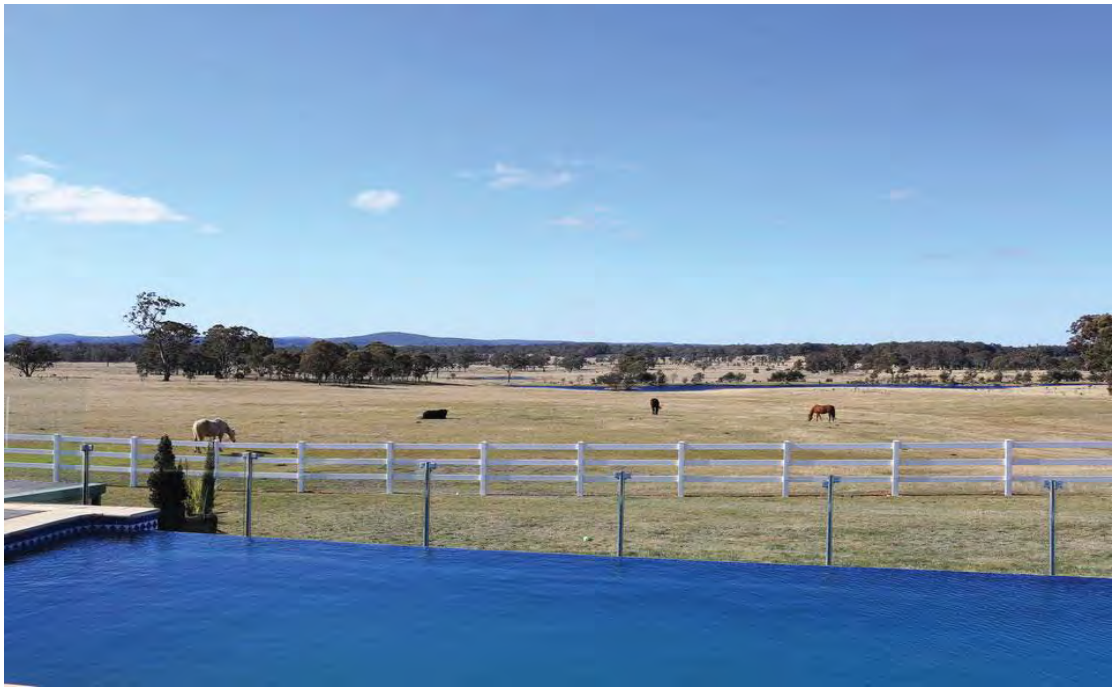


Plate 1/30

R10, 290 Glynmar Road

View from east-facing outdoor entertainment area. Part of the existing Eastern Overburden Emplacement at Peppertree Quarry is distantly visible from this location. An image from this location was used to prepare a photomontage in Appendix 3. It is likely that mid-ground topography and vegetation will block most of the views of the proposed Southern Overburden Emplacement from this location.

Plate 1/31

R13, Glenrock, 248 Highland Way

View from near the stables area south east of the residence. Part of the Eastern Overburden Emplacement at Peppertree Quarry is distantly visible from this location. 3D modelling indicates that the existing emplacement will block views of the proposed Southern Overburden Emplacement from this location.

Plate 1/32

R13, Glenrock

View from the rear on axis of the residence. Part of the Eastern Overburden Emplacement at Peppertree Quarry is distantly visible from this location while foreground trees are not in leaf. The same observations in regard to the view above apply to this view.

Plate 1/33

R13, Glenrock

View of the rear of the residence from the south. The formal orientation of the residence is to its gardens to the north. Part of the Eastern Overburden Emplacement at Peppertree Quarry is distantly visible from this location looking south. Upper level windows may provide slightly greater views, but are likely to be to bedrooms or service areas. 3D modelling indicates that the proposed Southern Overburden Emplacement will not be visible from here, as the view will be blocked by the existing Eastern Overburden Emplacement.

Plate 1/34

R14, 387 Long Point Road, Tallong

3D modelling indicates that the residence will not have significant views of the proposed Southern Overburden Emplacement. Vegetation in the middle distance blocks any direct view lines.

Plate 1/35

R15, 443 Long Point Road, Talllong

View from the balcony. 3D modelling indicates that the residence will have very minor views of part of the proposed Southern Overburden Emplacement, being the last lifts of the Southern Overburden Emplacement. Vegetation in the middle distance blocks any direct view lines. This view was analysed and used as the base for a photomontage in Appendix 3.

Plate 1/36

R15, viewing toward R16 (445 Long Point Road)

The dense vegetation screen between R16 and the direction of the proposed Southern Overburden Emplacement (to the right in this photograph) blocks views.

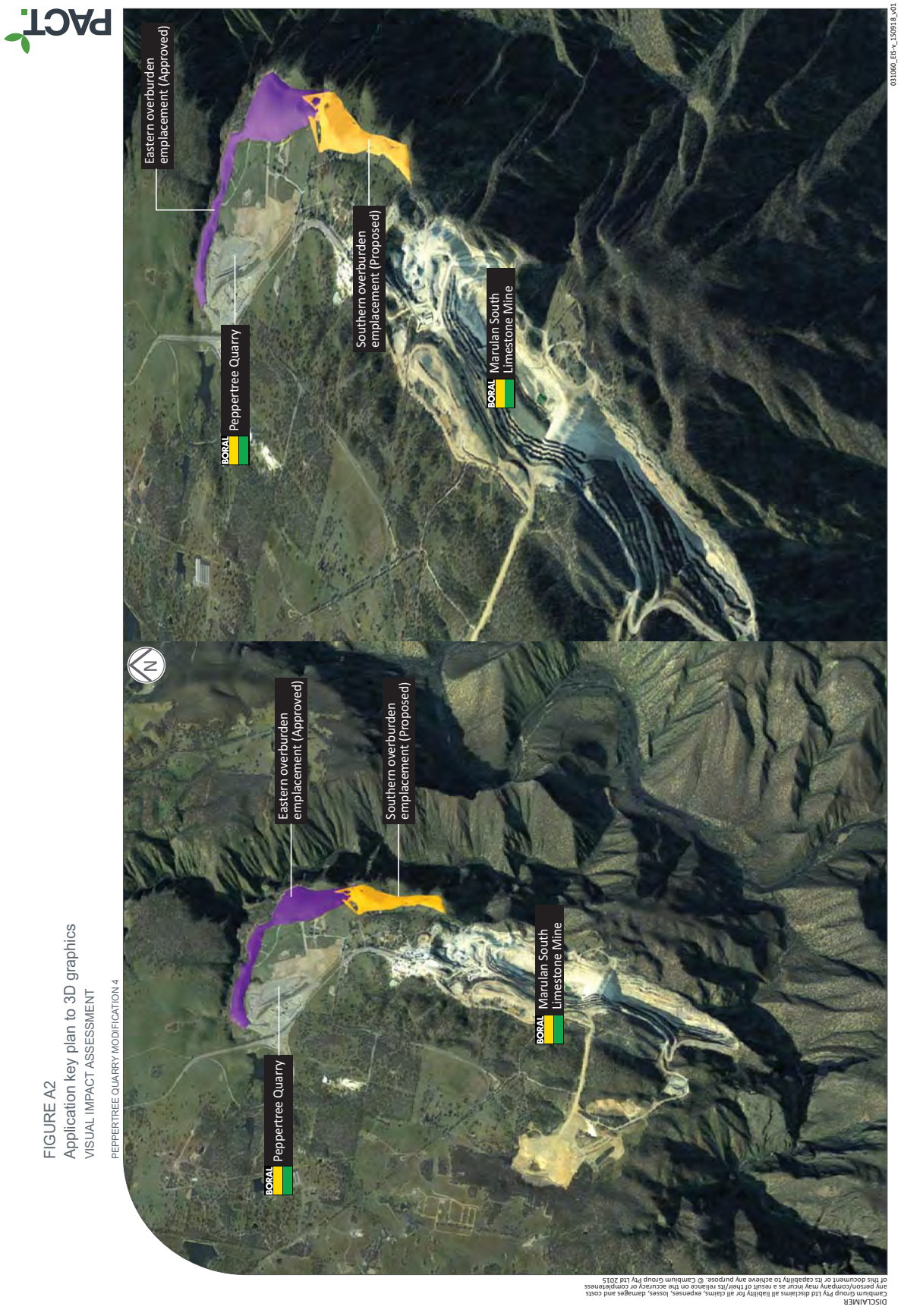
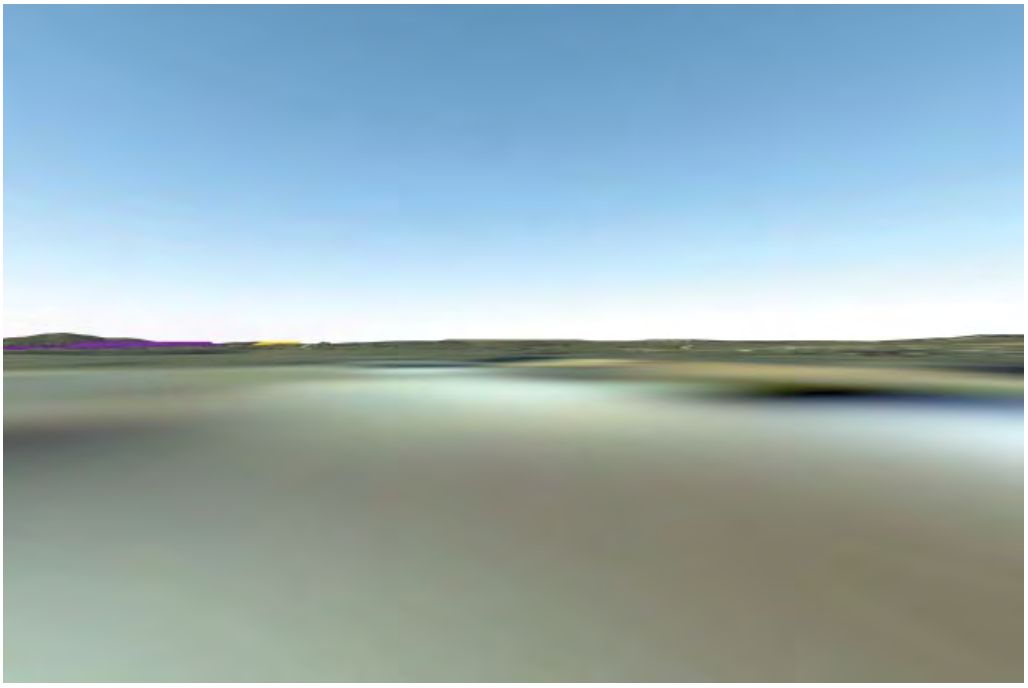


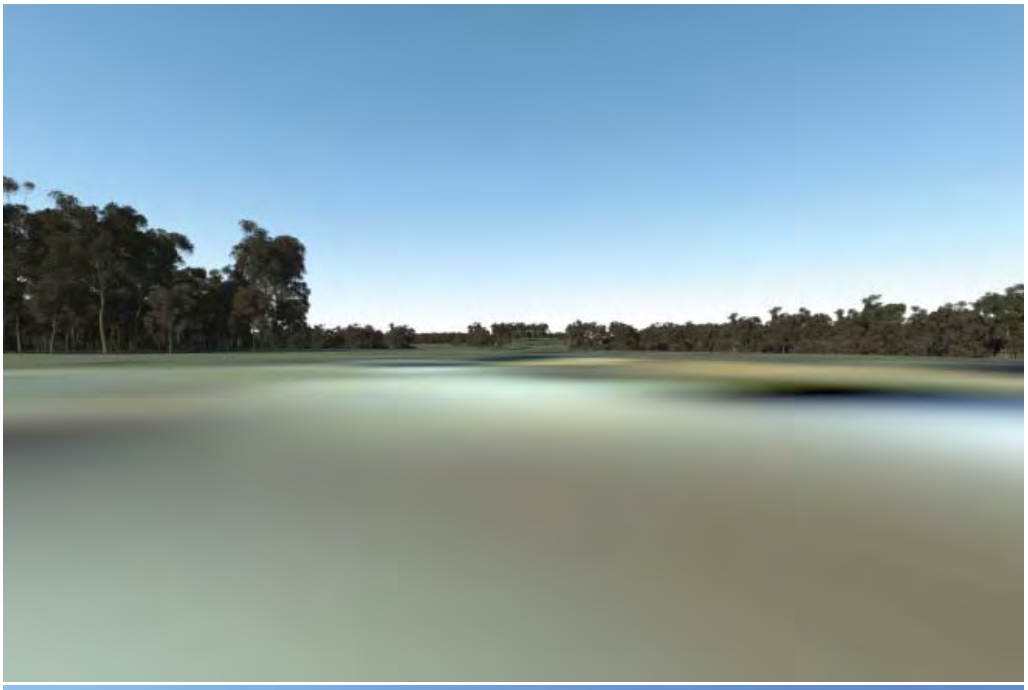
FIGURE A2
Application key plan to 3D graphics
VISUAL IMPACT ASSESSMENT
PEPPERTREE QUARRY MODIFICATION 4

