Rocla®
Materials Pty Ltd
ABN: 30 083 169 091

Preferred Project Report

for the

Calga Sand Quarry Southern Extension

Major Project Application No. 06_0278

Prepared by:

R.W. CORKERY & CO. PTY. LIMITED

November 2012

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1. INTRODUCTION

This report describes Rocla's plans to continue to operate the Calga Sand Quarry including the extension of extraction and processing activities in the area referred to as the "Southern Extension". The recoverable sand resources in both the existing quarry and Southern Extension are described together with details of the extraction plan and method of extraction. This section also provides detailed information on processing operations, including the importation and reprocessing of limited quantities of locally-sourced blending materials. Product transportation, water and waste management and details of services and employment are also presented along with Rocla's plans for the progressive rehabilitation of the entire Project Site. Possible long term land uses for the Project Site once rehabilitation is completed are also outlined.

This report describes the entire project incorporating those components of the existing approved operation that are planned to continue, those components of the existing approved operation that would be modified and the progressive development and operation of the Southern Extension.

Like the existing approved quarry, the proposed Southern Extension has been designed to ensure that all elements of the sand extraction and processing operations avoid, minimise or mitigate adverse impacts upon surrounding residents and land uses and the site's ecology.

This report is effectively an updated version of the Project Description, i.e. Section 2 of the *Environmental Assessment* dated November 2009. The updated text and figures reflect modifications to the boundaries of Stages 4 and 5 to accommodate the results of a supplementary Aboriginal heritage survey. Minor modifications were also made to the Biodiversity Offset Strategy.

Where appropriate, minor modifications have been incorporated into the text to accommodate the progress made within the Calga Sand Quarry since the *Environmental Assessment* was prepared.

2. PROJECT DESCRIPTION

2.1 INTRODUCTION

2.1.1 Objectives

Rocla's principal objectives in proposing the development and operation of the Southern Extension centre upon:

- consolidating access to the sand resources that will ensure the continued provision of a range of construction materials to the Sydney and Central Coast construction markets at reasonable prices;
- increasing the level of production at the Calga Sand Quarry from the existing approved level of 400 000tpa to 1 000 000tpa to meet the supply demands of these markets, particularly following the cessation of sand extraction at Penrith Lakes in about 2014;
- continuing the use of externally sourced excavated and other materials to produce a range of blended construction materials suited for its developed markets and consequently reduce the quantity of excavated materials committed to designated landfill facilities within the Gosford Local Government Area;
- providing for ongoing progressive rehabilitation of the Project Site to provide for a combination of future agricultural activities, long-term nature conservation and possibly other commercial/industrial land uses at completion of operations;
- maintaining local employment levels; and
- maximising the recovery of natural sand resources on site.

The sand produced within the Project Site would contribute significantly towards meeting the predicted shortages of this important construction material for the building and construction industry in the northern half of the Sydney Metropolitan Area and Central Coast. These broad objectives would be achieved by:

- planning and removing the sand resource within the defined extraction area in a manner that maximises the quality and quantity of materials removed;
- undertaking all activities in an environmentally responsible manner that enables compliance with all relevant statutory requirements;
- planning and operating all activities in consultation with surrounding residents and the wider community; and
- monitoring and reviewing the environmental performance of Rocla's activities.

2.1.2 Project Overview

Rocla proposes to develop and operate the Southern Extension as part of the overall Calga Sand Quarry to allow for an increase in sand production from the Calga Sand Quarry to a maximum of 1 000 000tpa. The Southern Extension has been designed to optimise the recovery of sand whilst satisfying both site and surrounding environmental constraints and progressively creating a final landform suited to the proposed end uses.

Figure 2.1 displays the following principal components of the Project.

- The Stage 3 extraction areas where sand extraction will continue generally in a manner consistent with the current approved operation.
- Two new extraction stages, namely Stages 4 and 5. Stage 4 would be a direct southerly extension of the existing Calga Sand Quarry and Stage 5 would be developed as a separate extraction stage. It is proposed that extraction within Stage 5 would only commence following:
  - i) identification and securing of a suitable biodiversity offset for the area; and
  - ii) the validation of various predictions relating to noise and air quality levels received at residences to the south and southeast of Stage 5.
- Four proposed sand processing areas comprising two sequential locations for the existing 400 000tpa plant (Sites A and B) and two sequential locations for the proposed 600 000tpa plant (Sites C and D). The 400 000tpa sand processing plant (Site A) will be located to the floor of the quarry (Site B) prior to the extraction of Stage 3/4. Early in the development of Stage 4, a second processing plant would be established on Site C. Both processing plants would ultimately be combined or replaced by a single processing plant capable of producing 1 000 000tpa at a long-term location on the floor of a completed section of Stage 4 (Site D). No processing is proposed within Stage 5 as all raw sand materials would be transported to the plant(s) in Stage 4.
- Access to the Project Site would continue via the existing site entrance (referred to as the "Northern Entrance") and site access road off Peats Ridge Road. During the early stages of extraction within Stage 4, a new site entrance (the "Southern Entrance") and access road would be constructed from Peats Ridge Road to create a specific access point and road for activities within Stages 4 and 5. Whilst operations are underway within both Stages 3 and 4, it is proposed to use the Southern Entrance for incoming vehicles only and the Northern Entrance for departing vehicles only. Following the completion of activities within Stage 3, the Southern Entrance would become the sole entrance/exit for vehicles entering and leaving the Southern Extension, with the existing entrance retained for access to Lot 2, DP 229889 only.

