Table of Contents

Document Information 2
Document Control 2
Table of Contents 3
Executive Summary 5
GLOSSARY OF TERMS 8

1 Introduction 11
   1.1 Scope, Aims, and Objectives 11
   1.2 Location 11
   1.3 Overview 12
   1.4 Description of Proposed Development 13
   1.5 Terms of Reference 14
   1.6 Assessment Methodology 15

2 REGULATORY FRAMEWORK 16
   2.1 Commonwealth and State Requirements 16
      2.1.1 EPBC Act and Matters of National Environmental Significance 16
      2.1.2 Queensland Coastal Plan 16
      2.1.3 State Planning Policy 2/07 (Protection of Extractive Resources) 16
      2.1.4 SEQ Regional Plan 16
   2.2 Local Government Requirements 16
      2.2.1 Gold Coast Planning Scheme 16

3 EXISTING VISUAL ENVIRONMENT 19
   3.1 Regional Context 19
   3.2 Reedy Creek/Tallebudgera Study Area 20
   3.3 Subject site 21
   3.4 Landscape Context 22
      3.4.1 Landform 22
      3.4.2 Ridges and Valleys 23
      3.4.3 Land Cover 25
      3.4.4 Landscape Character 26
      3.4.5 Visual Absorption Capacity 29
      3.4.6 Visual Exposure, Scenic Preferences and Scenic Amenity 30
   3.5 Viewshed Analysis 35
      3.5.1 Viewing Distance 35
      3.5.2 Viewer Groups 36
      3.5.3 View Sectors and Potential Receptor Areas 37
      3.5.4 Sensitive Viewpoints and Viewsheds 39
      3.5.5 Other viewsheds 43

4 Future Visual Environment 44
   4.1 Visibility 44
      4.1.1 Cross Sections 44
      4.1.2 Visibility from Viewpoints 45
      4.1.3 Visibility of Upper Quarry High Walls 49
      4.1.3 Visibility of Other Quarry Components 52
4.1.4 Zone of Visual Influence 52
4.1.5 Sensitive Visual Receptor Analysis 55

5 Impact Mitigation 59
5.1 Quarry Planning 59
5.2 Bench Rehabilitation and Temporary Mitigation 59
5.3 Structures 60

6 Visual Impacts 61
6.1 Effects on Landscape Character 61
6.2 Visualisation 62
6.3 Impacts 64
6.4 Scenic Preference Ratings (SPR) 65

7 Conclusion 67
Executive Summary

Boral Resources (Qld) Pty Limited (Boral) proposes to develop a hard rock quarry on a State-designated Key Resource Area (KRA) at Reedy Creek, Gold Coast. The site of the proposed Gold Coast Quarry (the subject site) comprises approximately 220 hectares (ha) and occupies a complex arrangement of ridges, spurs and side valleys between Old Coach Road and Tallebudgera Creek Road, south of the Pacific Motorway (M1), the existing Boral West Burleigh Quarry and a former quarry now used as the Reedy Creek Recycling Centre and industrial development. The surrounding area of West Burleigh, Tallebudgera and Reedy Creek (the study area) also includes residential and rural residential development, rural properties and forested ridges, forming part of the interface between the urban and hinterland parts of the City of Gold Coast.

In general, the main potential for visual impacts of quarrying arises from any near-vertical rock faces which may be visible from nearby residences and public places. In the case of the proposed Gold Coast Quarry, such impacts are minimised and mitigated as detailed in this visual impact assessment. The proposed development will clear and excavate a central 65 ha disturbance footprint area (30% of the site), leaving 300 - 500 m wide separation buffer areas around all four sides. The quarry will be progressively developed over a period of 40 – 70 years, dependent on market demand, in four broad phases – Establishment and Development (including access from Old Coach Road, a dam and a Plant Site for the infrastructure and stockpiles), followed by Construction and Quarry Operations in the main western pit.

Although designated for Extractive Resource under State Planning Policy 2/07 (Reedy Creek KRA 96) the subject site is within the Emerging Communities Domain in the 2003 Planning Scheme of Gold Coast City Council (Council), with three strategic designations (Urban Residential, Park Living and Open Space/Nature Conservation). These designations are reflected in the Reedy Creek Structure Plan (Emerging Communities Map EC8), with half the site designated ‘Residential’, including an east-west collector road, with retention of native vegetation on land above 70 m AHD and development constrained to foothills and valley floors. This discrepancy between Council’s 2003 Planning Scheme and State interests presents a conflict with the proposed quarry development and the Planning Scheme intentions for the site as future residential development and open space.

The existing landscape values of the study area, as identified and mapped in several Council studies, are associated mainly with its topography and urban/hinterland interface location. The main ridges extending north-east from Springbrook to the coast are identified as visually significant. In general, these ridges form broad green wedges of forested hills which characterise the interface, although several have ridge-top housing or pockets of quarrying (current or past). These ridges form the background hills and forested skylines to local views and scenic driving routes; they divide and distinguish each residential precinct, and they also provide their setting and neighbourhood identity (sense of place). The subject site is part of one of these forested ridges, which form important landscape elements in the study area, and the southern part of Gold Coast generally. However the subject site is not prominently visible from public places or within view corridors identified by Council as important to the Gold Coast, with the exception of an internal ridgeline (visible in 1-2 view corridors) and a ridge peak outside the proposed disturbance footprint (visible in 4 view corridors).

The viewsheds of selected nearby residential areas, within the potentially affected view sectors, were analysed by GIS modelling based on detailed LiDAR survey (including tree heights), and supported by field survey and photographs from external viewpoints. Potential sensitive visual receptor areas are the existing and approved houses and streets in nearby residential suburbs and the scenic route of Tallebudgera Creek Road. Key findings from this analysis are:
Three ridges partly enclose the disturbance footprint on three sides (western, southern and northern), such that visibility from external sensitive visual receptors is limited;

The disturbance footprint also includes a central forested ridge which is visible from some surrounding areas, but is rarely seen on the skyline because other higher forested ridges are behind it;

The visibility of the disturbance footprint area is largely limited to elevated parts of Old Burleigh Town (1 – 2 km to the north-east) and the more distant Elanora ridge to the east. It is not visible from the west (The Observatory and Kingsmore estate areas), from the south (Tallebudgera Creek valley) nor from the M1 Pacific Motorway.