Key Plan to Analytical 3D Graphics Prepared by Cambium Group in plan and oblique view from the south



Receiver C2

3D render of terrain and proposed landforms only

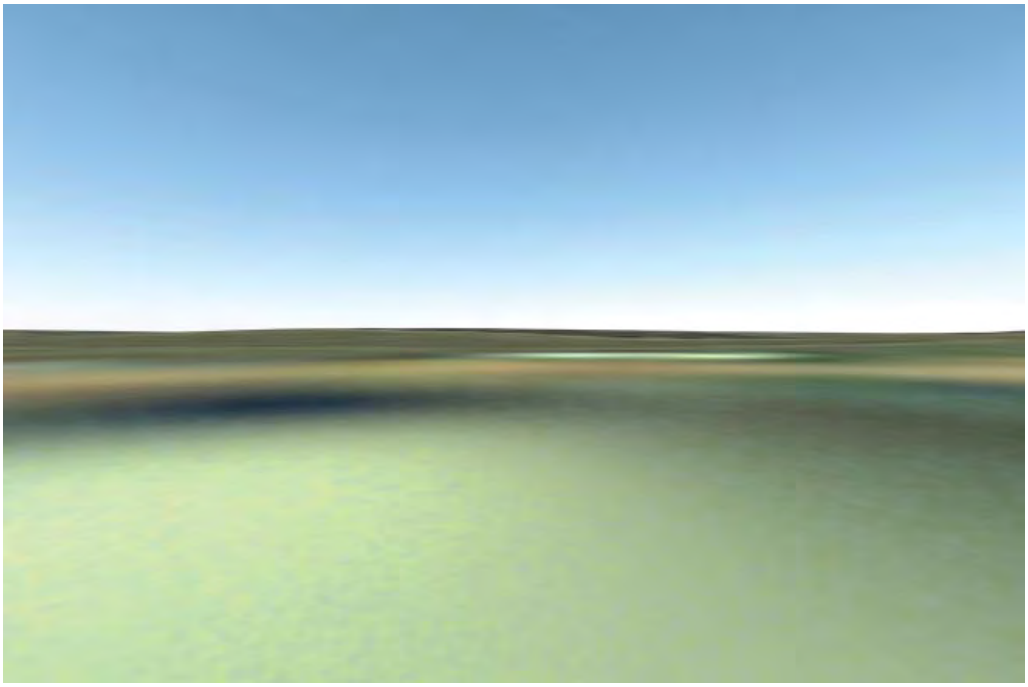


Receiver C2

3D render of terrain and proposed landforms with vegetation

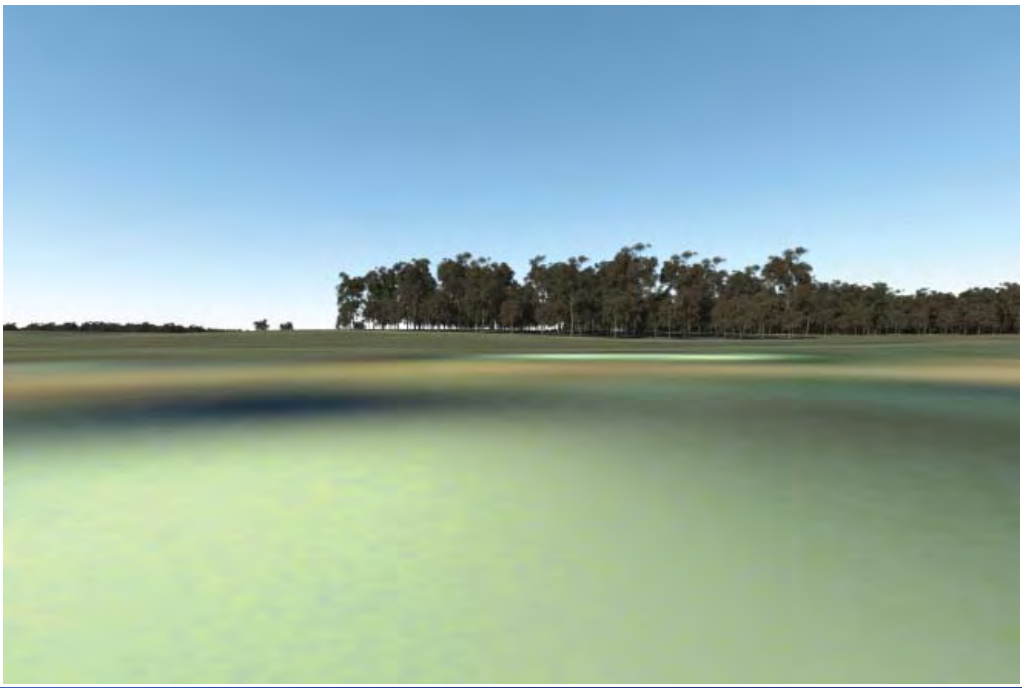
Receiver C2

Actual image from potential future residence site approximately 300m west of the commercial receiver location. The bearing of the image is to the left compared to the centre of the 3D renders



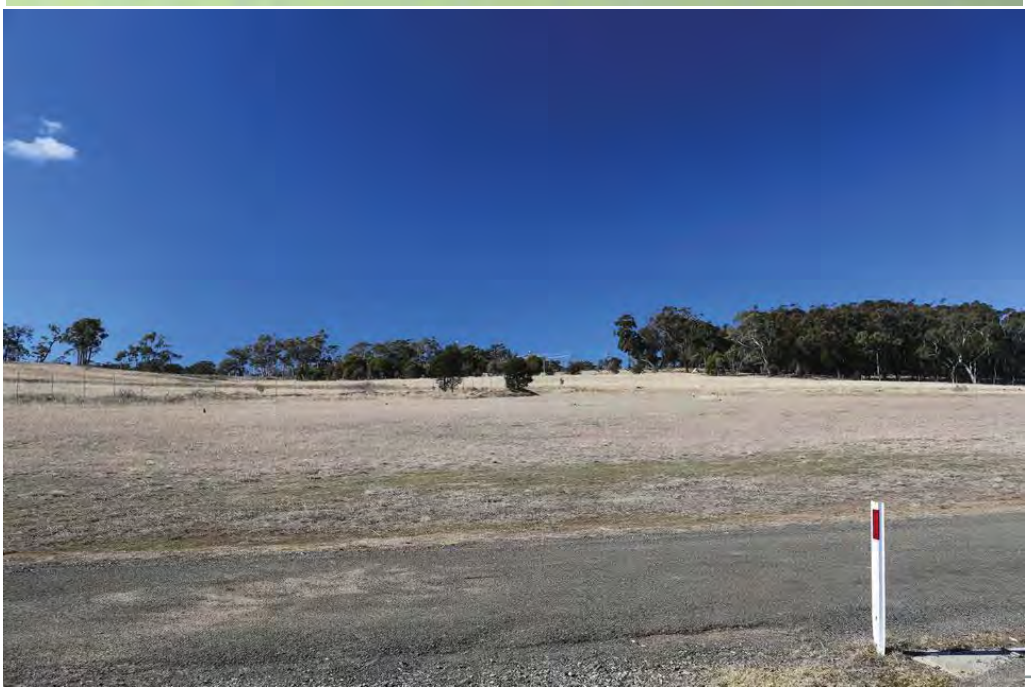
Receiver C3

3D render of terrain and proposed landforms only



Receiver C3

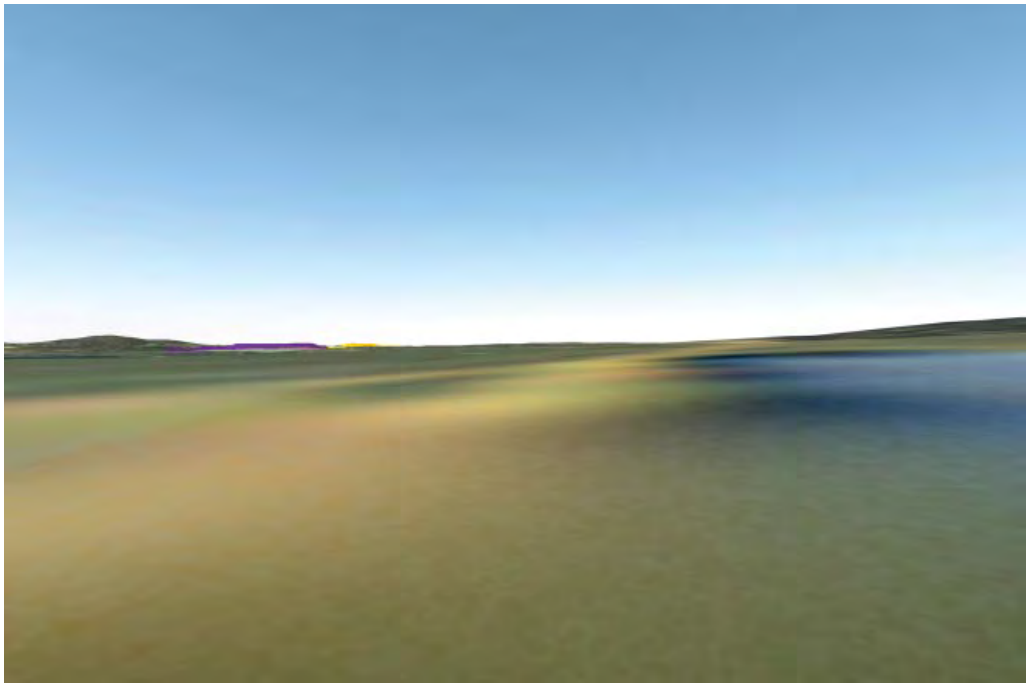
3D render of terrain and proposed landforms with vegetation



Receiver C3

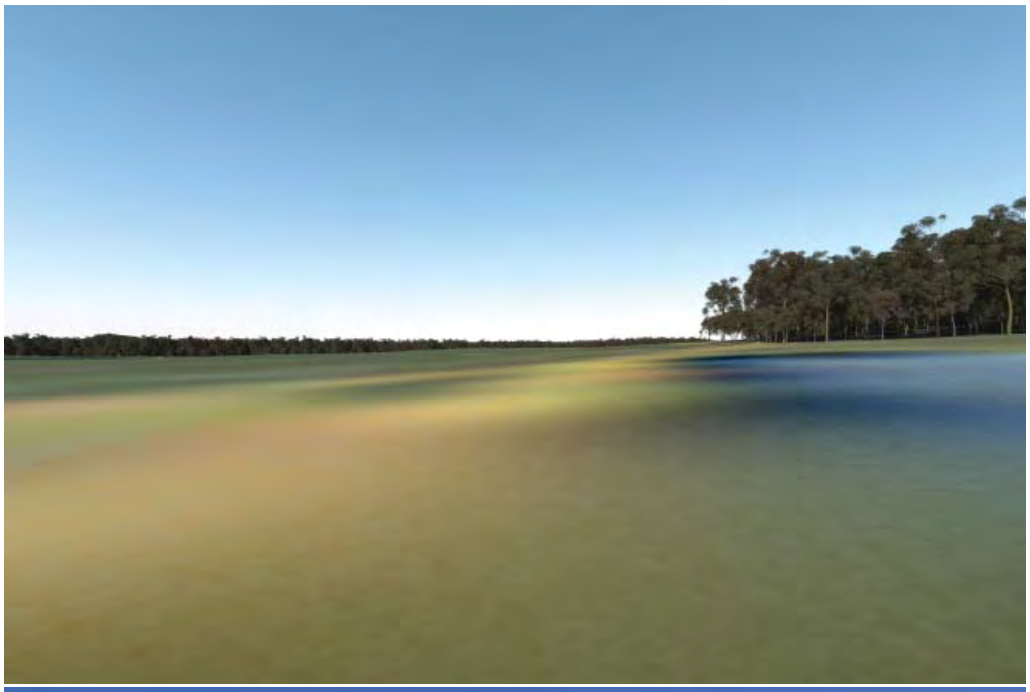
Photographic image from office balcony at C3

The centre of the photograph is to left of the centre of the 3D render. The combined graphics show that C3 will not have a view of the Modification