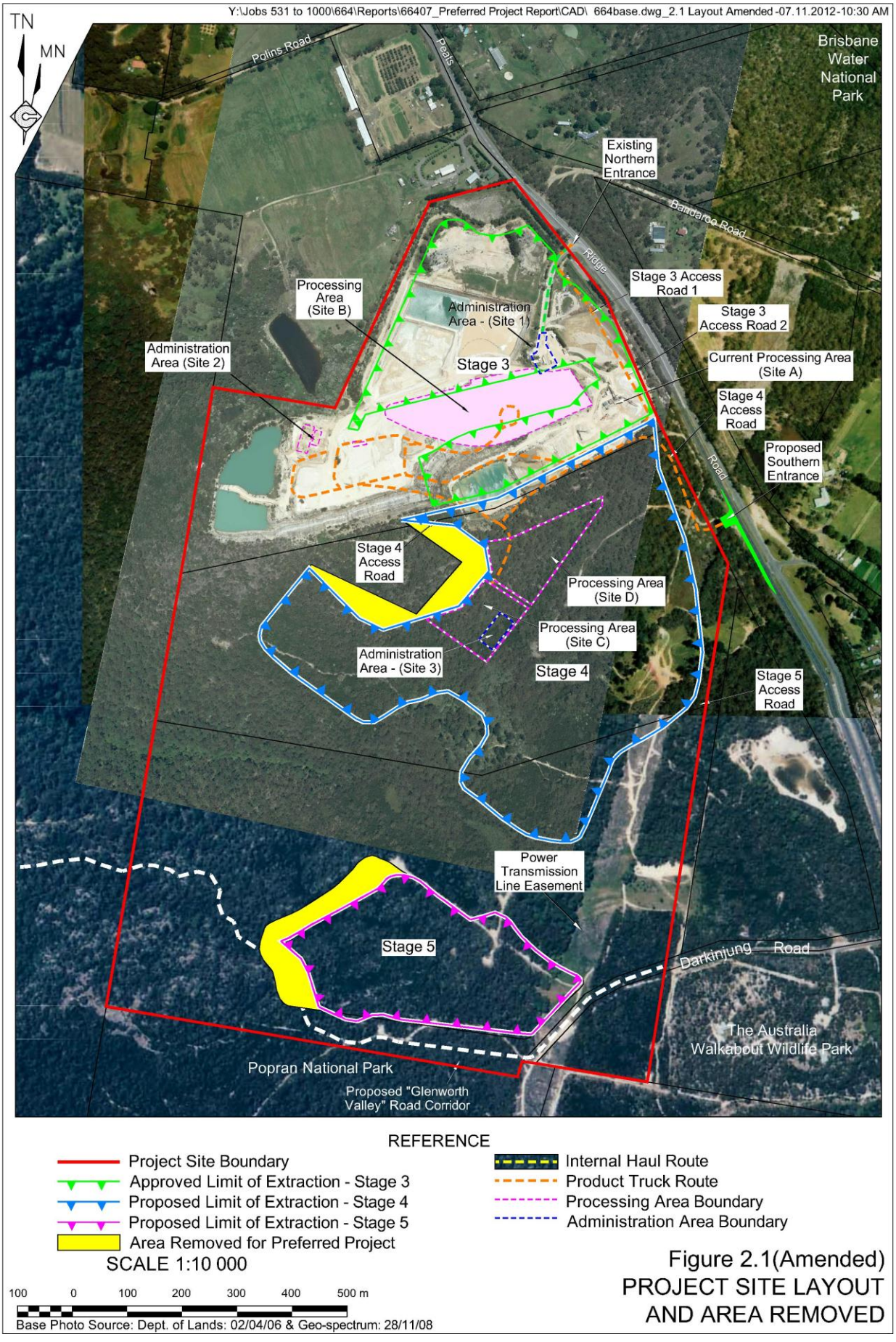


Figure 2.1(Amended)
PROJECT SITE LAYOUT
AND AREA REMOVED

- The Project Site administration area (including workshops and fuel storage) will initially be retained in its current location before being relocated adjacent to the wash plant on the floor of Stage 1 (Site B) to accommodate extraction from Stages 3/3 and 3/4. In the long term, the administration area would be relocated to Stage 4/1 (Site C), coinciding with the consolidation of processing operations within the Southern Extension.

The Project Site would be progressively rehabilitated with Stage 4 incorporated into the final landform of the existing Calga Sand Quarry. It is proposed that Stage 5 is rehabilitated to provide long-term nature conservation and water storage.

2.1.3 Approved and Proposed Extraction Stages

2.1.3.1 Introduction

For the purposes of describing the activities already approved and those proposed, Stages 3, 4 and 5 have been subdivided internally into sequential extraction stages. **Figure 2.2** displays the approved extraction area (Stage 3) and extraction Stages 3/1 to 3/6 and proposed Southern Extension extraction areas (Stages 4 and 5) and extraction Stages 4/1 to 4/8 and 5/1 to 5/3. Sections 2.1.3.2 and 2.1.3.3 provide further detail on the limits of the approved and proposed stages of the Calga Sand Quarry as well as relevant design features.

2.1.3.2 Stage 3

The design of the Stage 3 extraction area includes six extraction stages (Stage 3/1 to Stage 3/6), with their boundaries controlled by the following parameters.

- A setback of 30m from the western and northern boundary of Stage 3 to accommodate an acoustic bund wall.
- A setback of 30m from Peats Ridge Road or the northeastern property boundary, whichever is closer.
- A setback of 30m from the southern boundary (of Stages 1, 2 and 3) to be consistent with the limit set under Development Consent No. 10604, given the occurrence of native vegetation beyond that boundary.

The overall quarry has been designed to be free-draining (except for final water storage dams) and to optimise capacity for silt deposition, storage and consolidation. The quarry design parameters are a continuation of those employed for Stages 1 and 2, i.e. approximately 70° quarry faces with 5m wide benches on the final extraction faces. Benches are to be developed at approximately 10m intervals and merged into the existing extraction walls in Stages 1 and 2.

All approved boundaries for Stage 3 are marked with steel fence posts positioned at regular intervals and/or corners of the approved extraction area.

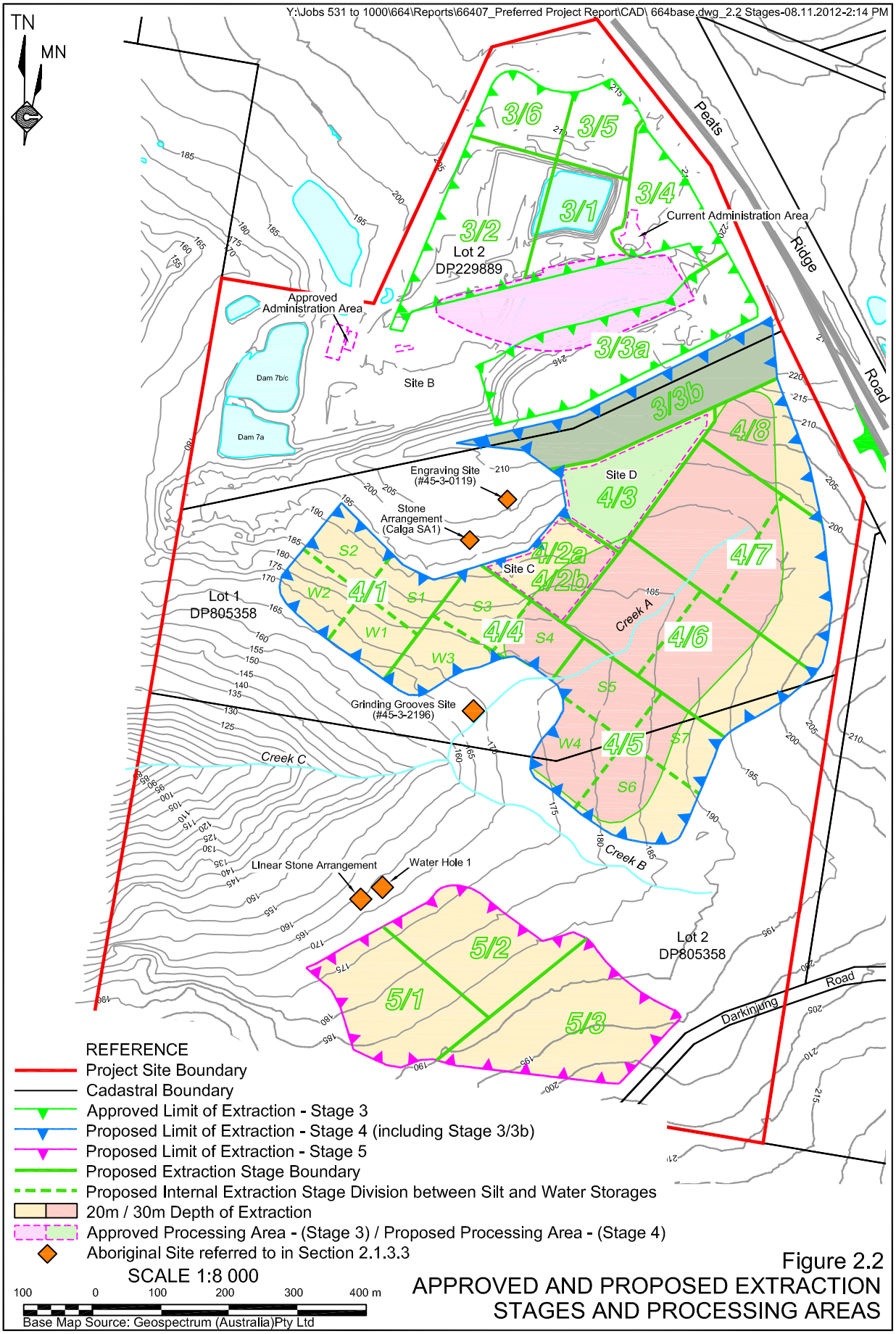


Figure 2.2
APPROVED AND PROPOSED EXTRACTION STAGES AND PROCESSING AREAS

2.1.3.3 Stages 4 and 5

The design of the Southern Quarry Extension reflects Rocla's intent to maximise the recovery of the friable sandstone resource whilst developing it in such a manner that reflects the environmental and community constraints affecting the area of the proposed extension. The proposed limits of extraction within Stages 4 and 5 of the proposed Southern Extension have been set with the following parameters.

Stage 4

- A large proportion of the northern perimeter joins directly to Stage 3, providing for a continuation of the Stage 3 extraction area.
- An excision of an area of approximately 4.5ha from the northwestern perimeter to provide a buffer of 40m to 80m and ensure the in-situ management of an identified Aboriginal engraving site (Site No. 45-3-0119[1]) and a stone arrangement (Calga SA1).
- A southwestern perimeter setback at least 50m from an ephemeral drainage line (referred to as Creek B). The southwestern perimeter is set back slightly where Creek B joins with a second ephemeral drainage line (Creek A) to form Creek C to avoid disturbance to an Aboriginal heritage site (Site No. 45-3-2196) and identified habitat of the Red-crowned Toadlet (a listed threatened species) along Creek A. The remainder of the southwestern limit of the extraction area is defined (approximately) by the 165m AHD contour where the depth of friable sandstone reduces less than 20m.
- With the exception of the northeastern corner of Stage 4 where the extraction area is limited by the property boundary (offset by at least 30m), the eastern limit of Stage 4 is representative of where the sandstone either becomes too hard to be extracted by ripping, or the limit of the sandstone itself.