From these viewpoints, small elevated parts of the disturbance footprint area are visible at midground distances. Due to the wide separation area buffers, no sensitive visual receptor is within the foreground view distance of the disturbance footprint. There are no public lookouts within view of the disturbance footprint.

The potential visibility of the proposed quarry (Zone of Visual Influence) was also modelled in GIS using LiDAR data to create a Digital Surface Model, incorporating a CAD model of the quarry phases, as well as by cross-sectional sight lines and by photomontages. This analysis of potential visibility at the ends of two key phases (Development Phase D4 and Quarry decommissioning Q5) indicated that:

- Through the Development Phase, and up to Quarry Phase Q3, only the upper curved high walls (generally 12 m high) behind the Plant Site and ROM pad, and some of the taller operational infrastructure, are likely to be visible, as seen from a few elevated houses and streets at 1.6 to 4.5 km distance;
- After Q3 (ie. after 25 – 30 years of quarry operation), when a screening ridge is progressively lowered, parts of the upper 5 or 6 high walls of the main pit will also become visible as exposed rock faces over varying lengths up to 750m. At that stage, possibly 60 – 70 residential allotments in Old Burleigh Town may be within view of some exposed rock faces, at viewing distances of 1.6 to 2 km, mostly in shadow and seen at an oblique angle (ie. not ‘front-on’ to viewers) and will be below the local skyline of the main wooded ridge;
- The above rock faces and infrastructure are also likely to be visible at a greater distance from some houses on Elanora ridge.

The identification of potentially visible rock faces helped guide the Rehabilitation Strategy by prioritising benches for early revegetation. The proposed sequence of quarry excavation in the main pit will result in a staggered configuration of benches and faces, and ages of rehabilitation planting, at any point in time. While this will avoid long straight ‘cliffs’ of exposed rock, this sequence will prevent early planting of permanent revegetation. However even when the screening ridge is removed after 25 – 30 years, the upper western and north-western rock faces of the main pit will not be fully exposed to view as bare rock walls, because their bases will be screened by bench revegetation of various heights, depending on the sequence and staggering of bench excavation; and the upper parts of rock faces are likely to be visually softened and screened within 10 – 15 years after final bench revegetation. Until these trees grow tall enough to provide such screening, the exposed rock faces will be subject to appropriate surface treatments of colour and pattern (to be trialled over the 25 – 30 years before visual exposure) to reduce their visual contrast.

The visual impacts of the proposed Gold Coast Quarry, with proposed mitigation measures in place, are considered minor and acceptable over the long period proposed for quarry operations. The natural topography, wide separation area buffers and the distance of view from residential receptors, all contribute to screening and reducing visibility. Although approximately 40,000 m$^2$ of rock faces may potentially be visible above the tree canopies of the separation area, the visual impacts will be reduced by the following:
• Although part surrounded by residential and rural residential areas, most are screened and only a small proportion of houses and streets in elevated locations will have views to some rock faces in the main pit upper walls, at distances of 1.6 to >4 km, and then only after the quarry has been operating for 25 – 30 years, and the rock faces will be visually exposed for a period of 10 – 15 years until trees grow tall on the terminal benches;

• The exposed rock faces will not be on the skyline, but will be below the forested skyline of the main ridge behind;

• No single place will be within view of the entire potential length or area, but will see only parts, and the rock faces will mostly be seen at a sharp angle;

• The exposed rock faces will be a minor proportion of the quarry and a minor proportion of the visible forested ridges which form the local scenic landscape frame;

• The exposed rock faces will have variation in colour and texture, with a southerly and easterly aspect, which will be in shadow for parts of the day, and will not ‘catch’ the glare of the western sun to the same extent as (for example) the existing West Burleigh Quarry;

• The quarry plant, equipment and access road will be largely hidden from external view, and structures which are partly visible will be visually semi-permeable or clad in subdued colours; and

• The vegetative rehabilitation and non-vegetative measures proposed for trial will soften and screen the exposed rock faces and, over time, help to visually integrate them into the existing hillside landscape.

Photomontages, with and without rehabilitation planting, illustrate the likely appearance of the proposed quarry at the end of D4 and Q5, and confirm the predicted visual impacts. The visual impacts and changes in Scenic Preference Rating (SPR) between the existing and post-development scenario has been calculated, using a methodology recommended in the SEQ Regional Plan Implementation Guideline 8, confirming that the visual impacts are likely to be minor.
GLOSSARY OF TERMS

Aesthetic: concerned with visual appreciation of beauty, a sensory and subjective experience which brings pleasure to the viewer

Attribute: (with respect to landscape) An identifiable element, quality or characteristic located at or associated with a place or feature

Amenity: The pleasantness or usefulness of a place, as conveyed by desirable attributes

Attributes: see Elements, Criteria and Indicators

Character / Landscape Character: A distinct pattern or combination of elements that occurs consistently in parts of the landscape, and often conveys a distinctive ‘sense of place’

Character Type / Landscape Character Type: A broad categorisation of landscape character, generally on a geographic basis using topography, land cover and land use

DTM / DEM: Digital Terrain Model / Digital Earth Model, a 3-dimsional model of the land surface (without trees and buildings) generated by computer from contour, survey or remote-sensing data

DSM: Digital Surface Model, a 3-dimsional model of the land surface (with vegetation and buildings) generated by LiDAR data.

EIS/EIA: Environmental Impact Statement / Environmental Impact Assessment

Element / Landscape Element: A component part of the landscape, usually biophysical, such as hills, river, islands, lake, forest etc.

Feature / Landscape Feature: A prominent, eye-catching or noteworthy element or landmark that makes a contribution to landscape character or identity, or helps mark a place or route

GIS: Computerised Geographic Information System

Integrity / Scenic Integrity: the extent to which the landscape is perceived to be in its original natural condition or consistent with long established patterns of land use and built form. The term ‘Condition’ is similar

Landcover: Vegetation (natural or rural)

Landscape Assessment / Evaluation: Description and analysis (and usually mapping) of landscape values and attributes, including scenic amenity, visual quality, sensitivity, integrity, cultural heritage and associations; usually by repeatable procedures including relative ranking of landscape values

Landscape Setting / Setting: Landscape units at district scale separated by visual barriers formed primarily by the topography but also by vegetation or natural systems, or defined by viewing distance, land use patterns or cultural factors; and which are perceived by observers in various locations as the setting or backdrop for human activity and association. Landscape Settings are the visual catchments of places or areas used by people, and are generally large enough to support the cultural or natural processes which create its character.