Receiver R5

3D render of terrain and proposed landforms only



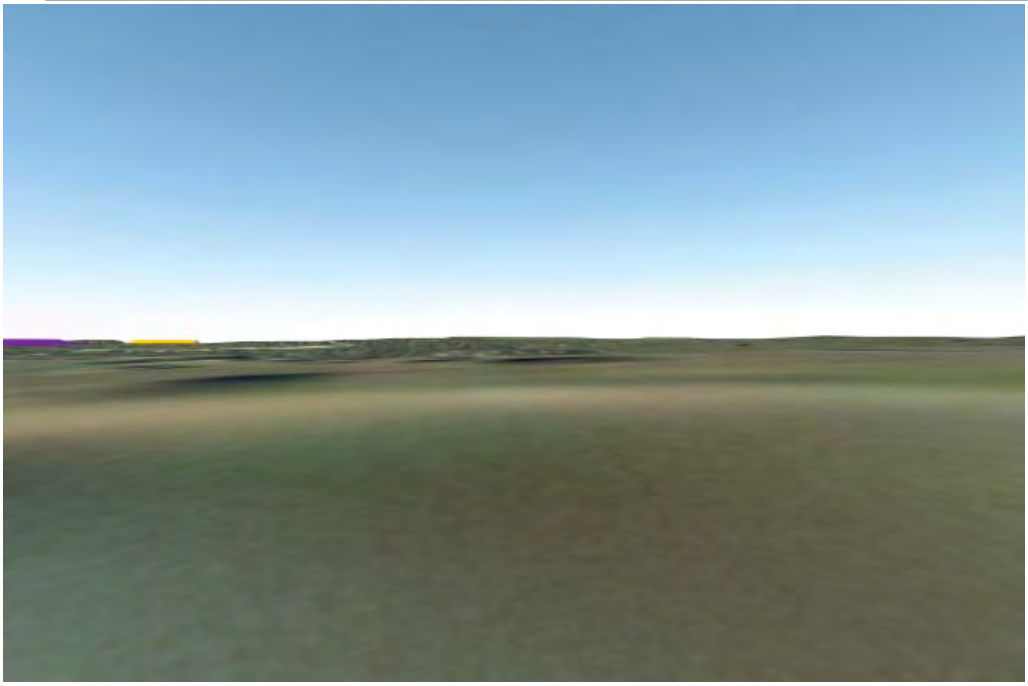
Receiver R5

3D render of terrain and proposed landforms with vegetation

Receiver R5

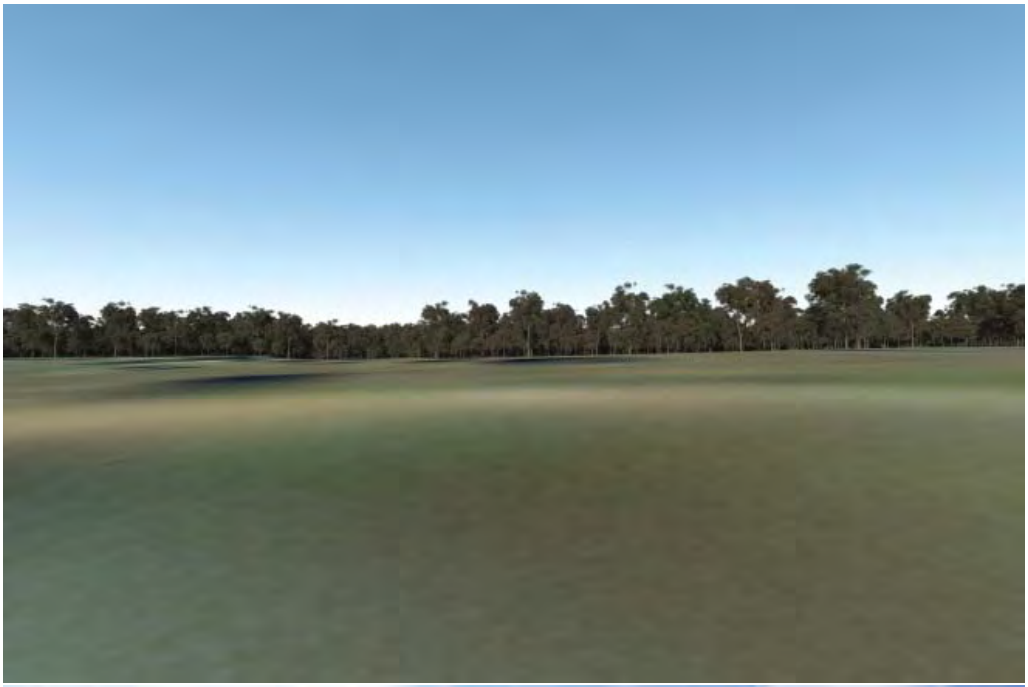
Photographic image from the dwelling balcony at R5

The centre of the photograph is slightly to right of the centre of the 3D render. It is unlikely that R5 will not have any view of the Modifcation



Receiver R8

3D render of terrain and proposed landforms only



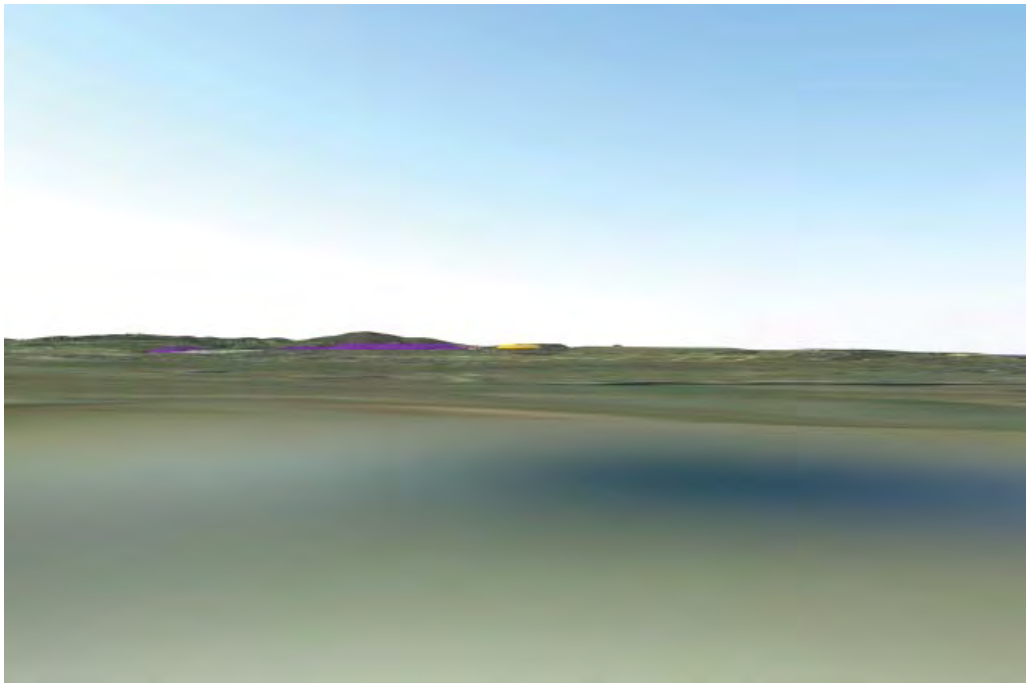
Receiver R8

3D render of terrain and proposed landforms with vegetation

Receiver R8

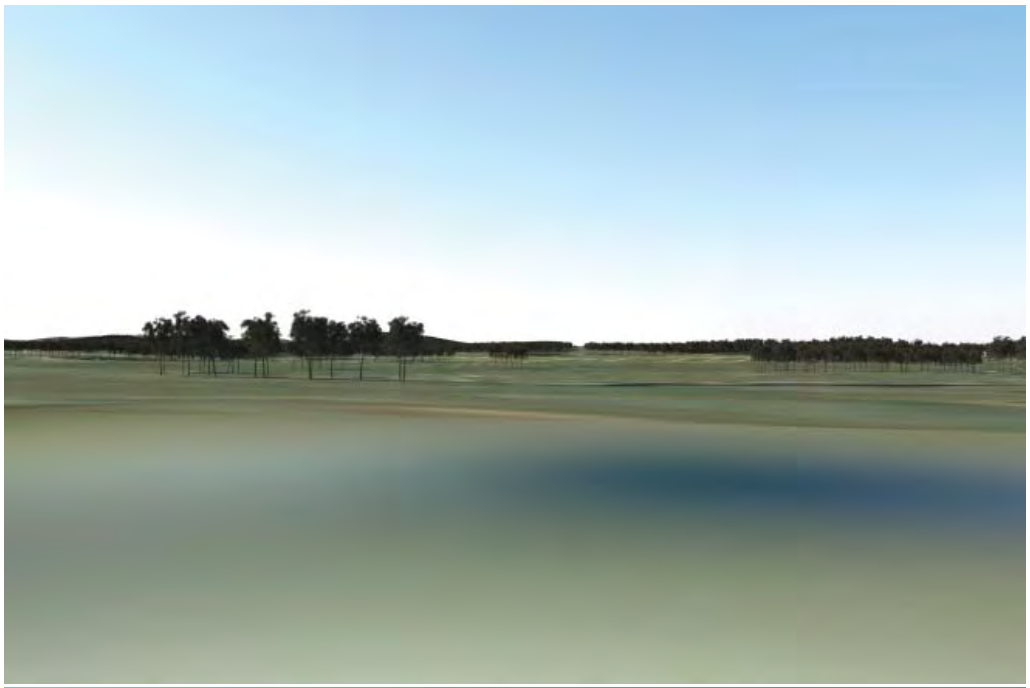
Photographic image from the land east of sheds that block view from the dwelling at R8

R8 will not have a view of the Modification



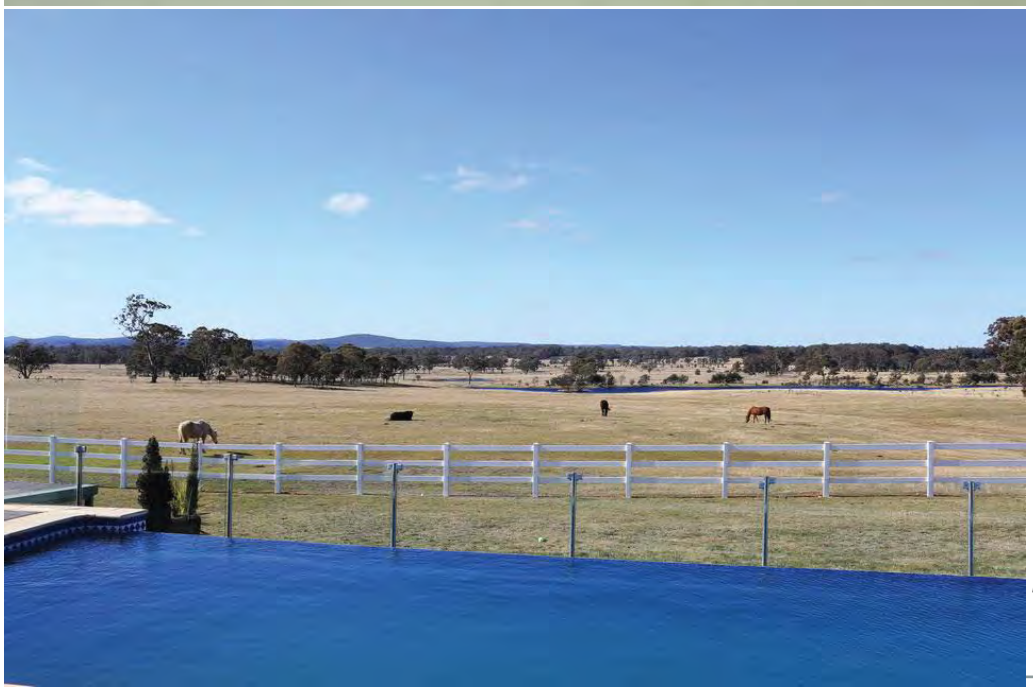
Receiver R10

3D render of terrain and proposed landforms only



Receiver R10

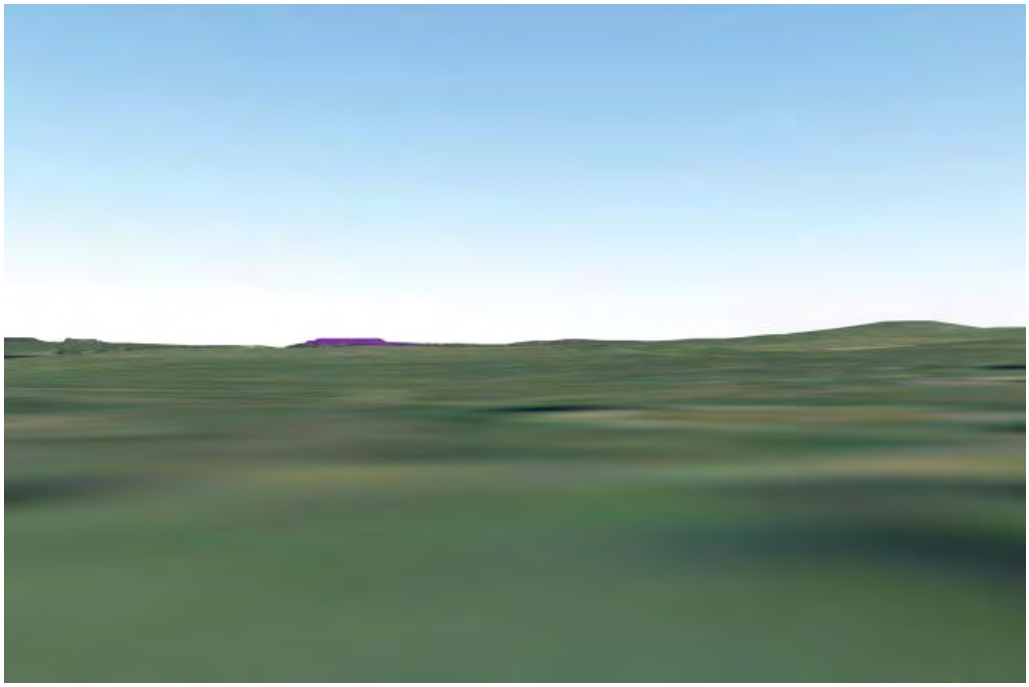
3D render of terrain and proposed landforms with vegetation