Stage 5

- A northwestern perimeter set back by approximately 20m from two recorded Aboriginal sites, i.e. the linear stone arrangement and Water Hole 1.
- A setback of at least 100m from the banks of Creek B along the northeastern perimeter of the extraction area. This setback has been increased further to avoid disturbance to potential habitat of the Red-crowned Toadlet, Giant Burrowing Frog, Littlejohn's Tree Frog and Green and Golden Bell Frog (all listed threatened species).
- A setback of at least 50m from the southern boundary of Lot 2, DP 805358.
- A setback of at least 30m from Darkinjung Road.

[1] Also recorded as Site #45-3-2195 on the AHIMS Aboriginal Sites Register

The overall quarry has been designed to avoid significant impacts to important flora, fauna and Aboriginal heritage sites while maximising recovery of friable sandstone and optimising capacity for silt deposition, storage and consolidation. As for Stage 3, the design parameters for the Southern Extension would essentially be a continuation of those currently in place, namely 70º extraction faces with 5m wide benches on the final extraction faces. Benches would be developed at approximately 10m intervals and (in the case of Stage 4) merged into the existing extraction walls in Stages 1, 2 and 3.

All approved boundaries of the extended extraction area would also be marked with painted concrete posts positioned at regular intervals and/or corners of the approved extraction area. The locations of these posts would be recorded in an updated version of the Environmental Management Plan for the Calga Sand Quarry.

2.1.4 Approvals Required

Based upon the current project design and understanding of environmental issues, the proposed project would require the following approvals to proceed.

1. Project approval from the Minister for Planning and Infrastructure or his/her delegate – as the Project has been classified as a "Major Project" under State Environmental Planning Policy (Major Projects) 2005. Extractive industries are permissible on the Project Site through the designation of a defined area where extractive industries are permissible within the Gosford/Wyong Local Environmental Plan No 2001 – Central Coast Plateau Areas.

   In order for the combined existing quarry and proposed Southern Extension to be managed in accordance with a single approval, Rocla intends to seek a project approval that covers the entire Project Site. Subject to the receipt of a satisfactory project approval covering the entire quarry development, Rocla proposes to relinquish DA 94-4-2004 once the project approval becomes effective.

2. The existing Environment Protection Licence 11295 would need to be modified through an application to the DECCW to incorporate the entire proposed extraction area, increased production level and to acknowledge the continued importation and reprocessing of virgin excavated natural and other materials onto the Project Site.

3. A water supply work approval, which authorises the construction of a bore[2], well or spear point at a specified location, i.e. the quarry excavation, would be required in accordance with Section 90 of the Water Management Act 2000.

4. A Water Access Licence (WAL) for the Calga Sand Quarry, issued under the *Water Management Act 2000* by the NSW Office of Water, would be required to include capacity sufficient for the incidental in-flow of groundwater for the existing and extended Calga Sand Quarry operations. This WAL would then be assigned to the water supply work approval for the excavation.

[2] A bore is defined under Section 105 of the *Water Management Act 2000* to include any bore or well or any excavation or other work connected or proposed to be connected with sources of sub-surface water and used or proposed to be used or capable of being used to obtain supplies of such water

5. A Section 138 Permit, issued under the *Roads Act 1993* by Gosford City Council, would be required for the construction of a new entrance from Peats Ridge Road to the Project Site (the Southern Entrance).

No species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were found to occur on the Project Site and while habitat was identified for one EPBC Act listed species (Giant Burrowing Frog), Cumberland (2009) determined that the Project is not likely to be of significant impact on any EPBC Act listed threatened species and therefore referral to the Commonwealth Minister for the Environment for an approval under the EPBC Act is not considered necessary.

2.2 ON-SITE RESOURCES AND RESOURCE ASSESSMENT

2.2.1 On-site Resources

2.2.1.1 Introduction

Extraction would continue from the friable units of the Hawkesbury Sandstone which exhibit a gentle southwesterly dip of the sub-horizontal sedimentary units currently being targeted within the Calga Sand Quarry. Overall, a total of approximately 7.83 million m^3 of in-situ friable sandstone could be extracted from Stages 3, 4 and 5 yielding approximately 13.2 million tonnes of sand products.

2.2.1.2 Stage 3

Between 2002 and 2004, a comprehensive geological assessment of the resources within Stage 3 of the Calga Sand Quarry established a good correlation between the detailed drilling and sampling program in Stage 3 with the information gained from the Stage 1 and 2 quarry operations. Four sandstone units were identified based on hardness with the maximum base of extraction defined as the top of the hardest sandstone unit, i.e. generally between 180m and 190m AHD.

Table 2.1 lists the in-situ friable sandstone resources and proposed yield from each of the remaining five extraction stages of the Stage 3 extraction area.

Table 2.1
In-situ Friable Sandstone Resources and Proposed Sand Recovery within Stage 3

Extraction Stage	Area (ha)	In-situ Friable Sandstone (m^3)	Sand Recovery (tonnes)*
3/3b#	3.1	520 000	870 000
3/4	1.7	420 000	705 000
3/5	1.2	260 000	434 000
3/6	1.2	275 000	461 000
Total	7.2	1 475 000	2 470 000

* Sand recovery based upon 2.4t/m^3 and approximately 70% recovery after processing.
\# Additional to the approved area of Stage 3 extraction under DA 174-4-2004.

It is noted that the sand resources within Stage 3/3 have been increased from those recorded in the 2004 EIS and an amendment to the 2004 EIS (2005 DA Amendment) given it would be possible with the approval of the Southern Extension to recover additional resources that would otherwise be left in-situ in the perimeter walls in Stage 3/3.

2.2.1.3 Stages 4 and 5

Since 2002, a total of 17 exploration drill holes have been drilled over the Southern Extension area. All holes have been logged by Rocla's consultant geologist (Mr Len Koncek) (hereafter referred to as Koncek) and evaluated for colour, grain size, hardness and impurities such as clay and shale and correlated with information gained from current extraction operations. The results of the geological investigations have been summarised by Mr Koncek, with **Figure 2.3** presenting the locations of the drill holes and representative cross-sections across the Southern Extension.

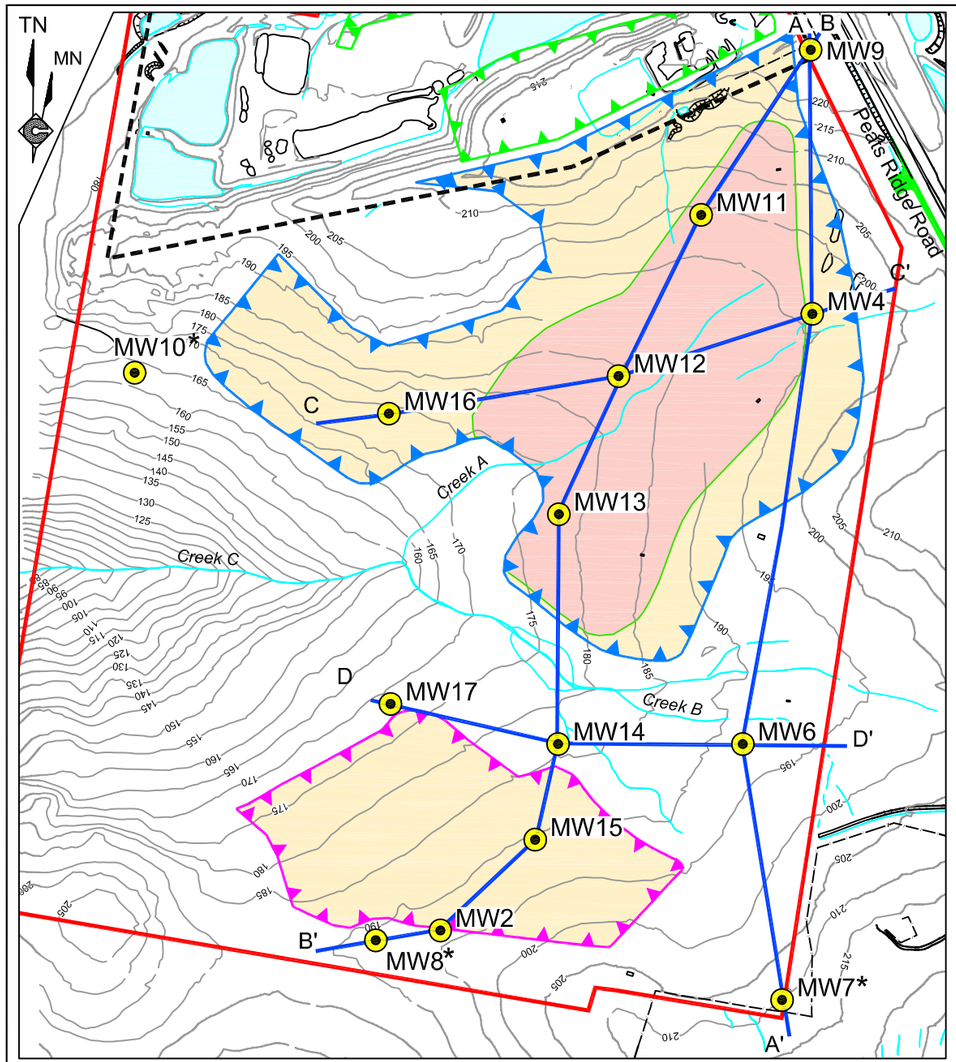
The colour, grain size and hardness of the friable sandstone in Stages 4 and 5 is variable although there is a general transition from yellow-orange, clay containing, soft-medium material below a shallow topsoil layer, to a more coarse-grained, cream-brown and harder material at depth. Koncek has indicated that the sandstone can be classified as either soft, medium or hard, based on the following classification.