Land Type: A geographic sub-unit of the landscape, distinguishable as an area with essentially homogeneous elements, usually topography, land use and/or character; such as hill slopes, foreshore, town, headland, cane fields, plain, lake etc., and which may occur within a number of different Landscape Settings.

LiDAR: Light Detection and Ranging data used to create a Digital Surface Model incorporating vegetation and building heights;
Lot 105: Lot 105 on SP144215. This lot constitutes the land that is subject to the proposed quarry development.

Receptor: A place, route, viewer group or interest group which may experience an effect.

Regional Frame / Landscape Frame: The natural topographic “frame” of a region or district visible from many viewpoints, usually determined by landform but also formed by vegetation and water features, and not confined to a single Landscape Setting.

Scenery: The composite impression of a number of landscape features and elements surrounding a viewer, perceiving a wider scene than just the immediate foreground, for example as seen from a vantage point or while moving through a landscape. Usually refers to landscapes which are mostly natural or rural.

Scenic: Attractive scenery, particularly combinations of landscape features and elements which appear ‘composed’ similar to landscape paintings i.e. the concept of ‘scenic’ is culturally-based.

Scenic Amenity: A measure of the relative contribution of each place in the landscape to the collective appreciation of open space as viewed from places that are important to the public. The South-East Queensland Regional Plan Implementation Guideline No.8 defines Scenic Amenity as a function of both Scenic Preference and Visual Exposure.

Scenic Demand: A relative indication (High/Medium/Low) of the expectations of viewers for attractive unspoilt scenery as the setting for their activities and travel.

Scenic Preference: A subjective evaluation whereby one or more scenes are preferred relative to others. The South-East Queensland Regional Plan Implementation Guideline No.8 provides a method for ascertaining community consensus regarding scenic preferences, using a process whereby representative samples of the community population rank photographs of scenery, and the results are collated and averaged. The selected photographs sample various Visual Domains and a range of landscapes and naturalness, with varying proportions of elements. Analysis of the photographs for their varying proportions of Visual Domains and landscape elements allows the results to be applied to air photos to produce Scenic Preference maps.

Scenic Quality / Visual Quality: The values of visible components of landscape which contribute to its scenic characteristics, assessed by reference to defined Scenic Quality criteria. Scenic quality is the relative nature or character of landscape features expressed as an overall impression by people after perceiving an area of land. The degree of harmony, contrast and variety within the landscape; the overall impression retained after driving through, walking through or flying over an area of land.

Sense of Place: The perception that a particular place is recognisable and identifiable, distinct from other places, through a combination of landscape and/or urban elements, features and less tangible sensations. Similar to ‘genius loci’.

SPP: State Planning Policy.

Stakeholders: Persons, groups, government and semi-government agencies, non-government organisations and corporate bodies with a legitimate interest in the process of assessment, its inputs and outcomes.

ToR Terms of Reference

VIA: Visual Impact Assessment

Viewing Distance: Division of seen areas into categories (Foreground, Midground and Background), which largely determine the degree of visible detail.

Viewpoints / Sensitive Viewpoints: Viewpoint places and/or people likely to be particularly affected by visible changes to landscape values, by virtue of the numbers of viewers and/or their expectations of scenery.
Viewshed: Edges or limits to views from a single place or combination of viewpoints. Viewshed mapping or modelling usually shows all areas, which are potentially within view of viewpoints, based on topography.

Visual Absorption Capability (VAC): The capacity of the landscape to absorb change (usually development-related), without significant detriment to its landscape values (character, scenic quality and integrity). VAC is a function of both slope and vegetation screening capacity.

Visual Analysis: Landscape analysis based on visual qualities only, excluding consideration of heritage, cultural or social values, or other sensory attributes of the landscape.

Visual Catchments: Areas within viewsheds

Visual Exposure: The visibility of parts of the landscape to lookouts, the major road network, sensitive viewpoints and scenic routes, usually computer-generated from a DTM (with or without screening trees and buildings). The South-East Queensland Regional Plan Implementation Guideline No.8 provides a method for mapping composite Visual Exposure from multiple viewpoints along routes, ranked according to traffic numbers, viewing distance and the length of viewing time.

Visual Impact Assessment / Landscape Impact Assessment: Likely impacts of development projects or land use change on landscape values, usually assessed through detailed landscape analysis as part of an EIS.

Visualisation: Photo-realistic representation of the likely appearance of proposed structures and features, such as by modelling and/or photomontage images.

Zone of Visual Influence (ZVI): Areas from which a particular feature is or may be visible (i.e. views to a feature). ‘Maximum possible ZVI’ is based on landform topography, often modelled from DTM data, without taking into consideration the screening effects of vegetation and/or buildings.
1 Introduction

1.1 Scope, Aims, and Objectives
This Visual Impact Assessment Report forms part of the Environmental Impact Statement (EIS) for the Gold Coast Quarry Project, undertaken on behalf of Boral Resources (Qld) Pty Limited (Boral) and responds to the Terms of Reference (ToR) issued by Queensland’s Coordinator General in July 2011, specifically Section 4.2.1 Scenic Amenity (reproduced as Appendix 1).

Consistent with the ToR, this report describes existing environmental values, potential visual impacts and mitigation measures, including rehabilitation as detailed in the accompanying Rehabilitation Strategy report.

1.2 Location
The subject site is located to the south-west of the Pacific Motorway, approximately five kilometres (km) from Burleigh (Figure 1-1). The subject site is described as Lot 105 on SP144215 and Lot 901 on RP907357 with a combined area of 219.998 hectares. Lot 105 (216.7 hectares) is the area proposed for quarrying, while Lot 901 (3.298 hectares) is a reserve administered by Gold Coast City Council and is not relied upon for this project. As shown on Figure 1-1, the subject site is close to the nearby existing West Burleigh Quarry, also owned and operated by Boral, on the northern side of the Pacific Motorway.

Figure 1-1  Site location
1.3 Overview

Boral is seeking to establish a new extractive industry operation on a greenfield site between Tallebudgera Valley, Reedy Creek and West Burleigh within the City of Gold Coast. This will coincide with the scheduled decommissioning of Boral’s existing West Burleigh Quarry, which has sufficient reserves for only a further 5 to 8 years of production.