Receiver R10

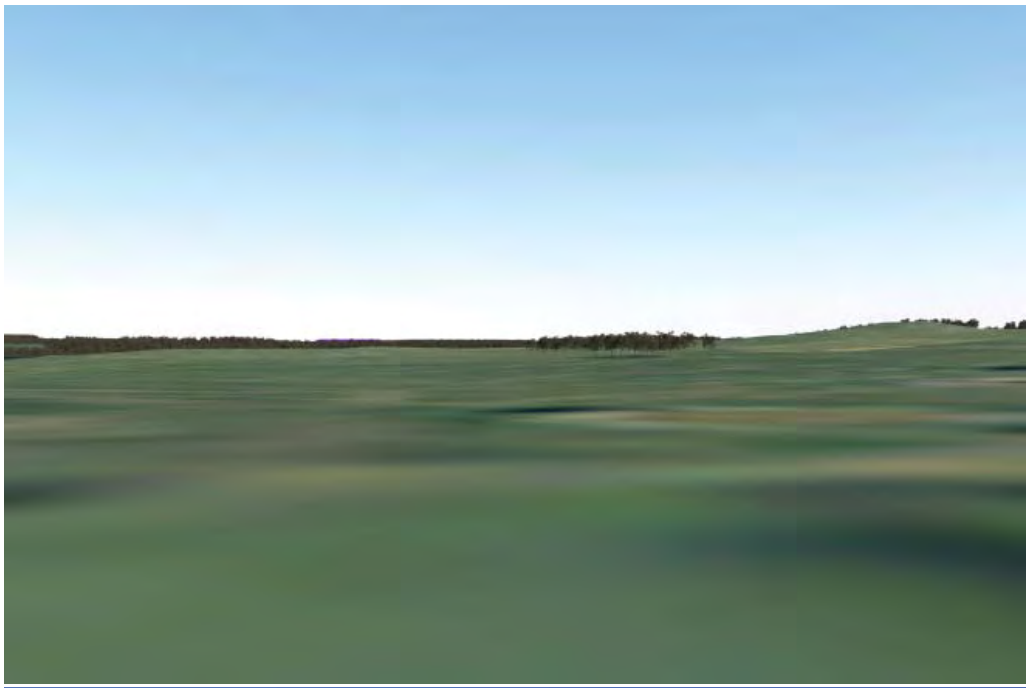
Photographic image from the pool edge at R10

R10 may have a minimal view of part of the Southern Overburden Emplacement, rehabilitation of which will minimise its visibility



Receiver R13

3D render of terrain and proposed landforms only



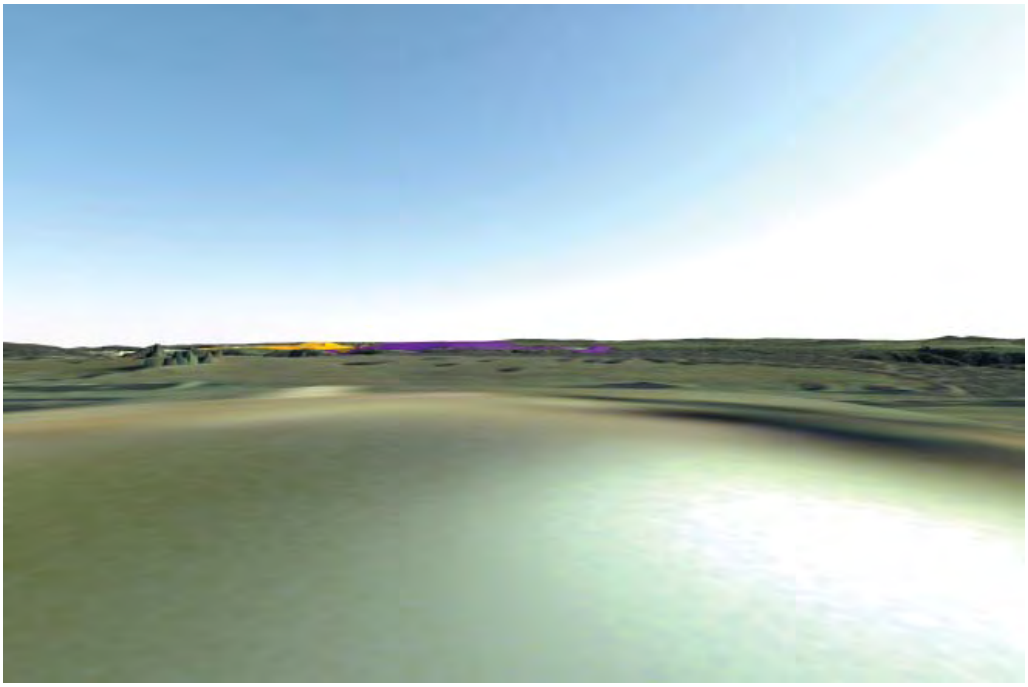
Receiver R13

3D render of terrain and proposed landforms with vegetation

Receiver R13

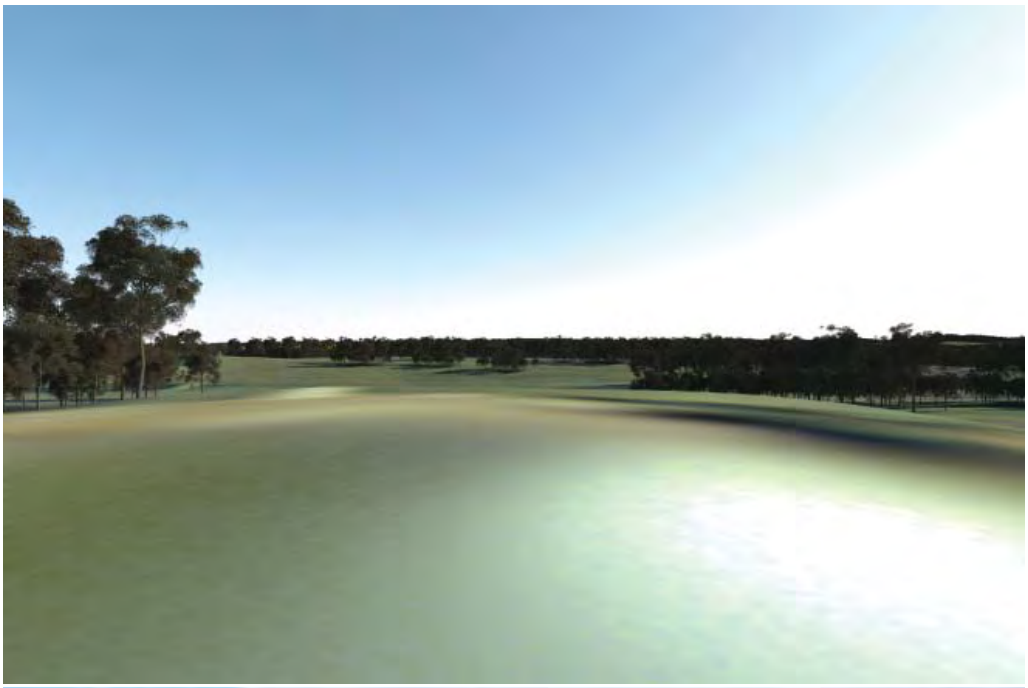
Photographic image on the axis from the rear of the residence

R13 is unlikely to have any view of the proposed Southern Overburden Emplacement area after rehabilitation of the existing Eastern Overburden Emplacement



Receiver R14

3D render of terrain and proposed landforms only



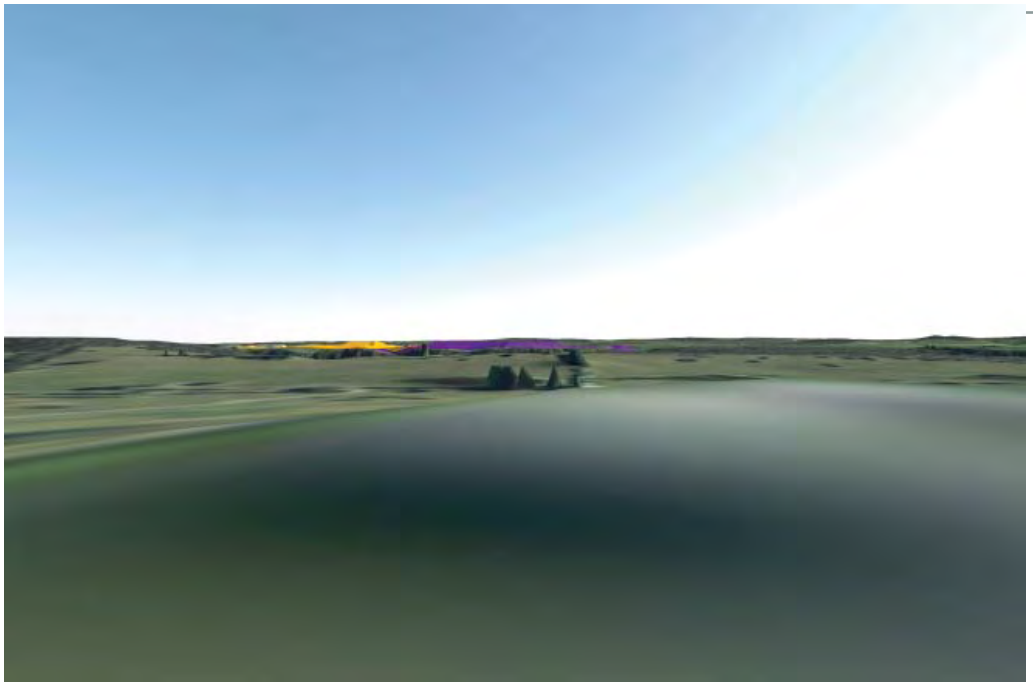
Receiver R14

3D render of terrain and proposed landforms with vegetation

Receiver R14

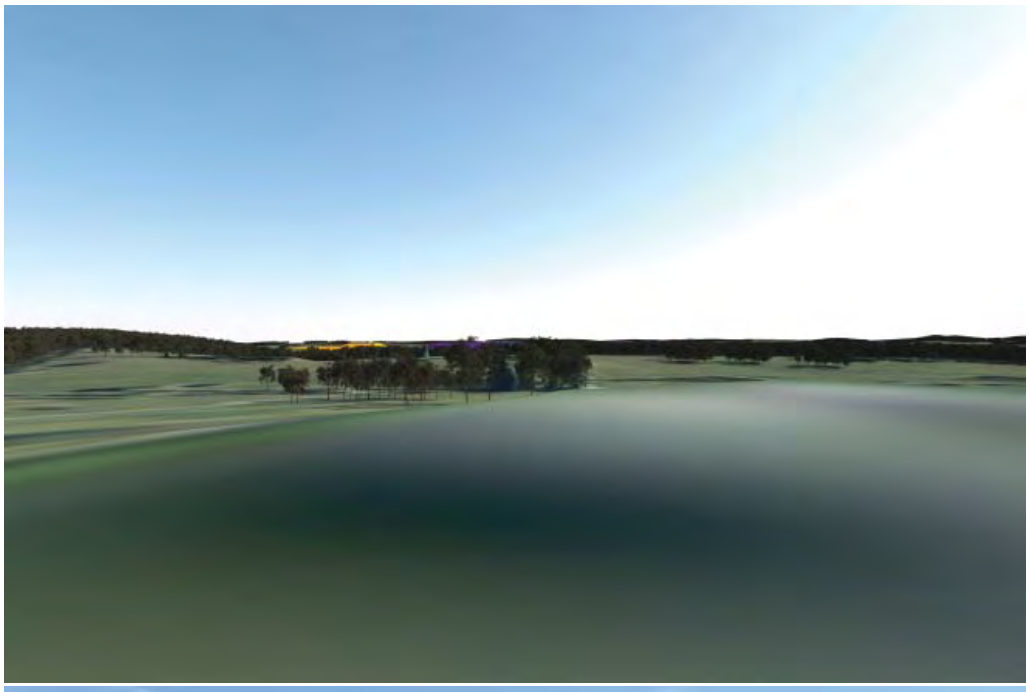
Photographic image taken from veranda north side of residence