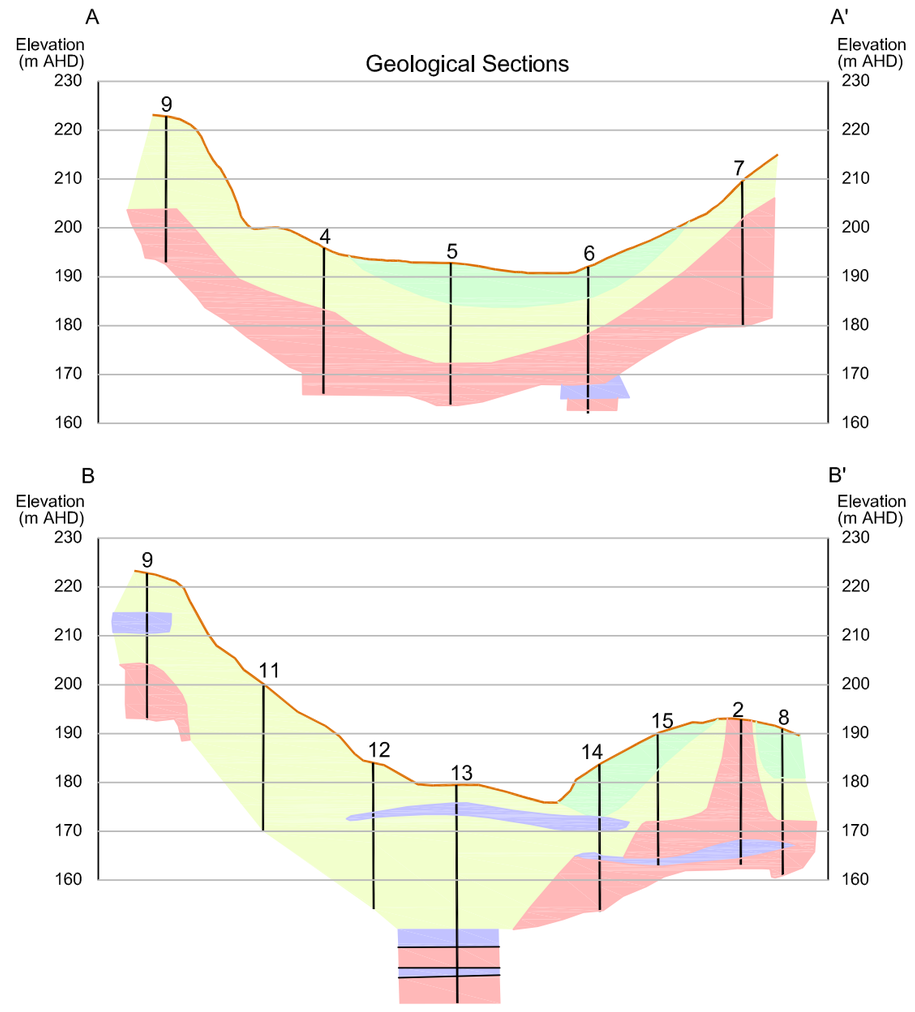
- Soft: falls apart by itself or by light pressure from the fingers.
- Medium: falls apart under pressure from fingers.
- Hard: can only be broken with a hammer.

The majority of the friable sandstone has been described as medium-hard, i.e. with a coarse fraction requiring heavy pressure or hammer to initially break, but then readily friable with light to medium pressure. Koncek has indicated that the medium-hard sandstone, which represents the dominant type of sandstone within the Southern Extension, is extractable by ripping, load and haul methods. The transition to hard sandstone, generally between 8m and 30m below surface within the nominated extraction areas, represents the intended vertical limit of extraction. Limited zones of soft sandstone have been identified but are generally restricted to the low-lying drainage depressions.

Based on the defined thickness of soft and medium friable sandstone in each extraction stage, the recoverable resource in Stages 4 and 5 has been estimated as 6.35 million m^3.

Table 2.2 lists the in-situ friable sandstone resources within each of the extraction stages within Stages 4 and 5 and the proposed yield from each extraction stage. It is noted that the sand resources recorded within Stages 4/1 and 4/7 assume a vertical boundary with Stage 3.





REFERENCE
- Project Site Boundary
- Limit of Approved Calga Sand Quarry
- Approved Limit of Extraction - Stage 3
- Proposed Limit of Extraction - Stage 4 (Including Stage 3/3b)
- Proposed Limit of Extraction - Stage 5
- 20m / 30m Depth of Extraction
- 195 Contour (m AHD)(Interval = 5m)
- Creek / Drainage Line
- Cross Section Location
- Drillhole (* Fitted with Automatic Water Level Recorder)

REFERENCE
- Existing Surface
- 2 Drillhole
- Soft Sandstone
- Medium Sandstone
- Hard Sandstone
- Shale / Clay

SCALE 1:7 500

100 0 100 200 300 400m

Base Map Source: Geospectrum (Australia) Pty Ltd
Geological Sections Compiled by Koncek

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Figure 2.3
STAGE 4 AND 5 RESOURCES

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Table 2.2
Stages 4 and 5: In-situ Friable Sandstone Resources and Proposed Sand Recovery

Extraction Stage	Area (ha)	Average Depth of Friable Sandstone (m)	In-situ Friable Sandstone (m^3)	Sand Recovery (tonnes)*
4/1	3.3	19	435 000	730 000
4/2	1.5	17	220 000	370 000
4/3	2.1	17	348 000	585 000
4/4	2.7	22	431 000	724 000
4/5	5.1	27	1 150 000	1 932 000
4/6	4.8	26	1 098 000	1 845 000
4/7	5.3	25	1 102 000	1 851 000
4/8	1.7	22	398 000	670 000
Subtotal	**26.5**		**5 182 000**	**8 707 000**
5/1	3.0	11	280 000	470 000
5/2	2.7	11	245 000	412 000
5/3	4.0	17	646 000	1 085 000
Subtotal	**9.7**		**1 171 000**	**1 967 000**
Total	36.2		6 353 000	10 674 000
* Sand recovery based upon 2.4t/m^3 and 70% recovery after processing				

2.2.2 Raw Materials for Blending

The principal raw materials likely to be imported, reprocessed and incorporated within various blended products are as follows.

Soils Small quantities of soils would be imported from local building sites, etc. for blending with washed sand to produce a top-dressing sand.

Aggregates The aggregates blended with the washed sand would comprise hard rock crusher fines, i.e. typically less than 5mm or 7mm or other materials typically between 2mm and 10mm in size.

Excavated Sandstone Friable sandstone material excavated from a range of sources e.g. building foundations and cutbacks and maintenance activities on the F3 Freeway would be suitable to process in the same manner as friable sandstone excavated on site to produce specification construction materials.

For all of these materials, Rocla has a procedure to inspect the source of the materials to ensure none of the materials are contaminated in any manner.