The subject site (Figure 1-2) includes several ridges that form significant topographical features in the southern part of the City of Gold Coast, but the valuable hard rock resource (meta-greywacke) is located within a central deposit on the subject site, such that only approximately 65 hectares or 30% of the subject site is proposed for extraction, associated plant and a dam (the disturbance footprint), largely within a topographic frame of existing wooded ridges. The balance of the area, including the forested ridgelines, is proposed to remain undeveloped and/or rehabilitated as vegetated buffers (separation area) on land owned by Boral.

The proposed quarry development is a State-Coordinated Project designed to provide high grade hard rock construction materials for at least 40 years for the Gold Coast region.

Preliminary quarry planning and community consultation, at an earlier stage of project feasibility and review, had taken potential visual impacts into account and significantly reduced its likely visibility from surrounding residential areas and scenic routes. In particular, the proposed disturbance footprint has been restricted to a central zone surrounded by ridges, with a wide separation area of buffering forest, as shown in Figure 1-2.

Figure 1-2  Air photo showing context and main ridges (Refer to Appendix A for larger version).

Quarry staging and other details have been further refined through the EIS process, including this visual impact study.
1.4 Description of Proposed Development

The proposed development will operate as a quarry for the extraction and processing of hard rock with an anticipated maximum production rate of 2 million tonnes per annum (Mtpa) for a period in excess of 40 years. The planned sequence of quarry development has been divided into four broad stages (Establishment, Development, Construction and Quarrying), with 14 intermediate phases, as shown in Appendix 2 and summarised as follows:

- Initial development in the Establishment Stage (Phases E1 – E3) includes road construction, the removal of large volumes of overburden and establishment of a construction facilities pad and a quarry dam.

- The Development Stage (Phases D1 – D4) will progressively remove overburden and excavate hard rock from the Plant Site (including a ROM pad and stockpile platform) in the eastern part of the disturbance footprint, with processing by mobile crushing plant until the fixed plant and equipment are constructed and operational.

- The Construction Stage (Phases C1 and C2) will establish the fixed processing infrastructure, workshop and site offices on the Plant Site (with most conveyors, crushers and stockpiles 10 - 20 m high, apart from the primary feeder enclosure to 30 m height) and commence opening the main quarry pit in the western part.

- The Quarrying Stage (Phases Q1 – Q5) will progressively extract material from the main pit, extending from the central ridge (at approximately 133m AHD) to a final void floor at approximately RL -66m by the final stage (Q5), establishing benches and exposed rock faces (high walls). Geological assessment indicates that high walls will be stable at 12m high and approximately 25° slope (from the vertical) with benches initially 20m wide, then reduced to a minimum of 8 m or 12m final widths for rehabilitation.

The phases illustrated in Appendix 2 represent likely ‘snapshots’ at the end of each stage, but the sequence of operations will be progressive transitions in various parts of the quarry at various times. Over the 40 to 70 year operational life of the quarry, the timing and rate of progression through the phases and stages will be determined by demand and market conditions, but will potentially be a ‘staggered’ transition across several benches at any one time, progressively excavating sections of up to 100 m length as indicated conceptually in Figure 1-3.
There will be progressive rehabilitation of quarry benches following exposure at each stage, dependent on the quarry operational program. Most benches and rock faces will be re-worked as quarrying extends back into the hillside, hence initial revegetation (non-terminal rehabilitation) will be removed in subsequent stages. However completion of the quarrying phase will be followed by terminal rehabilitation of all benches, prior to decommissioning. The strategy for rehabilitation of quarry benches (refer Rehabilitation Strategy) places emphasis on mitigating visual impacts during operational stages, adapted to the sequence and progression of excavation towards terminal benches.

As part of environmental impact mitigation, several noise barriers are required including a 6 m high acoustic fence located in the buffer near the northern boundary of the subject site, and this also requires visual screening.

1.5 Terms of Reference

The Terms of Reference for this report is defined under Section 4.2.1 ‘Scenic Amenity’ as follows:

‘Description of environmental values

Describe, in general terms, the existing character of the area and the general impression that would be obtained while travelling through and around it. Outline existing landscape features, panoramas and views that have, or could be expected to have, value to the community. Include information in the form of maps and photographs, particularly where addressing the following issues:

- major views, view sheds, outlooks, and features contributing to the amenity of the area, including assessment from private residences
- focal points, landmarks, waterways and other features contributing to the visual quality of the area and the project site
- character of the local and surrounding areas including vegetation and land use.

At a level of detail appropriate to the scale of the project, provide a description of the relevant geomorphology, supported by illustrative mapping highlighting any significant features and associated environmental values.

Detail the scenic and landscape values of the area focusing on the visual absorption capacity of the site, including any relevant World Heritage and National Heritage Values of the area.

Potential impacts and mitigation measures

Provide details of the likely height of buildings and structures across the entire site.

Use sketches, diagrams, computer imaging/simulation and photos where possible, to portray the near views and far views of the completed structures and their surroundings from visually sensitive locations. Depict and describe if the development will be buffered from surrounding areas with, for example, landscaping, retaining of vegetation, and architectural attenuation.

Provide details of any proposed landscape/vegetation buffer areas between roads, adjacent properties and waterways.

Discuss line-of-sight implications during pre-construction, construction and operation for areas including, but not limited to, Tuesday Drive, Sky Royal Terrace, Royal View Close, Chloe Court, Fenton Drive, Westminster Boulevard, Ladds Ridge Road, Chesterfield Drive, Tallebudgera Creek Road, Observatory Drive and Old Coach Road.

Provide views/simulations of the site for affected locations that will have line-of-sight to the project works during pre-construction, construction and/or operation.

Discuss the visual impact of the construction and operation of the project, including transportation, as it relates to the surrounding landscape. The assessment should address the local and broader visual impacts of the project buildings and structures. This should include views from places of residence, work, and recreation; from roads, cycle and walkways; from the air and other known vantage points day and night, during all stages of the project as it relates to the surrounding landscape.
Describe the potential beneficial and adverse impacts of the project on landscape character and visual qualities of the site and the surrounding area. Provide details about measures to be undertaken to mitigate or avoid the identified impacts.