It is unlikely that R14 will have a view of any part of the proposed Southern Overburden Emplacement



Receiver R15

3D render of terrain and proposed landforms only



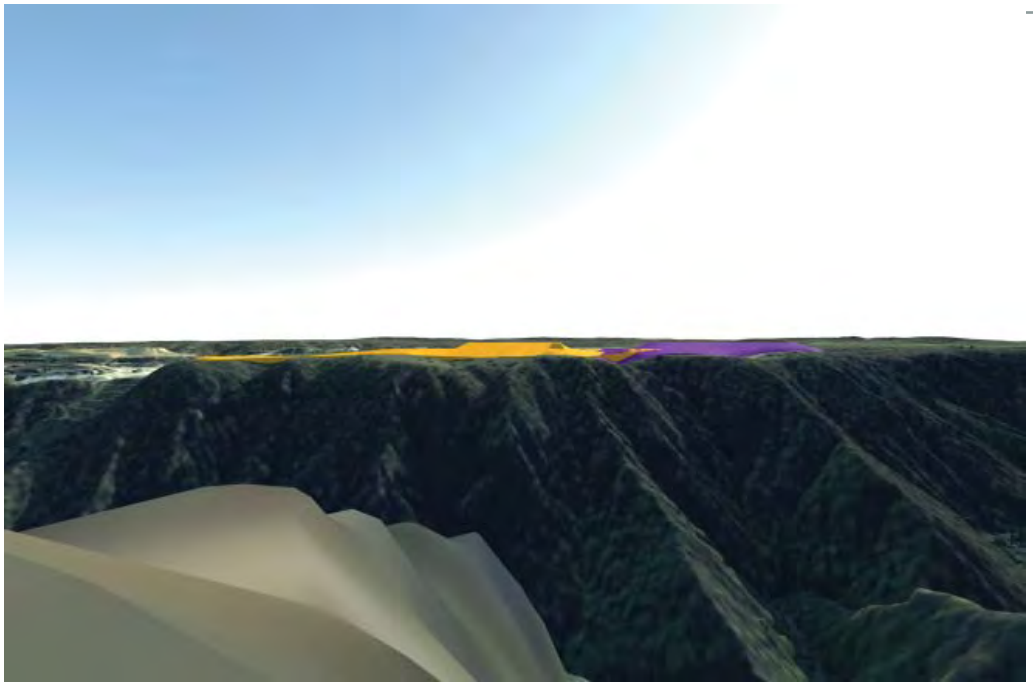
Receiver R15

3D render of terrain and proposed landforms with vegetation

Receiver R15

Photographic image taken from veranda north side of residence

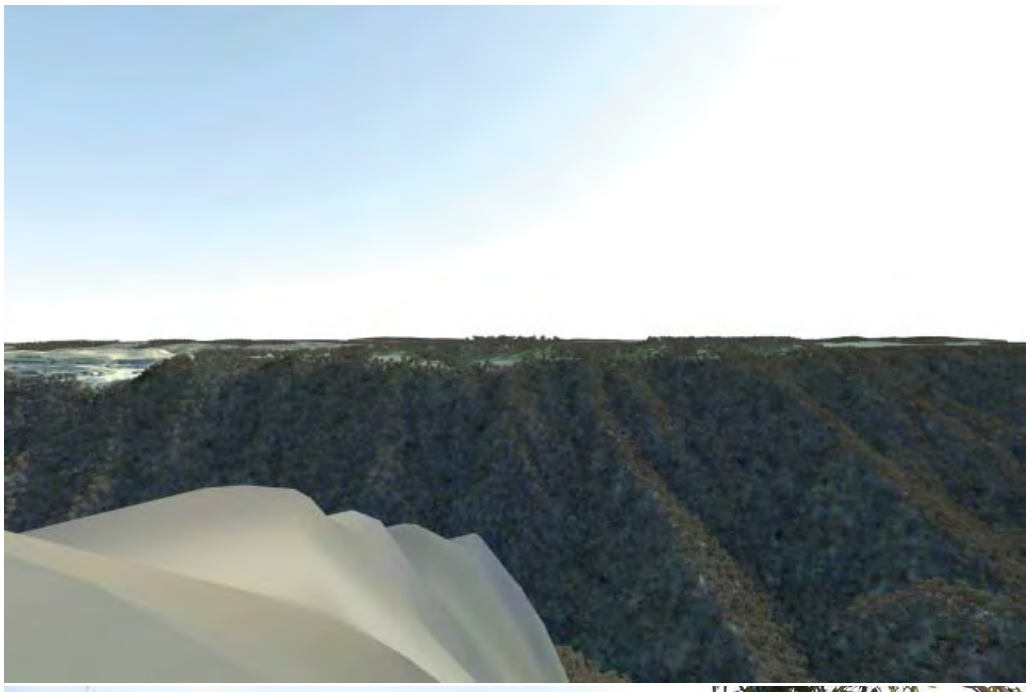
R15 may have a view of part of the Eastern Overburden Emplacement. The photomontage shows the impact of the proposed Southern Overburden Emplacement to be minimal



View Point 21

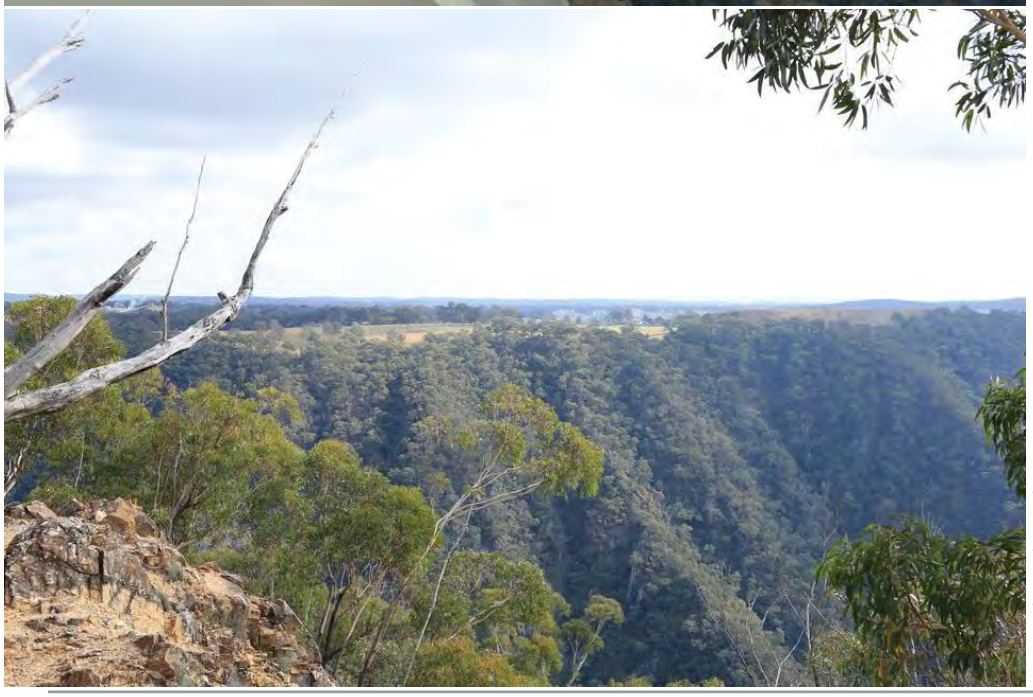
Site accessible from Long Point Track

3D render of terrain and proposed landforms only



View Point 21

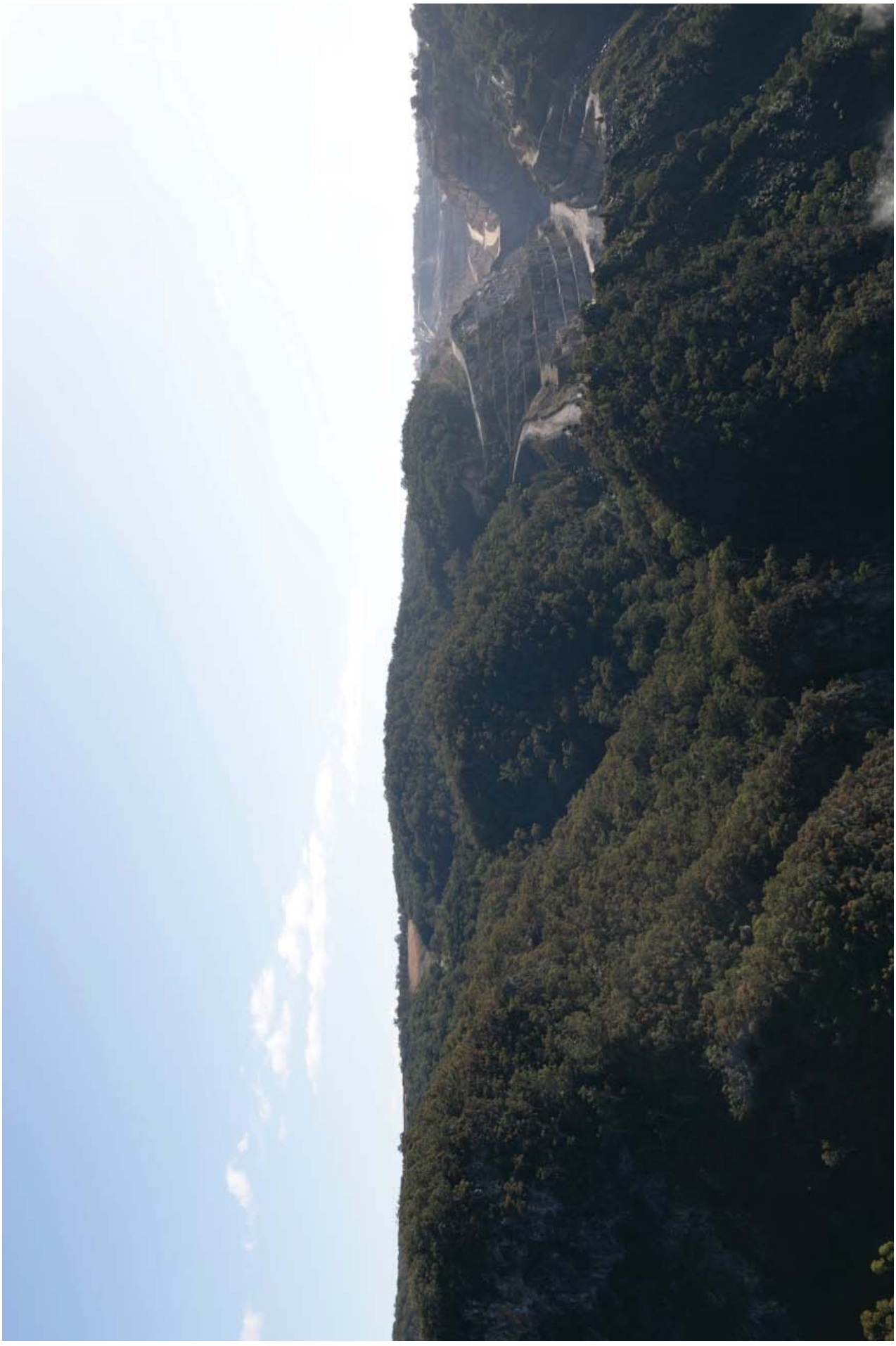
3D render of terrain and proposed landforms with vegetation