2.3 EXTRACTION OPERATIONS

2.3.1 Introduction

The proposed Southern Extension, incorporating Stage 3/3b, 4 and 5, would add approximately 41.2ha to the currently approved extraction area (26.5ha of Stage 4, 3.1ha area of Stage 3/3b, 9.7ha of Stage 5 and 1.9ha for internal access roads on the Project Site). Rocla intends to continue the current extraction procedures for the life of the extended quarry. It is estimated that this would result in the combined production of approximately 13.2 million tonnes of sand products at a rate of between 400 000tpa and 1 000 000tpa for the life of the quarry (when combined with current extraction from Stage 3).

2.3.2 Extraction Activities

The activities and procedures to be used in the extraction of sand within the Project Site have been selected to maximise the recovery of sand, minimise noise propagation from the Project Site, and contain all sediment-laden water within the nominated water storages of Stages 1 to 5.

The activities and procedures would involve the following sequential activities.

1. Identification/marking of the nominated sand extraction area.
2. Installation of the required surface water and erosion and sediment controls.
3. Vegetation removal.
4. Soil removal.
5. Overburden removal.
6. Acoustic bund construction.
7. Extraction of friable sandstone.
8. Delivery of friable sandstone to the processing area(s).

Identification and Definition of Extraction Stages

Prior to the commencement of any activities in each extraction stage, the internal stage boundaries would be identified and defined, either through the construction of an access road or with a series of pegs positioned at regular intervals around the nominated area.

Installation of Surface Water, Erosion and Sediment Controls

Surface water and/or erosion and sediment controls would be installed/constructed either prior to or immediately following clearing activities. These controls would be especially important on the downslope side of Stages 4/1, 4/2, 4/4, 4/5, 5/1 and 5/2, i.e. the stages to be developed immediately upslope of the areas of the Project Site to remain undisturbed, to prevent any sediment-laden runoff from flowing directly into the local catchments of ephemeral drainage lines within the Cabbage Tree Creek catchment.

The central element of this surface water management, and erosion and sediment control would be the construction of a sediment control dam at the low point of the proposed area to be disturbed, with catch banks constructed to divert water to this point. These sediment control dams would be maintained for the life of the Project and ensure that any discharge of water from the extraction area is controlled, both to:

- maintain base flows to Creek C and Cabbage Tree Creek downstream; and
- maintain the quality of water discharged from the Project Site meets appropriate water quality criteria.

Vegetation Removal

Vegetation covering areas required for the ensuing 6 to 12 months operations would be either chainsaw felled or cleared using a bulldozer. Collection of available seed for rehabilitation purposes would occur immediately after the vegetation is felled. The small tree limbs and tree trunks would be set aside for use in habitat improvement on site.

The larger trees not used for habitat construction/improvement as part of progressive rehabilitation (see Section 2.13), would be either cut into manageable log lengths or mulched/chipped for future internal or external use. Wherever possible, these materials would be managed on site as part of the progressive rehabilitation activities.

Understorey vegetation such as grasses, low shrubs and forbs would be managed in combination with the Project Site soil resources.

Soil Removal

The soil in each stage would be stripped following removal of the larger vegetation. Small shrubs and groundcovers would be removed with the topsoil. In those areas where natural soils remain on the Project Site, Rocla would remove approximately 0.15m of topsoil and up to 0.5m of subsoil.

Where practical, Rocla would remove topsoil and directly transfer it to rehabilitation and revegetation areas. This practice would avoid double handling and maximise natural regeneration. All excess topsoil and subsoil removed during operations would be stockpiled around the Site B processing area for subsequent use in progressive revegetation.

Overburden Removal

Following removal of topsoil and subsoil, and if present, the limited quantities of overburden, generally thin lenses of clay or shale would be ripped, if necessary, using the tynes of a bulldozer and excavated from above the surface of the friable sandstone using an excavator. The removed overburden would be:

- used in the construction of an acoustic bund wall around the extraction stage;
- used to construct silt cell or water storage walls on the floor of the extraction area;
- transferred directly for the capping of completed silt cells;
- transferred directly to completed sections of the extraction area for final landform construction; or
- stockpiled for future use in the construction and capping of silt cells or the construction of the final landform.

Acoustic Bund Construction

In order to ensure that noise levels received at residences surrounding the Project Site remain at or below noise criteria established in accordance with the EPA's Industrial Noise Policy, the overburden and/or initial sandstone removed from the extraction stage would be placed around the perimeter of the stage to create a 5m high bund wall. Each bund wall would be similar in construction to the bund wall which surrounds Stage 3, although whereas the Stage 3 acoustic bund wall is permanent structure, and has been vegetated accordingly, the Stage 4 acoustic bund walls would only remain for the life of each extraction stage.

The upslope side of each acoustic bund wall would be shaped to prevent runoff ponding against these structures.

Extraction of Friable Sandstone

The soft and medium sandstone would be cross-ripped, pushed into a small stockpile and loaded into a haul truck for transportation to either the mortar sand plant or wash plant(s) or loaded directly into the hopper of a mobile mortar sand plant.

Extraction activities in each stage would not commence until the construction of the acoustic bund wall for that stage is completed. It is noted, however, that extraction within other stages where the acoustic bund walls are already in place would be undertaken concurrently with bund construction activities.

Wherever possible, the ripping, excavation and loading of trucks would be undertaken behind the benches formed during each stage. This would provide the activities with the maximum acoustic shielding, thereby limiting the potential noise levels at residences to the east and southeast of the proposed Southern Extension.

Delivery of Friable Sandstone to the Processing Area(s)

The delivery of friable sandstone from the active extraction stage to the processing area(s) would continue in a similar fashion to the existing operations. The friable sandstone material would be loaded into a haul truck by front-end loader or excavator. The route travelled to the processing area(s) by the haul truck would vary depending on the prevailing stage of extraction, with the main variations coinciding with the installation of the new processing plant into Stage 4 (Stage 4/4a then Stage 4/1). Each internal haulage route would, however, remain similar in distance and therefore, up to four haul trucks would continue to be used to transport the friable sandstone to the processing area.

The proposed internal access routes for haul trucks during each stage of extraction are identified in **Figures 2.4** and **2.5**.

2.3.3 Extraction Sequence

Figure 2.4 presents the extraction sequence for Stage 3 of the Calga Sand Quarry. Each extraction stage is prefaced with the number "3" with the following number indicating the progressive sequence of extraction within each stage. Extraction from Stage 3 has been undertaken since March 2006 with Stage 3/1 completed in July 2008.

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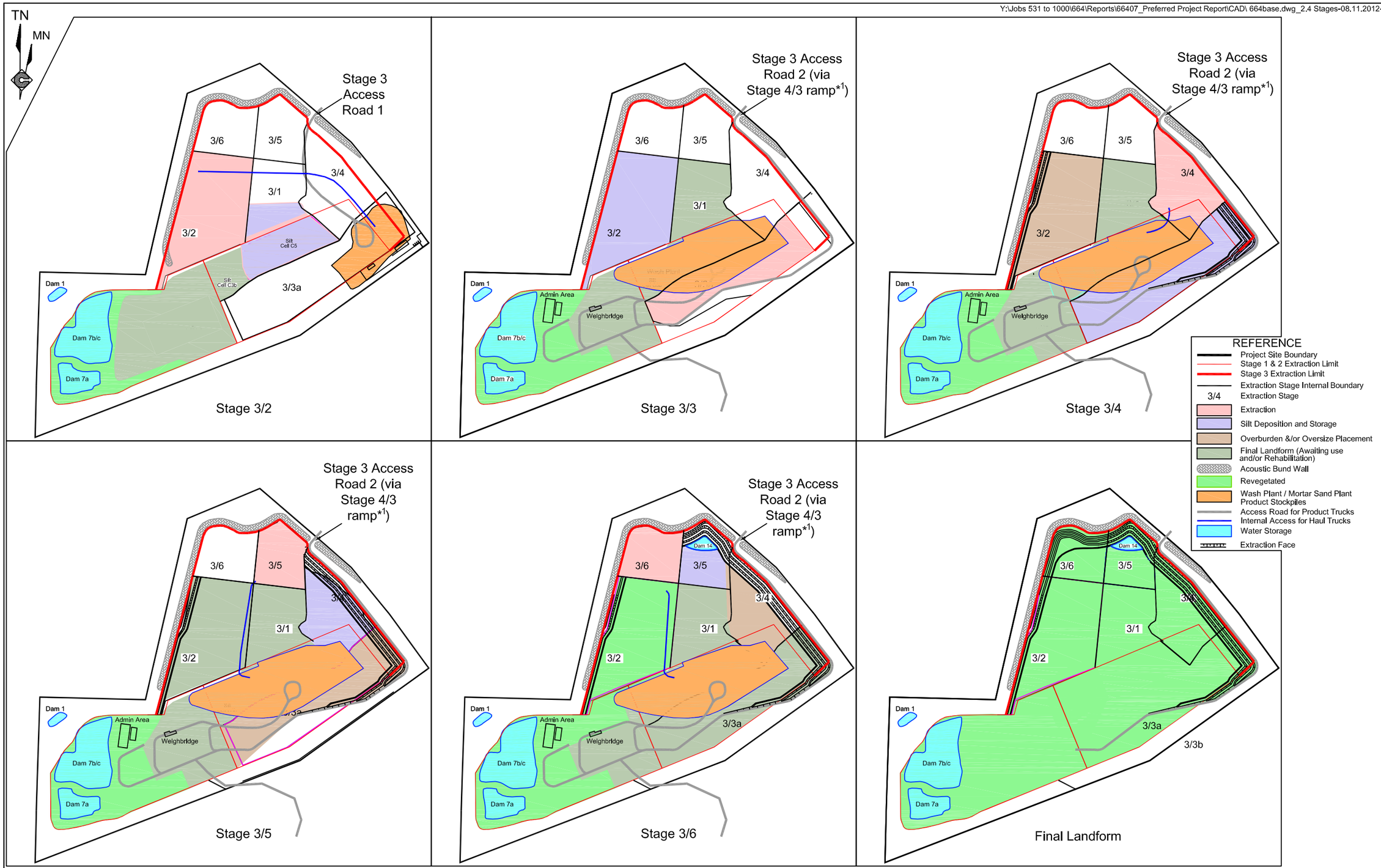