1.6 Assessment Methodology

A study area was defined at district scale (West Burleigh / Tallebudgera), both as context and to encompass the areas potentially within view of the proposed quarry (roads, public places, residences and other visual receptors). Within the study area, the landscape values previously documented by Gold Coast City Council (landscape character, scenic amenity, view corridors and significant ridgelines) were reviewed and applied, and assessed in greater detail by desktop studies and field assessment, with particular emphasis on visibility of the proposed disturbance footprint and its screening by existing landform. Council’s visual exposure mapping of the City of Gold Coast (based on topographic data) was repeated for the study area using high resolution 2009 LiDAR (Light Distribution and Ranging) data to capture topography, tree canopy height and the screening capacity of existing vegetation, buildings and other view barriers.

These investigations allowed the identification of viewpoints in sensitive visual receptor areas for more detailed GIS and 3D modelling and verification (through photomontage visualisation) of potential visibility, likely appearance and visual impacts, within broad view sectors surrounding the subject site.

This visual impact assessment follows a structured approach, based on the ToR (s 4.2.1), as follows:

(a) Description of the existing visual environment of the study area and subject site, including character, features and landscape values recognised in Council’s planning scheme and other studies, and as identified in this study. This section includes analysis of each of the ridges which semi-enclose the disturbance footprint area, visual absorption capacity, visual exposure and detailed consideration of potentially sensitive visual receptors ie. those roads and residential areas with existing views into the disturbance footprint area, and their existing viewsheds. This was undertaken by desktop study using GIS data sets, aerial imagery and Google Streetview to identify viewpoints, then viewsheds were analysed by a Digital Surface Model (DSM) (based on LiDAR data, with viewpoints 1.7m above ground level) and verified through field work and survey photos.

(b) Description of the future visual environment of the subject site, as the quarry is progressively developed, by analysis of the proposed quarry phases and stages (with roads and structures, by day and by night) over their 40+ year timespan, with modelling of visibility ( Zones of Visual Influence of visible points midway up quarry rock faces) using the LiDAR-based DSM, again assuming viewer eye levels of 1.7m above ground level. This has included identification of specific quarry faces likely to be visible from sensitive residential and road receptors at each phase and stage, as inputs into the accompanying Rehabilitation Plan in order to plan bench revegetation and other visual impact mitigation measures.

(c) Visual Impact Assessment, based on the above analysis and illustration of project visibility ie. where the proposed quarry operations and exposed rock faces will be visible from, and the viewer groups affected, illustrated by photomontages to visualise its appearance. For the viewer groups and viewsheds affected, the landscape values likely to be impacted have been assessed, in terms of the values and significance ascribed in the Planning Scheme and other regulatory documents. One measure of the significance of visual impacts is by calculation of Scenic Preference Rating before and after quarrying, using the SPRAT-2 (Scenic Preference Rating Assessment Tool) in accordance with the SEQ Regional Plan Implementation Guideline 8 (Identifying and protecting scenic amenity values). A SPRAT-2 assessment has been undertaken for elevated parts of Old Burleigh Town; the most affected visual receptor residential area;

(d) Recommendations regarding impact mitigation strategies (screening, rehabilitation, siting, design and lighting) to reduce impacts within viewshed, with risk assessment of the significance and likelihood of impacts with and without mitigation measures; and

(e) Assessment of the significance of visual impacts, in terms of the identified landscape values of the study area, together with the risks associated with such impacts and mitigation measures; and comparison with the visual impacts likely to arise if the subject site was instead developed in accordance with the current Planning Scheme.
2 REGULATORY FRAMEWORK

2.1 Commonwealth and State Requirements

2.1.1 EPBC Act and Matters of National Environmental Significance

There are no landscape values of national environmental significance associated with the subject site or likely to be affected by the proposed quarry development.

2.1.2 Queensland Coastal Plan

The subject site is outside the designated Coastal zone of the Queensland Coastal Plan (SPP11/13) there are no State Government provisions or legislative frameworks for the protection of visual and scenic amenity for this project.

2.1.3 State Planning Policy 2/07 (Protection of Extractive Resources)

SPP 2/07 designates the site as a Key Resource Area (KRA 96) for extractive industry, and is the only remaining undeveloped KRA in the southern Gold Coast. This Policy aims to identify those extractive resources of State or regional significance where extractive industry development is appropriate in principle, and ensure those resources are available for extraction when the need arises. Notwithstanding this priority, SPP 2/07 also acknowledges the need to protect the amenity of surrounding communities from potential adverse effects of extractive industries. For KRA 96, it notes the opportunities for effective visual screening on the site because:

"is large enough and has the topographic features to almost completely self-buffer the resource, providing a separation distance of between 300 and 500 metres. Given the topographic screening provided by perimeter ridges, this distance should be sufficient to mitigate adverse impacts”.

Although the subject site is not designated ‘Extractive Resource’ under the Gold Coast Planning Scheme, SPP 2/07 has effect in the assessment of development of KRAs which may not be appropriately reflected in local planning schemes.

2.1.4 SEQ Regional Plan

In the South East Queensland Regional Plan, the subject site is within the Urban Footprint and the policies relating to scenic amenity in the Regional Landscape and Rural production Area do not apply. Nevertheless Regional Policy 3.2 (Acknowledge, protect and manage significant scenic amenity areas and features) is a guiding principle for local government planning in general, and has been implemented by Gold Coast City Council in particular. Council has mapped Scenic Amenity in accordance with Implementation Guideline 8 (Identifying and protecting scenic amenity values), and has also mapped view corridor exposure, although these have not yet been incorporated into its planning scheme. Guideline 8 also provides a method for assessing relative visual impacts of development by a Scenic Preference Assessment Tool (SPRAT-2) method, as referred to in the ToR.

2.2 Local Government Requirements

2.2.1 Gold Coast Planning Scheme

Planning Scheme provisions relevant to landscape and visual impacts in the Gold Coast Planning Scheme 2003 (ver 1.2) are, in summary:

(a) Desired Environmental Outcomes

Scenic and visual amenity values are protected or referred to in Desired Environmental Outcomes (DEOs) as follows:

(Ecol 1) “...of international, national, state, regional or local significance, and of other natural ecosystems, to ensure maintenance of the city’s biodiversity and natural landscape values”
The most important physical features of the City that warrant protection for nature conservation and/or landscape reasons are the *mountains, ridges, valleys, river systems, wetlands and coastal systems*.