View Point 21

Photographic image taken from informal vantage point

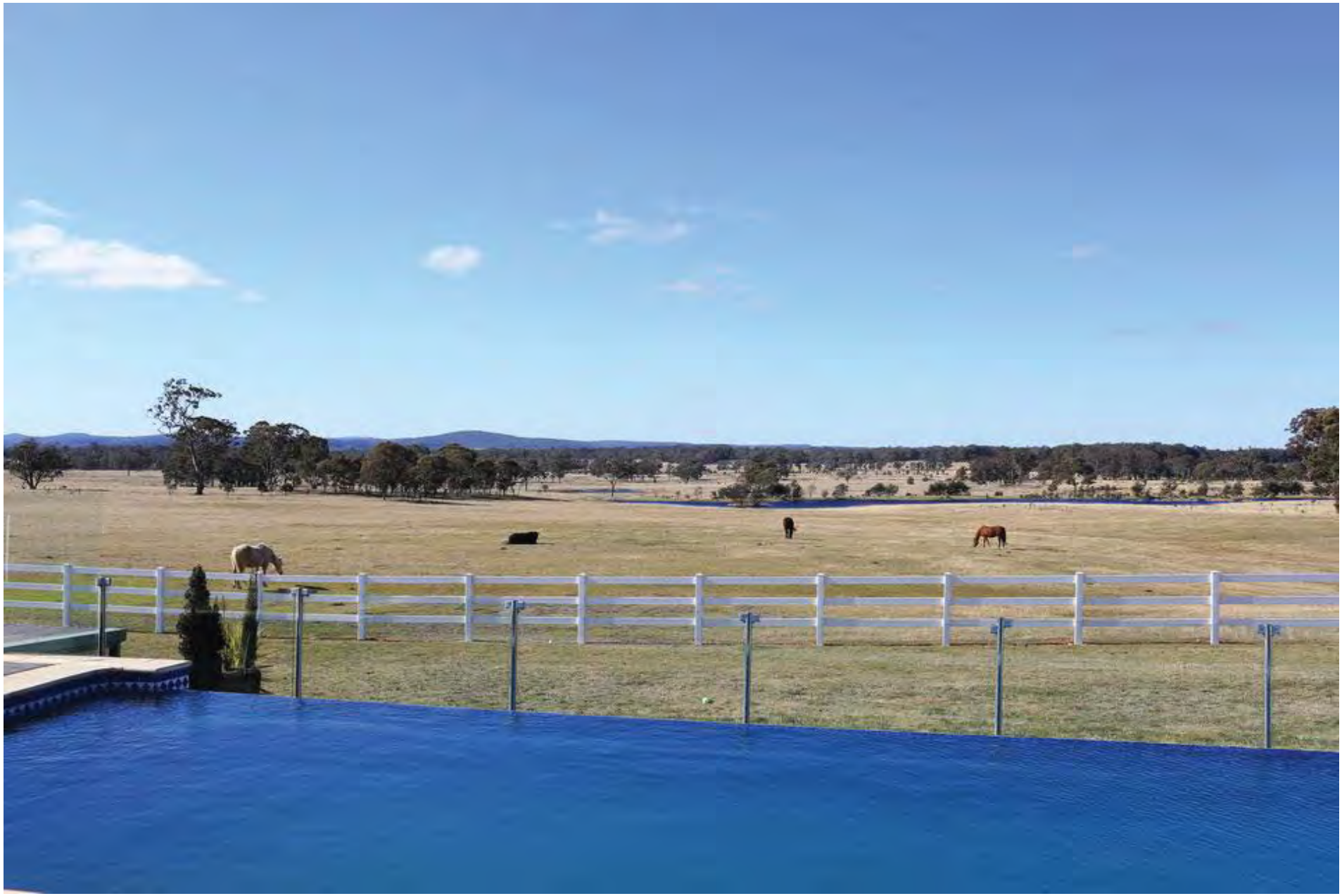
The photomontage shows the impact of the proposed Southern Overburden Emplacement to be minor following rehabilitation



VP20: The Lookdown Northern Lookout, existing view

VP20: The Lookdown Northern Lookout, Analytical 3D view

VP20: The Lookdown Northern Lookout, Photomontage



R10: Residential receiver, existing view

R10: Residential receiver, analytical 3D view

R10: Residential receiver, photomontage

R15: Residential receiver, existing view. 3D analytical study was not prepared, as vegetation blocks all views of the Modification (see 3D graphics for R15 in Appendix 2)

R15: Residential receiver, photomontage. The only evidence of the Modification is the canopy of vegetation shown growing on the rehabilitated Southern Overburden Emplacement Area

View Place Documentation Sheets

Receiver ID: VP1	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
Peppertree Quarry	IMG_4431	34,45.9312	150,2.3159	614.2

Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View				X
Effect on Scenic Quality of View			X	
Variable factors				
Effect On View Composition				X
Effect of Relative Viewing Level				X
Effect of Viewing Period				X
Effect of Viewing Distance				X
View Loss or Blocking Effect			X	
Overall Extent of Visual Effect		High		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity			X	
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features		X		
Overall Extent of Visual Impact		Low (View is inside Modification area)		

View Place or Viewer Sensitivity (N/A*)				
		L	M	H
Public Domain	Roads			
	Lookouts			
	Reserves			
Private Domain	Residence			
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: VP2	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
Peppertree Quarry	IMG_4643	34,45.614	150,1.7622	616

Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View				X
Effect on Scenic Quality of View			X	
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level				X
Effect of Viewing Period				X
Effect of Viewing Distance				X
View Loss or Blocking Effect			X	
Overall Extent of Visual Effect		High		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity			X	
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features		X		
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads		X	
	Lookouts			
	Reserves			
Private Domain	Residence			
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: VP6	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
Marulan South Road	IMG_4661	34,45.9299	150,0.6473	633.7
	IMG_4662	34,45.9299	150,0.6473	633.7

Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View		X		
Effect on Scenic Quality of View		X		
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level		X		
Effect of Viewing Period		X		
Effect of Viewing Distance		X		
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Low		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features		X		
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads		X	
	Lookouts			
	Reserves			
Private Domain	Residence			
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: VP8	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
Marulan South Road adjacent R8, C2	IMG_4649	34,45.5981	150,0.3415	630.3
	IMG_4650	34,45.5948	150,0.3385	626.2

Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View		X		
Effect on Scenic Quality of View		X		
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level		X		
Effect of Viewing Period		X		
Effect of Viewing Distance			X	
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Low		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features		X		
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads		X	
	Lookouts			
	Reserves			
Private Domain	Residence			
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: VP11	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
Marulan South Road adjacent R5	IMG_4652	34,45.0077	149,59.9056	647.2

Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View		X		
Effect on Scenic Quality of View		X		
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level		X		
Effect of Viewing Period		X		
Effect of Viewing Distance			X	
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Low		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features		X		
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads	X		
	Lookouts			
	Reserves			
Private Domain	Residence			
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: VP14	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
Jerrara Road	IMG_4471	34,44.0751	149,58.7341	664.2

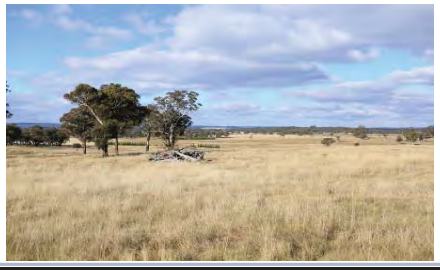
Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View		X		
Effect on Scenic Quality of View		X		
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level		X		
Effect of Viewing Period		X		
Effect of Viewing Distance		X		
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Low		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features			X	
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads	X		
	Lookouts			
	Reserves			
Private Domain	Residence			
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: VP15	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
Jerrara Road	IMG_4472	34,44.8859	149,58.5826	671.3



Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View		X		
Effect on Scenic Quality of View		X		
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level		X		
Effect of Viewing Period		X		
Effect of Viewing Distance		X		
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Low		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features			X	
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads	X		
	Lookouts			
	Reserves			
Private Domain	Residence			
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: VP18	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
Glynmar Road adjacent to R10	IMG_4476	34,46.2216	149,59.1682	670.6
				
Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View		X		
Effect on Scenic Quality of View		X		
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level		X		
Effect of Viewing Period		X		
Effect of Viewing Distance		X		
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Low		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features		X		
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads	X		
	Lookouts			
	Reserves			
Private Domain	Residence			
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

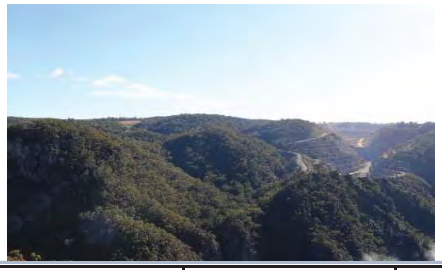
Receiver ID: VP19	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
Glynmar Road	IMG_4477	34,46.0473	149,59.2004	674.7
				
Expansive	Restricted	Panoramic	Focal	Feature

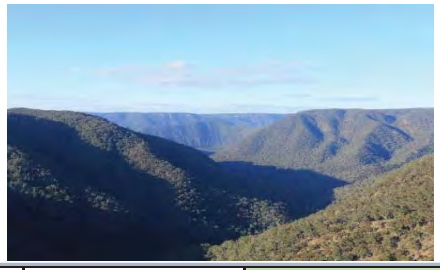
Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View		X		
Effect on Scenic Quality of View		X		
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level		X		
Effect of Viewing Period		X		
Effect of Viewing Distance		X		
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Low		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility withRural/Natural Features		X		
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads	X		
	Lookouts			
	Reserves			
Private Domain	Residence			
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: VP20	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
The Lookdown Lookout Morton NP	IMG_4483	34,47.9164	150,1.1372	557.4
	IMG_4485	34,47.9164	150,1.1372	557.4
	IMG_4489	34,47.9164	150,1.1372	557.4
	IMG_4607	34,47.9164	150,1.1372	557.4





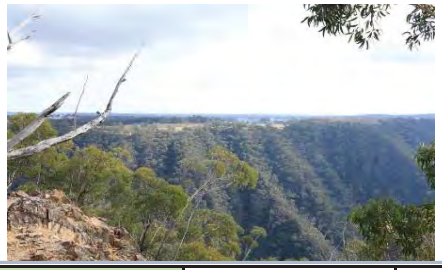
Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View			X	
Effect on Scenic Quality of View			X	
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level				X
Effect of Viewing Period				X
Effect of Viewing Distance		X		
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Medium		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features			X	
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads			
	Lookouts	X		
	Reserves			
Private Domain	Residence			
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: VP21	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
Long Point track Morton NP	IMG_4460	34,45.9529	150,3.0573	634.1
	IMG_4462	34,45.9595	150,3.0652	646.5



Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View			X	
Effect on Scenic Quality of View			X	
Variable factors				
Effect On View Composition			X	
Effect of Relative Viewing Level			X	
Effect of Viewing Period				X
Effect of Viewing Distance			X	
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Medium		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity			X	
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features			X	
Overall Extent of Visual Impact		Medium		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads			
	Lookouts		X	
	Reserves			
Private Domain	Residence			
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: VP22	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
Long Point Lookout	IMG_4453	150,3.2231	150,3.2231	624.7
	IMG_4454	34,45.8797	150,3.2149	624.9

Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View		X		
Effect on Scenic Quality of View		X		
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level		X		
Effect of Viewing Period		X		
Effect of Viewing Distance		X		
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Low		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features		X		
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads			
	Lookouts		X	
	Reserves			
Private Domain	Residence			
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: VP23	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
Long Point Road adjacent B7 and R17	IMG_4463	34,45.5123	150,3.4385	632.8
	IMG_4464	34,45.4271	150,3.5599	625

Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View		X		
Effect on Scenic Quality of View		X		
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level		X		
Effect of Viewing Period		X		
Effect of Viewing Distance		X		
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Low		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features		X		
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads		X	
	Lookouts			
	Reserves			
Private Domain	Residence			
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: VP24	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
Long Point Road adjacent R15, R16	IMG_4465	34,45.1974	150,3.565	622.4

Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View		X		
Effect on Scenic Quality of View		X		
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level			X	
Effect of Viewing Period			X	
Effect of Viewing Distance		X		
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Low		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features		X		
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads		X	
	Lookouts			
	Reserves			
Private Domain	Residence			
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: R5	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
359 Glynmar Road	IMG_4624	34,45.0843	149,59.823	658
	IMG_4625	34,45.0871	149,59.8296	639.7

Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View		X		
Effect on Scenic Quality of View		X		
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level			X	
Effect of Viewing Period			X	
Effect of Viewing Distance			X	
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Low		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features			X	
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads			
	Lookouts			
	Reserves			
Private Domain	Residence	X		
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: R8	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
381 Marulan South Road	IMG_4438	34,45.5061	150,0.509	629.2
	IMG_4439	34,45.5062	150,0.510	629.4
	IMG_4440	34,45.4994	150,0.53	629.7
	IMG_4441	34,45.507	150,0.4974	625.6

Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View		X		
Effect on Scenic Quality of View		X		
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level		X		
Effect of Viewing Period			X	
Effect of Viewing Distance			X	
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Low		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features		X		
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads			
	Lookouts			
	Reserves			
Private Domain	Residence		X	
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: R10	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
290 Glynmar Road	IMG_4638	34,46.2284	149,59.3644	662.7

Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View		X		
Effect on Scenic Quality of View		X		
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level			X	
Effect of Viewing Period			X	
Effect of Viewing Distance		X		
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Low		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features			X	
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads			
	Lookouts			
	Reserves			
Private Domain	Residence	X		
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: R13	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
Glenrock 248 Highland Way	IMG_4633	34,43.0789	150,2.6343	621.9
	IMG_4635	34,43.0657	150,2.5836	623
	IMG_4636	34,43.0602	150,2.610	623.3

Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View		X		
Effect on Scenic Quality of View		X		
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level		X		
Effect of Viewing Period			X	
Effect of Viewing Distance		X		
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Low		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features		X		
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads			
	Lookouts			
	Reserves			
Private Domain	Residence	X		
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: R14	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
387 Long Point Road	IMG_4468	34,45.0618	150,3.6452	631.4

Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View		X		
Effect on Scenic Quality of View		X		
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level			X	
Effect of Viewing Period			X	
Effect of Viewing Distance			X	
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Low		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features			X	
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads			
	Lookouts			
	Reserves			
Private Domain	Residence		X	
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: R15	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
443 Long Point Road	IMG_4638	34,45.2228	150,3.7212	639.8
	IMG_4642	34,45.256	150,3.7319	635.9

Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View		X		
Effect on Scenic Quality of View		X		
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level			X	
Effect of Viewing Period			X	
Effect of Viewing Distance			X	
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Low		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features			X	
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads			
	Lookouts			
	Reserves			
Private Domain	Residence		X	
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: C2	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
408 Marulan South Road	IMG_4627	34,45.7	150,0.0747	637.1
Potential residence	IMG_4628	34,45.699	150,0.0777	635.6

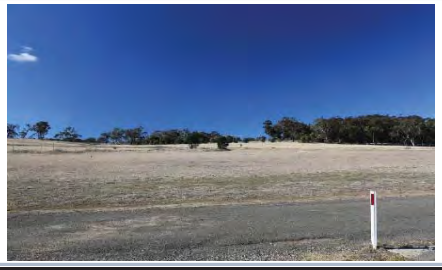
Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View		X		
Effect on Scenic Quality of View		X		
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level		X		
Effect of Viewing Period			X	
Effect of Viewing Distance			X	
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Low		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features			X	
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity				
		L	M	H
Public Domain	Roads			
	Lookouts			
	Reserves			
Private Domain	Residence		X	
		>3000m	500-3000m	<500m
		Viewing Distance		

View Place Documentation Sheets

Receiver ID: C3	R=Residence	C=Commercial	B=Boral owned	VP=Public View
Address/Location	Image No.	LATITUDE	LONGITUDE	ELEVATION (M)
452 Marulan South Road	IMG_4620	34,45.9358	150,0.487	626.7



Expansive	Restricted	Panoramic	Focal	Feature

Assessment and weighting factors		Ratings		
Assessment Factor where effects increase as ratings increase	Assessment	Low	Medium	High
	Visual Effect	(Low Effect)	(Medium effect)	(High effect)
Base-line factors				
Effect On Visual Character of View		X		
Effect on Scenic Quality of View		X		
Variable factors				
Effect On View Composition		X		
Effect of Relative Viewing Level		X		
Effect of Viewing Period		X		
Effect of Viewing Distance			X	
View Loss or Blocking Effect		X		
Overall Extent of Visual Effect		Low		
Weighting factors				
Weighting Factor where impacts decrease as ratings increase	Assessment	High	Medium	Low
	Visual Impact	(Low Impact)	(Medium impact)	(High impact)
Physical Absorption Capacity		X		
Compatibility with mining/industrial features		X		
Compatibility with Rural/Natural Features			X	
Overall Extent of Visual Impact		Low		

View Place or Viewer Sensitivity (N/A)				
		L	M	H
Public Domain	Roads			
	Lookouts			
	Reserves			
Private Domain	Residence			
		>3000m	500-3000m	<500m
		Viewing Distance		

APPENDIX 5: CURRICULUM VITAE DR RICHARD LAMB

Summary

I am a professional consultant specialising in landscape heritage and visual impacts assessment and the principal of Richard Lamb and Associates (RLA). I was a senior lecturer in Architecture and Heritage Conservation in the Faculty of Architecture, Design and Planning at the University of Sydney for 28 years and Director of the Master of Heritage Conservation program. I have taught and specialised in environmental impact assessment and visual perception studies for 30 years.

As the principal of RLA I provide professional services, expert advice and landscape heritage and aesthetic assessments in many different contexts. I carry out strategic planning studies to protect and enhance scenic quality and heritage values, conduct scenic and aesthetic assessments in contexts from rural to urban, provide advice on view loss and view sharing and conduct landscape heritage studies. I act for various client groups on an independent basis, including local councils, government departments and private clients to whom I provide impartial advice. I provide expert advice, testimony and evidence to the Land and Environment Court of NSW and the Planning and Environment Court of Queensland in various classes of litigation. I have appeared in over 200 cases and made submissions to several Commissions of Inquiry. I have been the principal consultant for over 500 consultancies concerning the visual impacts and landscape heritage area of expertise during the last ten years.

At the University of Sydney I had the responsibility for teaching and research in my areas of expertise, which are visual perception and cognition, aesthetic assessment, landscape assessment and conservation of heritage items and places. I taught postgraduate students in these areas and also gave specialised elective courses in aesthetic heritage assessment. I supervise postgraduate research students undertaking PhD and Masters degree academic research in the area of heritage conservation and Environment Behaviour Studies (EBS). The latter field is based around empirical research into human aspects of the built environment, in particular, in my area of expertise, aspects of visual perception, landscape preference and environmental cognition.

I have a number of academic research publications in local and international journals that publish research in EBS, environmental psychology and cultural heritage management. I have developed my own methods for landscape heritage assessment, based on my education, knowledge from research and practical experience.

Qualifications

- Bachelor of Science, First Class Honours, University of New England (Botany and ecology double major).
- Doctor of Philosophy, University of New England in 1975.
- Visiting lecturer, University of New South Wales, School of The Built Environment
- Principal of Richard Lamb and Associates and Director of Lambcon Associates Pty Ltd.

Employment History

- Tutor, Botany and Ecology, School of Botany, UNE (1968-1974)
- Lecturer in Resource Management, School of Life Sciences, UTS (1975-1980)
- Lecturer, Foundation Program in Landscape Architecture, Faculty of Architecture, University of Sydney (1980-1989)
- Lecturer and Senior Lecturer, Architecture and Heritage Conservation, University of Sydney (1989-2011)

Since 1975 I pursued research related to my teaching responsibilities and professional practice. My research works are in:

- Plant ecology
- Landscape heritage assessment
- Visual perception
- Social and aesthetic values of the natural and built environment

Publications and presentations relevant to visual perception and assessment of landscapes are listed at the end of this CV.

Affiliations

Professional

Chartered Biologist, Institute of Biology (UK)

International Journals for which papers have been refereed

- Landscape & Urban Planning
- Journal of Architectural & Planning Research
- Architectural Science Review
- Journal of the Australian & New Zealand Association for Person Environment Studies
- Journal of Environmental Psychology
- Australasian Journal of Environmental Management
- Ecological Management & Restoration
- Urban Design Review International

Recent experience

Landscape Planning

Assessment and Advice

Private Clients

- Advice on merits of proposal for SEPP HSPD development, Pokolbin.
- Advice on visual impacts of alternative building footprint locations, Foxground Road, Foxground.
- Advice on visual impacts of proposed residential development at Cambewarra.
Report on strategic planning issues related to Scenic Preservation hatching and Draft LEP specific to visual quality protection, Cambewarra Village.
- Advice on visual impacts of proposed subdivision and draft submission to Gosford Council, The Scenic Road, MacMasters Beach.
- Aesthetic assessment and evaluation of REF for proposed wind farm by Pacific Power and Partners, Crookwell.
- Assessment of visual impacts of proposed development and submisson to Shoalhaven City Council, Bendeela Road, Kangaroo Valley.
- Heritage and visual impacts assessment as part of statement of environmental effects, proposed monastery at Mangrove Mountain, City of Gosford
- Independent assessment and advice concerning identification of viewing places and presentation of visual impact scenarios, Harrington Park Stage II, Camden.
- Initial advice concerning visual resources of site and potential to accommodate large scale institutional development, Campbelltown Road, Denham Court.
- Landscape assessment and evaluation of alternative building sites, Saddleback Mountain, Kiama.
- Landscape character analysis and visual assessment in relation to “Gateway” concept, The Northern Road, Glenmore Park.
- Landscape constraints and development capability assessment for potential residential development, Governors Way, Macquarie Links.
- Landscape planning strategy and visual impacts assessment, proposed cemetery and crematorium, Elizabeth Drive, Luddenham.
- Landscape visual constraints and capability assessment for potential for residential development, Shellharbour Road, Dunmore.
- Landscape visual constraints and capability assessment for potential residential development, Old Princes Highway, Dunmore.

- Landscape visual constraints and capability assessment of a land proposed fo be rezoned for residential development, Cooby Road, Albion Park
- Landscape visual constraints and capability assessment of a parcel of land proposed for rezoning, Ashburton Drive, Albion Park
- Landscape visual constraints and capability assessment of parcels of land proposed for rezoning to residential use within the urban fringe area, Albion Park.
- Pre DA advice and statement of visual exposure, seniors living proposal, Cobbitty, Camden municipality.
- Pre DA advice on constraints and development envelopes, strategy and advice, Windang, Lake Illawarra.
- Pre-DA advice and visual impact assessment of proposed rezoning of rural land for potential residential development, Corner Kirkham Lane and Macquarie Grove Road, Kirkham.
- Pre-DA advice on design, visual and streetscape impacts assessment, proposed Islamic school, Burragorang and Cawdor Roads, Camden
- Pre-DA advice on visual impacts of proposed SEPP 5 development at Cambewarra.
- Report on visual impacts and effects on adjoining zones of a proposed subdivision, Glenhaven Road, Glenhaven.
- Pre DA advice and advocacy on proposed rural residential subdivision, The Northern Road, Glenmore Park.
- Statement of visual impact to accompany rezoning application, Old Northern Road, Castle Hill.
- Strategic planning advice concerning development potential, Fernhill, Mulgoa.
- Strategic planning and 3D modelling study to establish visibility constraints on zone boundaries, East Leppington Urban Release Area.
- Submission of feasibility study for re-zoning of land and subdivision for rural residential uses, Macquarie Grove Road, Kirkham.
- Submission to NSW Department of Planning against proposed extension of Catherine Hill Bay, Mooney Village and Gwandalan for residential development by Asquith & Dewitt Pty Ltd for Rosecorp Ltd.
- Visual and environmental impact assessment, proposed new dwelling, Dora Creek.
- Visual and heritage landscape assessment of impacts of proposed additions on the locality and Landscape Conservation Area, Benedictine Abbey, Jamberoo Pass.
- Visual and scenic impacts advice both pre- and post-DA, SEPP 5 Development, Old Northern Road, Castle Hill.
- Visual and scenic resources management study and visual impact assessment of a Concept Plan for Mixed Use Development, Tallawarra Lands, Tallawarra.
- Visual assessment and development strategy for proposed re-zoning of land partly for cemetery purposes, Varroville, Campbelltown.
- Visual assessment and development strategy for proposed re-zoning of land partly for residential purposes, Grange Hills, Campbelltown.
- Visual assessment and statement of environmental effects, proposed rezoning and subdivision, Cooranbong, Lake Macquarie.
- Visual assessment of proposed Town Centre land, Nambucca Drive, Scotts Head.
- Visual impact advice and report regarding location of dwellings on subdivided lots, Princes Highway, Kiama.
- Visual impact advice for proposed location of new dwelling, Weir Street, Kiama.
- Visual impact assessment and scenic amenity statement, proposed rural residential development, Dido Street, Kiama.
- Visual impact assessment for Jack Nicklaus Golf Resort, Rothbury, Hunter Valley
- Visual impact assessment for proposed Seniors Living Development, Pokolbin, Hunter Valley.
- Visual impact assessment of potentially unsightly landscape features vis-à-vis the Local Government Act definition in the vicinity of Vacy Downs Estate subdivision, Vacy.
- Visual impact assessment of proposed new dwelling, Pheasant Point Drive, Kiama.
- Visual impact assessment of proposed rezoning of land for urban residential use, Blue Seas Parade, Lennox Head.

- Visual impact assessment of proposed subdivision, Hillcrest Road, Mirrabooka, Lake Macquarie.
- Visual impact assessment, assessment against the provisions of Wingecarribee DCP 53 and advice concerning merits of proposed new dwelling location and design, Bibbys Lane, Werai Junction, Southern Highlands.
- Visual impact assessment, residential subdivision and development application, Scotts Head.
- Visual impact assessment, strategic planning analysis and peer review of proposed Forde Masterplan, Canberra.
- Visual impacts assessment of the proposed residential subdivision, Old Northern Road, Castle Hill.
- Visual resources and visual constraints study to accompany DA for establishment of new necropolis, Berrima district, Southern Highlands of NSW.
- Visual resources and visual constraints study, design advice and advocacy for potential DA, proposed resort and seniors living development, Glossodia.