SCALE 1:8 000

100 0 100 200 300 400 m

Note *1: Stage 3 Access road is likely to be used as a one-way exit road with all traffic entering via the Southern Entrance and Stage 4 Access Road

Figure 2.4
EXTRACTION SEQUENCE - STAGE 3

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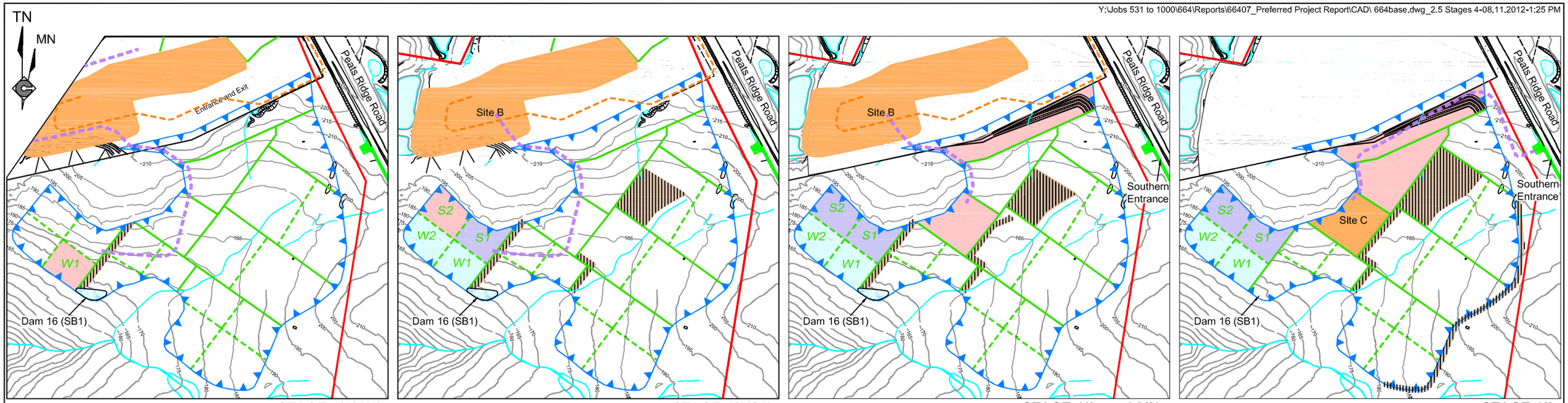

REFERENCE

- Project Site Boundary
- Proposed Extraction Stage Boundary
- Proposed Limit of Extraction
- Contour (m AHD)(Interval = 5m)
- Creek / Drainage Line
- Internal Haul Route
- Product Truck Route
- Extraction Bench (schematic only)

Activity Areas

- Active Extraction Area
- Overburden and Oversize Placement / Backfill
- Overburden Storage (Stockpile or Acoustic Bund)
- Processing Area
- Water Storage
- Silt Deposition
- Rehabilitation

SCALE 1:10 000

100 0 100 200 300 400 500 m

Figure 2.5
INDICATIVE EXTRACTION SEQUENCE STAGE 4

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Figure 2.5 presents the proposed extraction sequence for Stage 4 and **Figure 2.6** presents the proposed extraction sequence for Stage 5. Each extraction stage is prefaced with the number "4" or "5" identifying with the following number indicating the progressive sequence of extraction within each stage.

The sequence of extraction, in all stages, would generally commence as far as practicable from neighbouring landholdings, residences and/or commercial enterprises so that Rocla can establish well ahead of time, that compliance with noise and air quality criteria would be satisfied at these locations when operations gradually move towards the boundary of the quarry extension.

Concurrent Development of Stages 3, 4 and 5

Development of the proposed Southern Extension would occur concurrently with the ongoing approved operations within Stage 3 of the Calga Sand Quarry. This concurrent development would have ramifications on the management of water and silt on the Project Site, as well the impact the Project may have on the noise, air quality and water resources of the local environment.

Chart 2.1 presents an indicative sequence of concurrent development at the Calga Sand Quarry, a sequence that has been assumed in the proposed management of residual silt (see Section 2.6.3) and assessment of impact on water resources, noise and air quality.

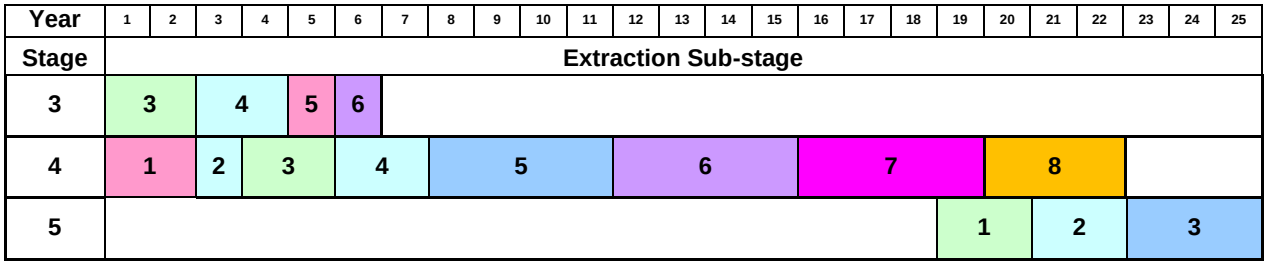

Chart 2.1
Indicative Concurrent Extraction Sequence

Figures 2.7 and **2.8** present an indicative development sequence within Stages 3, 4 and 5 at selected years in the proposed development and operations of the Project (Years 2, 6, 9, 12, 18 and 24), based on the concurrent development sequence identified in **Chart 2.1**.

The estimated years of extraction and the sequence of development are strictly indicative as there are a wide range of variables that influence the annual production rate and range of products required by customers. Rocla would review the sequence of operations on an annual basis and outline its plans in each Annual Review.