Objectives to achieve this DEO and which relate to scenic and visual amenity include:

- **Ecol 1.2** “to preserve natural foreshore areas so as to enhance coastal ecosystems and scenic amenity values”
- **Ecol 1.5** “to preserve visually significant natural areas and physical features, predominantly in their natural state”, and
- **Ecol 1.7** “to define an ‘edge’ to the City’s urban area, particularly on its western side, to maintain a distinction between the built up and natural areas of the city”

(Econ 4) “The enhancement of the tourism industry, including the protection of existing attractions, the protection and ecologically sustainable use of the City’s significant natural assets and the further diversification of the industry”

Relevant objectives include:

- **Econ 4.4** ensuring that “the city’s natural assets and scenic amenity values are protected and, where possible, enhanced to add further value to the visitor experience”.

(Soc 1) “the establishment, conservation and enhancement of local character and the promotion of a distinctive local identity and sense of place for the various communities of Gold Coast City”.

In particular, this DEO acknowledges the importance of local features on local character, such as significant landscape elements, character of the local built environment or the area’s open space areas. It also refers to the need for careful planning to ensure ‘sense of place’ over time in new urban areas, and the important visual contribution of existing open space areas in existing urban areas.

The Planning Scheme can influence development to ensure that, even in the context of rapid urban growth, natural topographic features and urban landscape values are identified and protected. It can also facilitate controls on design to ensure that any identified local character is respected and, where appropriate, enhanced.

Planning Objectives to Support DEO Soc.1 include

- **Soc.1.1** “to preserve the distinctive character of designated rural and non-urban areas, thereby facilitating a clear distinction from urban areas”.
- **Soc.1.2** “to protect and enhance the visual value of significant landscape features, including open space and recreation areas, within both the built and natural areas of the City, as characteristics contributing to the distinctive form of the city”.

(Soc 5) This DEO seeks to protect and maintain residential amenity, through:

“...the minimisation of any environmental harm or adverse social impacts occurring from the construction and operation of commercial, community, tourism, industrial and extractive industry activities”.

Planning objectives to support this DEO include:

- **Soc.5.1** “to ensure that land uses that have the potential to conflict with residential amenity are adequately separated and/or buffered from residential areas”.
- **Soc.5.2** “to ensure that the design and layout of development minimises any potential for activities to adversely impact upon the amenity of nearby residential premises”.
- **Soc.5.3** “to control, where possible, the nature of construction activity and the ongoing operational aspects of development to levels that are appropriate for a reasonable standard of amenity in nearby residential premises”.
Soc.5.4 “to ensure that new residential development does not unreasonably constrain productive or community facilities or significant transport infrastructure, including extractive resource haulage routes, by locating in areas where reasonable expectations for residential amenity, cannot be met.

(b) Planning Strategies

The above DEOs highlight the importance of places, features and visual values that contribute significantly to amenity, character and sense of place. More specific Planning Strategy Maps include Character Area mapping (PS10), Urban Form (PS11), Major Views (PS12), Visual Quality (PS13) and Major Scenic Routes and Gateways (PS14), supported by strategies, City Image maps and landuse themes.

These planning strategy maps highlight the diversity of character of the region (from ‘Beach Strip’, ‘Canal Estates’ to ‘River Valleys’), as well as identifying major views, nodes, gateways and scenic routes. Those of relevance to the study area and the subject site are:

- PS11 maps Major Ridgelines, including the 22 km long ridge extending east from Springbrook to Burleigh Heads, and passing through the subject site (labelled as Ridge 3 in Council’s mapping of significant ridgelines in “Natural and Physical Significant Landscape Features of the City” - see Figure 3-7 below);
- PS11 also identifies the Urban/Rural interface as located between the Pacific Motorway and Tallegudgera Creek Road, including the subject site;
- PS12 identifies the Pacific Motorway M1 as being a Primary View Boulevard and/or Connection;
- PS13 indicates the subject site forms part of the Visual City Edge; and
- PS14 identifies Tallegudgera Creek Road as a Major Scenic Route, also shown as a Scenic Tourist Route on Overlay Map OM22-4..

(c) Planning Scheme Designation

The subject site is within the Emerging Communities Domain in Council’s current Planning Scheme, with three strategic designations (Urban Residential, Park Living and Open Space/Nature Conservation), as reflected in the Reedy Creek Structure Plan. Despite the site’s KRA designation under SPP2/07, it is not zoned or designated for Extractive Resource. This represents a discrepancy between the Planning Scheme and State interests, and a conflict with respect to the proposed quarry development. This conflict is also likely to affect the expectations of nearby residents and others within the study area regarding future scenic amenity, in that the Planning Scheme indicates that part of the subject site is intended for residential development, and part for open space, rather than extractive industry.

(d) Reedy Creek Structure Plan

Although no Local Area Plan has been gazetted for the study area, it is mainly within an area covered by the Reedy Creek Structure Plan (Emerging Communities Map EC8). This structure plan designates approximately half the subject site as “Proposed Open Space and Nature Conservation” and half as residential development (“Park Residential” and “Low Density Urban Residential”, with an east-west collector road linking Old Coach Road to Reedy Creek, and a reservoir on the main ridge immediately to the west of the subject site. In the areas proposed for development, the Structure Plan code requires retention of existing native vegetation on land above 70m AHD and along visually significant ridgelines, with no buildings visible above the treeline in those locations, and residential development occupying mainly valley floors and lower slopes.
3 EXISTING VISUAL ENVIRONMENT

3.1 Regional Context

The subject site is located within the Gold Coast hinterland at Reedy Creek approximately 5 km from the coastline of Burleigh and Palm Beach (Figure 3-1). This area forms the southern part of Queensland approximately 8 km from the Qld/NSW border, and near the picturesque Currumbin and Tallebudgera Valleys.

The City of Gold Coast extends north-south along almost 40 km of coastline, including sandy beaches and southern Moreton Bay, with a flat coastal plain wider in the north and narrower in the south, rising to hills and mountains to the west. Topography exerts a strong influence on the form and character of the Gold Coast, where a series of ranges radiate from Mt Warning (in NSW) to form the Scenic Rim and Border Ranges, and extend towards the coast. The landscape is visually dominated by background mountain ranges of the Springbrook and Lamington plateaux to the west, the Darlington and Nimmel Ranges and Tamborine Plateau in the north, and the Tweed and Macpherson Ranges in the south. These mountains and their eastern spurs and foothills provide views to the coast and ocean, across rural and forested hinterland areas, to the linear strip of coastal urban development and high rise spine, which together create a distinctive Gold Coast image (‘the green behind the gold’). The largely linear urban form of high-rise units, canal estates and suburban residential areas occupies the flat coastal plain and extends in places west to the foothills, separated by rural land and pockets of industrial and tourist-related development.