Government Clients

- *Camden Council*

Camden Scenic and Cultural Landscape Study, Local Government Area of Camden.
Report on strategic planning for landscape protection based on the Camden Scenic and Cultural Landscape Study, for the Camden Rural Lands Study.

- *Dungog Council*

Assessment of visual and heritage impacts, scenic protection controls and heritage impact performance standards, proposed rezoning and rural residential development, Paterson, Upper Hunter Valley.

- *Shellharbour City Council*

Strategic planning study for identification, protection and conservation of landscapes of natural and cultural heritage significance, Shellharbour Local Government Area.

- *The Joint Old Growth Forest Project*

Empirical study to assess the feasibility of including cultural and aesthetic values in the evaluation of old growth forest.

- *The Resources and Conservation Council of New South Wales (RaCAC)*

Aesthetic values audit of the Upper North East region of NSW.

Expert workshop on integrating heritage values into the CRA/RFA process for evaluation of Australian forests.

- *Wingecarribee Shire Council*

Preparation of Development Control Plan No.53 for sighting of dwellings in rural zones.

Land and Environment Court Proceedings

Australian Native Landscapes v Warringah Council: s82A Review of conditions of consent, retail nursery, Mona Vale Road, Terrey Hills.

Baevski v Wingecarribbee Shire Council: proposed covered dressage arena, Myra Vale Road, Robertson.

Baulkham Hills Council ats Gelle: proposed extension to existing caravan park, KoVeda Caravan Park, Wisemans Ferry.

Broken Bay Pty Ltd v The National Parks and Wildlife Service of NSW: valuation matter concerning acquisition of land, Hawke Head Road, Killcare.

CD Barker Pty Ltd for Eodo Pty Ltd v Council of the City of Blue Mountains: proposed subdivision and detached residential development, Heather Road, Winmalee.

Design Collaborative Pty Ltd v Wingecarribee Shire Council: proposed spring water extraction facility, Governors Street, Bundanoon.

Erolmore Park Pty Ltd v Maitland City Council: proposed industrial development, New England Highway, Thornton.

Flower and Samios v Shoalhaven Council: proposed Seniors Living Development, Main Road, Cambewarra.

Heathcote Gospel Trust v Sutherland City Council: proposed place of worship, Forum Drive, Heathcote.

Hornsby Shire Council

- *ats Haoushar*, proposed attached dual occupancy dwellings, Crosslands Road, Galston.
- *ats Momentum Architects*, proposed SEPP5 development, Old Northern Road, Kenthurst.
- *ats M&R Civil*, proposed SEPP5 development, Old Northern Road, Kenthurst.

Kiama Council ats Moss: proposed new residence in rural land, Alne Bank Road, Gerringong.

Liverpool City Council ats Kira Holdings Pty Ltd: proposed subdivision and low density residential development, Hoxton Park.

Luke Tappouras v Lake Macquarie City Council: proposed Heritage College, Ironbark Road, Morisset.

Marsim (Queensland) Pty Ltd and Gold Coast City Council ats Hoffman & Ors: proposed neo-traditional settlement development, Killowill Avenue, Paradise Point, Gold Coast.

Molusso J v Gosford Council: proposed apartment building, Grosvenor Road, Terrigal.

Penrith City Council

- *ats Pacific Waste Management Pty Ltd*, proposed waste facility, Elizabeth Drive, Badgery's Creek.
- *ats Penrith Waste Services Pty Ltd*, prosecution for alleged breaches of conditions of consent, Mulgoa Quarry.
- *ats Sydney Anglican Schools Corporation*, proposed rural school construction, Homestead Road, Orchard Hills.

Pope Shenouda Coptic Christian Centre v Campbelltown City Council: proposed redevelopment of religious and community facilities, Wills Road, Long Point.

RTA ats Scollard: valuation matter concerning compulsory acquisition of land, Olympic Way, Gerogery.

Sangha Holdings Pty Ltd v Kiama Council: proposed subdivision, Cooby Road, Albion Park.

Save Hawkesbury's Unique River Environment (SHURE) ats Consensus Developments: proposed tourist accommodation facility, Kangaroo Point, Brooklyn.

Seaview Gardens Pty Ltd v Port Stephens Shire Council:proposed medium density residential development, One Mile Close, Boat Harbour, Port Stephens.

Sherringhams v Baulkham Hills Council: proposed retail nursery, Old Northern Road, Dural.

Sutherland Shire Council: primary submission to Commission of Inquiry into land use, Helensburgh.

The Coffs Harbour Environment Centre v the Minister for Planning: proposed rezoning of Look at Me Now Headland for the purpose of sewage treatment plant and outfall, Coffs Harbour.

*The Jehovah's Witnesses Congregations v Penrith Counci*l: proposed place of worship, Homestead Road, Orchard Hills.

Tony Fidler as Trustee for Howship Holdings v Port Stephens Shire Council: valuation matter concerning acquisition of land, Lily Hill, Nelson Bay.

Townsend W & D v Lake Macquarie City Council: proposed rural dwelling, Chelston Street, Warners Bay.

Warringah Council ats Vigor Master: proposed dwelling construction, Brooker Avenue, Beacon Hill

Wingecarribee Shire Council

- *ats Knox*, prosecution for illegal construction of earth bank, Range Road, Kangaloon.
- *ats Webb*, proposed rural dwelling, Silver Springs Hill, Burrawang.
- *ats Allen*, proposed rural dwelling Greenhills Road, Berrima.

Visual Impacts

Assessment and Advice

Private Clients

- Advices and visual impact assessment of a proposed aged care facility, McLaren Street, North Sydney.
- Advices and visual impact assessment of the proposed concept plan for a medium density residential development, Belmore Street, Ryde.
- Advices and visual impact assessment of the proposed new dwelling and swimming pool, Mountain Road, Austinmer.
- Advices and visual impact assessment of the proposed retirement resort, Oakey Creek Road and Marrowbone Road, Pokolbin.

- Advices on potential visual impacts of the proposed driveway and basement car park, Musgrave Street, Mosman.

Advice on potential visual impacts of proposed amendments to existing consent, Minamurra Road, Northbridge.

- Assessment and advice on visual effects of lighting from adjacent parking garage, Ocean Street, Woollahra

- Assessment of visual impacts of additions and alterations to existing retirement village, Jersey Road, Paddington.

- Assessment of visual impacts of proposed subdivision, Bantry Bay Road, Frenchs Forest.

- Landscape assessment, curtilage study and heritage impact assessment as part of a Local Environmental Study, curtilage of Duckenfield House, Duckenfield, Hunter Valley.

- Local environmental study, proposed subdivision and residential development, Berkeley Vale, Wyong Shire.

- Report on strategic planning issues and submission to Shoalhaven City Council related to Scenic Preservation hatching being proposed over the locality of Cambewarra Village, North Nowra.

- Scenic resources and visual constraints study, proposed seniors living proposal involving concurrent rezoning, Milton, South Coast.

- Strategic planning and visual impact assessment for proposed rezoning and master plan application, Riverlands Golf Course, Milperra.

- Strategic planning study for Stage 1 Master Plan, visual impact assessment for rezoning applications, principles for siting of buildings and mitigation of potential impacts, Boydtown, Eden region.

- Submission to Council against a proposed industrial development on Burley Road, Horsley Park on the visual amenity, Capitol Hill Drive, Mt Vernon.

- Submission to Council against a proposed industrial development on Burley Road, Horsley Park on the visual amenity, Greenway Place, Horsley Park.

- Submission to Waverley Council concerning visual impacts of proposed amended DA, Birrell Street, Tamarama.

- - Urban design and visual impact study, Beach Street, Coogee.

- Urban design and visual impacts assessment, proposed Trinity Point Marina and tourism development Concept Plan, Lake Macquarie.

- Visual and landscape strategic planning assessment of proposed draft amendment to Wingecarribee LEP 1989, Burradoo, Moss Vale

- Visual constraints and residential development strategy advice, Lennox Head.
Advocacy concerning strategic planning process and proposed rezoning of land, Lennox Head.

- Visual impact and view loss assessment for proposed seniors living development, former Loreto site, Bronte Road, Bronte

- Visual impact assessment and advice on building height controls for Greystanes Estate, Southern Employment Land, Greystanes.

- Visual Impact Assessment and advices on rural subdivision, The Northern Road, Glenmore Park.

- Visual impact assessment and strategic planning for proposed rezoning and subdivision of land at Menangle Road, Menangle

- Visual impact assessment as part of the Review of Environmental Factors for Shellharbour Waste Water Treatment Works.

- Visual impact assessment for subdivision application, The Northern Road, Glenmore Park.

- Visual impact assessment of land proposed for rezoing to support a proposed clay target shooting facility, Bong Bong Road, Huntley.

- Visual impact assessment of new school house, Kingswood Road, Orchard Hills.

- Visual impact assessment of proposed amendments to existing consent, Tulloch Avenue, Concord

- Visual impact assessment of proposed residential development, Bray Street, Mosman.

- Visual impact assessment of proposed residential subdivision, mitigation measures and advice on conditions for site specific DCP, Scarborough Gardens, Bonnells Bay

- Visual impact assessment of proposed seniors living development, St Albans Street, Abbotsford.

- Visual impact assessment of the proposed mixed use development, Columbia Precinct, Parramatta Road and Columbia Lane, Homebush.

- Visual impact assessment of the proposed residential townhouses development including preparation and certification of photomontages, Johnston Street, Annandale.

- Visual Impact Assessment Part 3A Concept Plan application. Old Canterbury Road, Lewisham.

- Visual impact evaluation of a series of possible locations for dwelling sites, Menai.

- Visual impacts assessment of proposed residential developments, Thomas and Dumbarton Streets, McMahons Point.

Government Clients

- *Ashfield City Council*

Ashfield Town Centre, Study of Building Heights to be incorporated into the Town Centre Development Control Plan.
Review of DA for Abacus Ashfield Mall Redevelopment, against the performance standards of Building Heights Study.

- *Brisbane City Council*

Cultural Mapping exercise, for Quality Urban Corridors Program, Logan Road, Lutwyche/Gympie Roads, in association with Archimix Brisbane.

- *Brisbane City Council and the Department of Natural Resources, Queensland*

Protection of Scenic Landscapes Study; Regional landscape study to develop a methodology for the documentation of scenic values of the South East Region of Queensland.
South East Queensland Regional Organisation of Councils
advice on Scenic Amenity Study

- *Council of the City of Gosford*

City Wide Visual Quality Study in association with David Kettle Consulting Services.
Development Control Plan-Scenic Quality.
Local Environmental Study, The Scenic Highway, Terrigal.

- *Department of Infrastructure, Planning and Natural Resources and The Uniting Church of Australia*

Visual impact assessment for subdivision of land at Ingleside Road, Ingleside.

- *Hastings Shire Council*

Review and redrafting of DCPs 9 and 20 relating to scenic and heritage resource protection, Port Macquarie.
Visual resources and scenic conservation study as part of Camden Haven River Estuary Processes Study, in association with Patterson Britton and Partners.

- *Ku ring gai Council*

Brief development for municipality wide neighbourhood visual and streetscape study.
Local Environmental Study: scenic quality of South Turramurra.

- *Landcom*

Strategic planning advice and visual impact assessment for proposed NSW Police Facilities on former Sydney Water land, Potts Hill.

- *Manly Council*

advice on and provision of certified photomontages of proposed Major Projects developments in Manly Town Centre.

- *Pittwater Council*

Scenic qualities, landscape resources and visual constraints study, potential rezoning and land swap exercise, Council Works Depot site, Ingleside.

- *Sydney Water*

Review of visual environmental effects for Wongawilli Reservoir proposal, West Dapto, Illawarra.

- *Road Transit Authority*

Review of visual environmental effects for Oak Flats Highway Interchange proposal, Oak Flats to Dunmore section, Princes Highway, Illawarra.

- *Office of Marine Administration and Department of Environment and Planning*

Methodology for assessment of visual issues and design guidelines for the DCP to accompany SREP 22 and 23, Sydney and Middle Harbours and Parramatta River: and Part 5 checklist.

- *Rockdale City Council*

Development control strategy and advice for Draft DCP, Rocky Point Road, Ramsgate.

- *Singleton City Council*

Visual impact assessment of proposed temporary accommodation village, Putty Road, Singleton.

- *Shoalhaven City Council*

East Nowra Local Environmental Study.
Old Erowal Bay visual quality study.
- Visual impacts assessment relating to land swap and rezoning proposals, Milton and Narrawallee.

- *Wingecarribee Shire Council*

Preparation of Development Control Plan No 53 for the siting of buildings in rural zones.