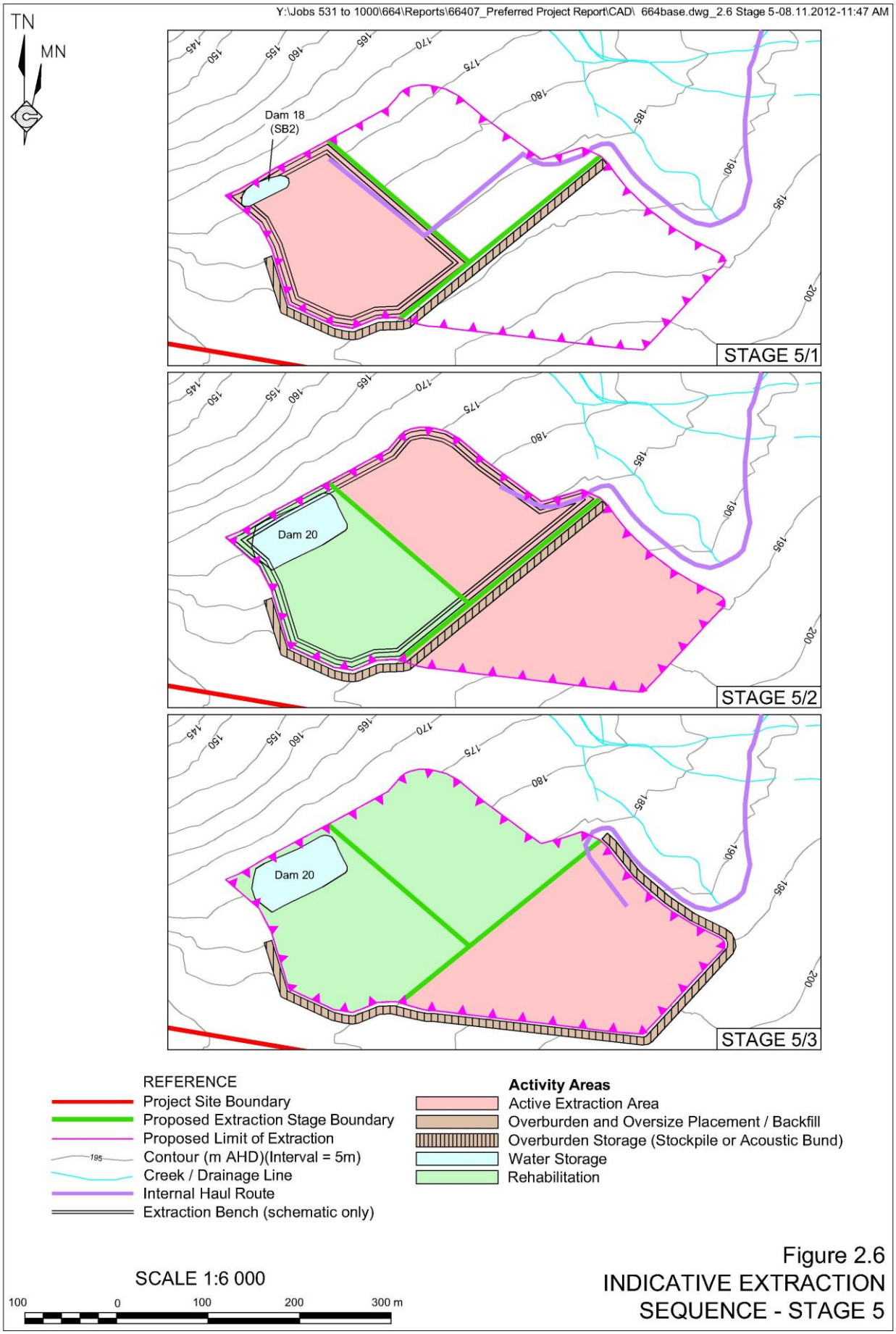

Figure 2.6
INDICATIVE EXTRACTION SEQUENCE - STAGE 5

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TN
MN

End Year 2

End Year 6

End Year 9

REFERENCE

- Project Site Boundary
- Proposed Extraction Stage Boundary
- Proposed Limit of Extraction
- Contour (m AHD)(Interval = 5m)
- Creek / Drainage Line
- Internal Haul Route
- Product Truck Route
- Extraction Bench (schematic only)

Activity Areas

- Extraction
- Overburden Placement
- Overburden Storage (Stockpile or Acoustic Bund)
- Silt Deposition / Management
- Water Storage / Sediment Basin
- Processing Area
- Final Landform (unvegetated)
- Final Landform (vegetated)

SCALE 1:8 000

100 0 100 200 300 400 m

Figure 2.7
INDICATIVE EXTRACTION SEQUENCE - YEARS 2, 6 AND 9

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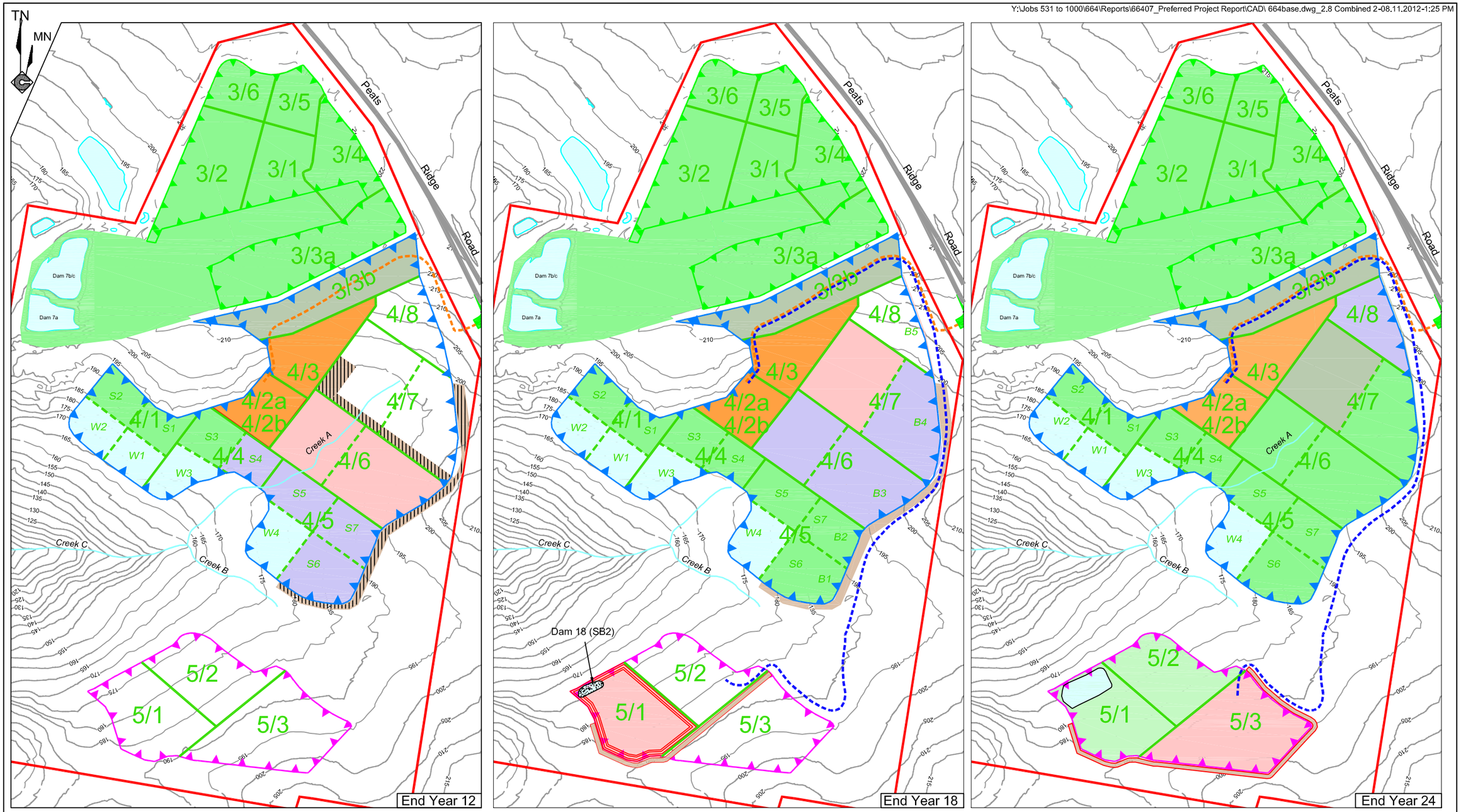

REFERENCE

- Project Site Boundary
- Proposed Extraction Stage Boundary
- Proposed Limit of Extraction
- Contour (m AHD)(Interval = 5m)
- Creek / Drainage Line
- Internal Haul Route
- Product Truck Route
- Extraction Bench (schematic only)

Activity Areas

- Extraction
- Overburden Placement
- Overburden Storage (Stockpile or Acoustic Bund)
- Silt Deposition / Management
- Water Storage / Sediment Basin
- Processing Area
- Final Landform (unvegetated)
- Final Landform (vegetated)

SCALE 1:8 000

100 0 100 200 300 400 m

Figure 2.8
INDICATIVE EXTRACTION SEQUENCE - YEARS 12, 18 AND 24

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2.3.4 Mobile Equipment

Table 2.3 lists the mobile earthmoving equipment currently in use, and proposed for use at maximum quarry production (1 000 000tpa) on the Project Site.