Figure 3-1 Southern Gold Coast air photo, showing subject site
3.2 Reedy Creek/Tallebudgera Study Area

The surrounding coastal, urban and rural landscape is defined as the Reedy Creek/Tallebudgera Study Area (Figure 3-2) for the purposes of landscape and visual impact assessment. Reedy Creek, Old Burleigh Town and Tallebudgera are separated from West Burleigh by the M1 Pacific Motorway, and the study area is set back from the coastline, close to the interface between the urban coastal plains and the Gold Coast hinterland.

Ridge R3 has scenic importance in southern Gold Coast, defining the Tallebudgera Valley and Burleigh Heads, and separating the Tallebudgera and Currumbin areas from the Burleigh – Robina area and the Guragunbah Floodplain to the north. At West Burleigh this ridge has additional local landscape significance.
as a bushland hill complex part-surrounded by residential development, associated with the urban-rural interface (Figure 3-3).

Figure 3-3  Urban/Hinterland interface at old Burleigh Town, with bushland ridges behind  

Figure 3-4  Existing West Burleigh Quarry (Boral), on northern side of M1 Pacific Highway

In this part of the Gold Coast, the narrow band of urban development is quite sharply separated from the rural and natural hinterland by the Pacific Motorway. In this interface zone, all large patches of bushland have a role in character integration and differentiation, but hillside bushland areas have particular scenic importance. This area also has a long association with quarrying activities on the Gold Coast, including the active West Burleigh Quarry operated by Boral to the north of the highway (Figure 3-4) and at least two other (non-operational) quarries in the Gold Coast area.

The hillside bushland areas associated with Ridge R3 appear forested and natural when seen from a distance (Figure 3-3) but include areas of existing quarry extraction, with their associated buffer areas. The area is characterised by clustered housing estates interspersed with existing quarries and undeveloped greenspace areas. The suburban residential estates of Reedy Creek, Kingsmore Estate, The Observatory, West Burleigh and Tallebudgera Valley vary in age, density, elevation and built form. Of particular note are Old Burleigh Town and the Skyline Terrace area which includes ridgeline housing with expansive views. These suburbs include elevated residential areas potentially within view of parts of the proposed quarry, as discussed below in section 0.

### 3.3 Subject site

As indicated in 1.3 above, the proposed quarry disturbance footprint will occupy approximately 65 ha, representing 30% (29.9%) of the total area of Lot 105 south west of Old Coach Road, Reedy Creek and the Pacific Motorway (Figure 1-1). The subject site is part of a complex group of ridges and intervening gullies, with several sub-catchments, draining generally to the east. The three main ridgelines (labelled I, J and K on Figure 3-8) each have secondary spurs and some steep side slopes. The site is mainly vegetated with native regrowth and eucalypt forest, despite its history of clearing, grazing, and other rural pursuits; and currently features some small cleared areas, dams and access tracks (Figure 3-5).
The height and density of forest cover varies, but the site appears vegetated when viewed from a distance (Figure 3-3) A detailed assessment of site vegetation is contained in the Ecology Report. The disturbance footprint (the area proposed for quarrying and associated disturbance) is centrally-located mainly between ridges which form side spurs off Ridge R3 (Figure 1-2).

3.4 Landscape Context

3.4.1 Landform

As outlined in 2.1 above, the Gold Coast hinterland region behind the coastal plains is relatively mountainous, with several high ridges, peaks and plateaus forming prominent landmarks of the Scenic Rim and Border Ranges, and many other spur ridges which separate the region into a number of valley catchments both in terms of hydrology, and visually. To the south of Ridge R3, the Tallebudgera and Currumbin Valleys are relatively narrow with strong landform frame which convey a distinctive rural valley landscape character close to the coast, but to the north the coastal plain broadens, with mountain ranges in the background.

The fringing coastline is long and sweeping (0), with no intervening headlands or bays for almost 20 km between The Spit/Main Beach and Burleigh Heads, a headland approximately 88m AHD at the mouth of Tallebudgera Creek, and Currumbin Hill further south at the mouth of Currumbin Creek.

Between the hinterland ranges and the coastline, the flat coastal plains have been highly urbanised. Once characterised by swamps and wetlands, these low-lying areas have been developed mainly for urban residential suburbs, including areas of canal estates. In the West Burleigh / Tallebudgera area, the landform of the hills has also been altered by urban development and extractive industry, with extensive areas of residential development and industrial development including existing quarries in various places on the slopes of Ridge R3, and elsewhere.

In overview, the geomorphology and size of the study area creates a diverse and attractive landscape, with a combination of rocky ranges and forested undulating hills, creeks and valleys and the long fringing beaches that help to define the scenic diversity of the Gold Coast and which also host the many different forms of urban development in the region.
3.4.2 **Ridges and Valleys**

Forested mountains, hills and ridgelines contribute to the green background and forested skyline as seen from many parts of the Gold Coast, and where close to the coastal urban strip (ie. in the southern part of the City) they are visually significant to the overall ‘green behind the gold’ image and local sense of place. Where developed or accessible, these ridges and hills also offer viewing opportunities to experience the region’s scenery. These ranges and ridgelines (Figure 3-7) define the western and southern extent of the visual catchment of the City and provide the main landscape frame for other important regional landscape features such as scenic rural valleys. The subject site is east of the main north-east trending ridge (R3), and a secondary spur ridge (‘I’ in Council mapping) extends south-east then curves eastwards.

![Regional Ridgelines and Valleys](image)

**Figure 3-7  Regional Ridgelines and Valleys** (Refer to Appendix A for larger version).

Ridge ‘R2’, separating the Tallebudgera Creek Valley from the Currumbin Creek Valley, also has a north-east alignment parallel to Ridge R3, and at its closest point is 4 – 5 km to the south and south-east of the subject site. For the purposes of this study, other smaller ridges (J and K) and side spurs (J1, K1 etc.) as well as their corresponding valleys, have been numbered consistent with the Council mapping (Figure 3-8).
Figure 3-8  Local Ridgelines and Side-valleys (Refer to Appendix A for larger version).

- Ridge R3 – the main ridgeline spur extending north-eastwards from Springbrook, up to 151 m AHD elevation near the western corner of the subject site and sloping northwards down to about 89 m. Further to the south-west, this ridge reaches approximately 200 m AHD (plus occasional peaks to 350 - 400 m) and to the north-east it ends at Burleigh Heads.

- Ridge I – secondary ridgeline extending south-east from R3 then curving east, corresponding in part to the Lot 901 strip, parallel to the southern border of the subject site but outside the disturbance footprint. The elevation extends from about 150 m AHD near the western site boundary to 104 – 106 m AHD, sloping down to 76 m near the eastern site boundary then extending to the Pacific Motorway;
  - I1, I2 and I3 – minor spurs extending north into the central valley;
  - I4- I5 – minor spurs extending south towards Tallebudgera Creek Road;

- Ridge J and J1 – a branching ridgeline entirely within the subject site and partly through the disturbance footprint, with two peaks of about 114 m AHD and about 94 m near its eastern limit;
  - J1 - major spur to the north and mainly outside the disturbance footprint;
  - J2 & J6 - minor spurs to the south and entirely within the disturbance footprint;
  - J3 – minor spur to the south mostly within the disturbance footprint;
  - J4 and J5 – short spurs to the northeast within the disturbance footprint.

- Ridge K (an extension of Ridge J) – an irregularly aligned ridgeline spur to the northeast of the subject site, corresponding in part to Old Coach Road, with lower elevations than the other ridges (generally 55 – 65 m AHD);
  - K1 – minor spur extending southeast of ridgeline, corresponding to an existing access track (within disturbance footprint);
  - K2 & K3 – minor spurs extending northerly, on either side of Old Coach Road.
Ridges I and K divide the subject site into three main valleys, two of which have side-valleys (Figure 3-8):

- V1 – V3, draining east away from Ridge R3 (with valley floors generally at 25 – 30 m AHD);
- V4 – V5 draining north from Ridge I (at 30 – 70m AHD); and
- V6 - draining south-east from Ridge R3 (at 20-30 m AHD).

In summary, Ridges R3, I and parts of K are largely outside the disturbance footprint and form its screening rim, while Ridge J is ‘internal’ and is mainly within the disturbance footprint. Overall, the landform of the subject site extends from about 20m to 114 m AHD, and represents the upper catchment hills, slopes and side valleys of Reedy Creek, Tallebudgera Creek and Oyster Creek draining north.

3.4.3 Land Cover

In the non-urban parts of the study area, the natural vegetation broadly correspond to variations in geology, landform, drainage, exposure and fire history; with hillside bushland generally supporting Eucalypt open forest and woodland of various community types, and rainforest or wet sclerophyll forest in gullies and along watercourses. Undeveloped areas which have been cleared in the past but which are no longer used for rural purposes now support regrowth vegetation of various ages, heights and density.

The vegetation of the subject site per se, as described in the Flora and Fauna Technical Report, includes mainly regrowth following previous clearing and rural land uses plus some remnant areas of several Regional Ecosystems (Figure 3-9), and cleared patches (see Figure 3-5). Mature trees are generally 10 – 23 m in height. Tree canopy heights are available as LiDAR survey data, and have been used for modelling the subject site and its vegetation screening capacity.

Figure 3-9 Native forest vegetation within subject site

Using 2009 LiDAR data of tree canopies and built form, a digital surface model has been prepared (Figure 3-10) which shows the visible surface as a more accurate representation of screening and visibility.
3.4.4 Landscape Character

The landscape character of the Gold Coast region is particularly varied, from the steep rainforest slopes and mountain plateaux in the west, to rural valleys and creeks, beaches and headlands, estuarine waterways, canal estates, suburban residential areas and the high-rise spine. These have been identified as 10 ‘character areas’ in the Planning Scheme (Map PS-10), and documented in Council’s “Landscape Character: Guiding the Image of the City” (Part 1 of the Gold Coast City Landscape Strategy). The West Burleigh / Tallebudgera Study Area is partly in character area 6.0 (River Valleys and Mountains) and character area 9.0 (Suburban Estates), with the dividing line roughly corresponding to the Pacific Motorway. Although the subject site is within the River Valleys and Mountains character area, the bushland hills of Ridge R3 are visible from some parts of the Suburban Estates, suggesting an interface zone between character areas.

Strategic Plan maps SP13 and SP14 identify the Springbrook Plateau and other mountain ranges as a ‘visual city edge’, with Ridge R3 as a ‘major visually significant remnant vegetation (in rapidly altering landscapes)’ and Tallebudgera Valley as a scenic route. As outlined above, the overall ‘green behind the gold’ image of the Gold Coast, and the character of local places along the coastal strip are strongly influenced by a backdrop of forested hills and mountains (Figure 3-11).
Council’s more recent draft mapping ("Natural and Physical Significant Landscape Features of the City") has updated the mapping of character areas to reflect changes since 2008, such as the spread of suburban estates into Bonogin and along the Tallebudgera and Currumbin valleys.

Finer scale assessment for this EIS indicates that, in the West Burleigh / Tallebudgera Study Area, the two broadscale character areas (River Valleys and Mountains, and Suburban Estates) are represented by the following Landscape Character Types (Figure 3-12):

- Park living (+ tree mosaic);
- Urban residential
- Industrial Subdivisions
- Quarry/Earthworks & Landfill
- Open Space (Rural/grazing + sports fields)
- Intact & semi-intact Bush (including the subject site)
- Watercourses & Lakes
Within the study area, the interface between the developed (urban, industrial and quarry) and hinterland (open space, park living and bushland) character types is fragmented but identifiable in the area south-west of the M1 Pacific Motorway, and is visually dominated by Ridge R3. The complex of forested hills is a broad wedge of hinterland bushland which extends north-east into and between areas of development. For residential areas near this interface, views of these undeveloped hills and their wooded slopes and skylines are likely to be important for visual amenity, local character and neighbourhood identity. The pockets of hilly bushland are distinctively non-urban, and provide ‘green breaks’ between residential precincts, for example where Old Coach Road passes through bushland as it winds across the hills (Figure 3-13), to the south of the M1.