Table 2.3
Mobile Earthmoving Equipment Fleet

Equipment	Number		Use/Activity
	Current (400 000tpa)	Proposed (1 000 000tpa)	
Front-end loader (Cat 972)	2	4	Haul truck and product truck loading
Haul truck (50t)	1-2	3-4	Raw material haulage to processing area(s)
Bulldozer (375)	1	2	Extraction, site works
Excavator (30t)	1	2	Haul truck loading
Water Truck	1	1-2	Dust suppression activities
Source: Rocla Materials Pty Ltd			

2.4 PROCESSING OPERATIONS

2.4.1 Washing and Dry Screening

As is the current practice, Rocla would continue to process the friable sandstone and imported materials by washing (wash plant(s)) and dry screening (mortar sand plant(s)). Following establishment of the Site C processing area (**Figure 2.5**), Rocla would operate two wash plants. The two wash plants may be consolidated into a single larger capacity wash plant on establishment of the Site D processing area, or they may continue to be operated as separate plants within the Site D location. Only a single mortar sand plant would be operated on the Project Site.

Each wash plant would comprise:

- a receival hopper;
- a crushing circuit to further break and reduce the size of the ripped sandstone;
- a vibrating screen where oversize material is removed;
- a final screen deck where the product is washed and the clay/fine silt content removed;
- a set of cyclones for dewatering the sand products prior to stockpiling; and
- radial stackers.

The use of a crushing circuit would reduce the requirement for the Project bulldozer(s) to rip the sandstone on multiple occasions to reduce it to sufficient size for the vibrating screen and screen deck.

Dependent on product specifications, the sand may be washed once or twice, with the higher quality sand (with less fines) washed twice. The washing operation may require a water pump and pipeline for the delivery of the slurry containing silts to silt cells.

As currently, the mortar sand plant would incorporate:

- a receival hopper;
- a vibrating screen (a Powerscreen), which is used to separate the oversize material from the sand product; and
- a mobile conveyor belt to distribute the screened sand to stockpiles.

The mortar sand plant would also be used to screen incoming soils.

The location and capacity of the processing plants would vary throughout the life of the Stage 3, 4 and 5 extraction areas, with the following sub-sections providing a description of the processing operations during the approved (Stage 3) and proposed (Stages 4 and 5) operations.

2.4.2 Approved (Stage 3) Operations

2.4.2.1 Location and Layout

Throughout the operational life of Stage 3, two processing areas would be used, namely Sites A and B. Processing operations will initially remain in their elevated location (Site A) while extraction activities are restricted to the western end of Stage 3/3. As extraction progresses into the eastern half of Stage 3/3, the current processing plants (i.e. the mortar sand plant and the wash plant) would be relocated to a position on the floor of the completed quarry (Site B), over previously consolidated, capped and stabilised silt cells. Changes are envisaged to the stockpiling arrangements around the processing plants to accommodate the quantities of excavated and other materials brought onto the quarry from external sources for reprocessing and blending.

Figure 2.9 displays the layout of the processing area at Site B.

2.4.2.2 Operating Capacity and Production Rate

The combined capacity of both the existing wash plant and mortar sand plant is estimated to be 400 000tpa, consistent with the production limit imposed by DA 94-4-2004.

2.4.3 Proposed (Stage 4 and 5) Operations

2.4.3.1 Location and Layout

Friable sandstone to be extracted from Stages 4/1 and 4/2a would be transported to Site B for processing. It is currently envisaged at the completion of Stage 4/2a, the second wash plant could be constructed within the constructed flat area of Stage 4/2a (Site C). The layout of the Stage 4/2a processing plants would be similar to the current mortar sand plant/wash plant arrangement depicted in **Figure 2.9**.

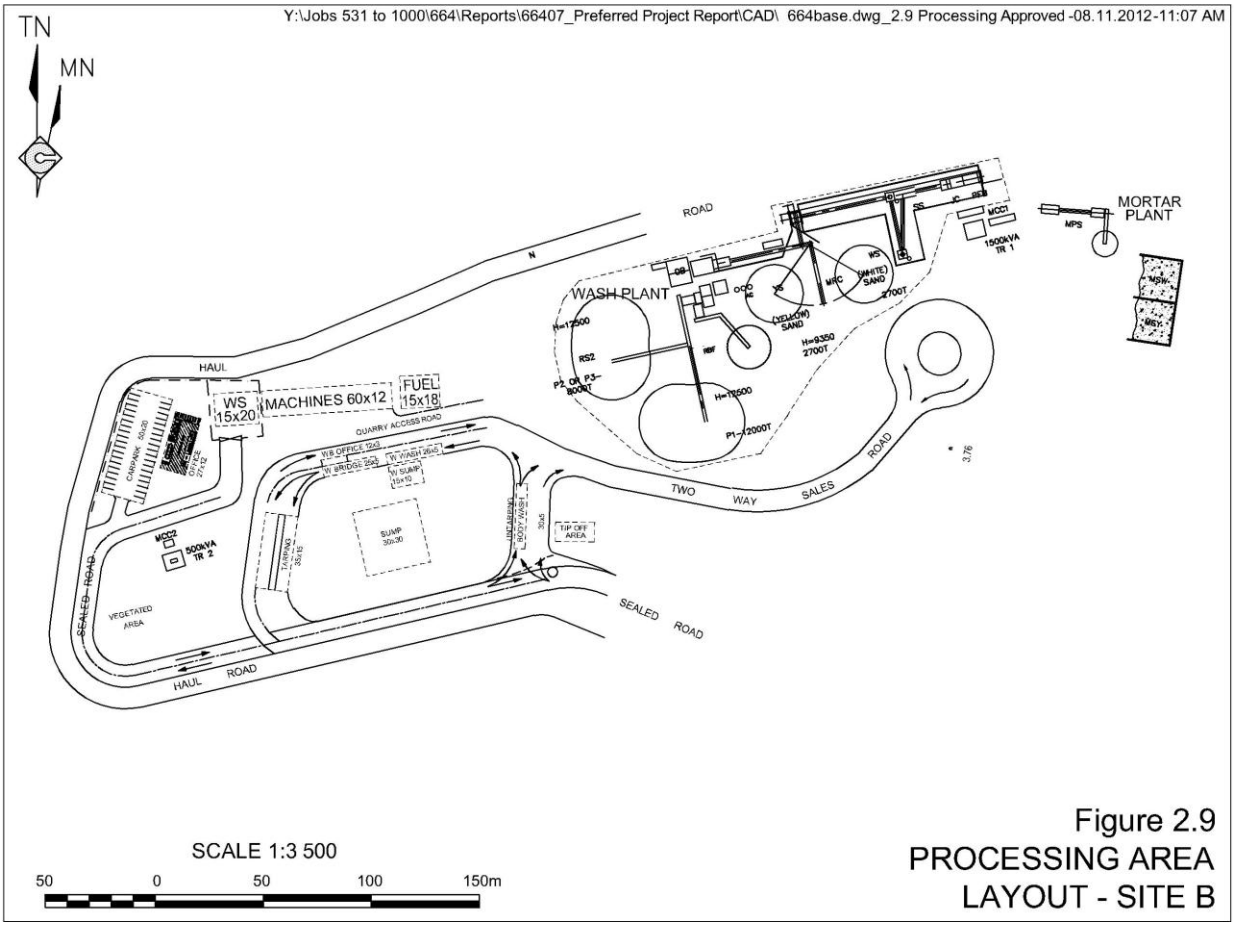

Figure 2.9
PROCESSING AREA
LAYOUT - SITE B

As extraction progresses to and beyond Stage 4/3 or Stage 4/4, i.e. coinciding with the approximate exhaustion of the resource in Stage 3, it is envisaged the processing plant within Site B for the combined Stage 3 and Stage 4 quarry would be relocated again, this time to the profiled and tiered floor of the completed Stage 4/3 (Site D). At this time, either both operating processing plants would be relocated to Site D, or a single replacement plant, capable of producing 1 000 000tpa would be constructed within Site D. The exact timing for the construction and relocation of the processing plants would be reviewed throughout the life of the Project and reflect the prevailing issues at that time.

2.4.3.2 Operating Capacity and Production Rate

The capacity of the processing plant to be installed within Site C would be 600 000tpa. As extraction and processing within Stage 3 and Stage 4 would be undertaken concurrently, the combined capacity of the processing plants would be approximately 1 000 000tpa, with up to 900 000tpa being washed products, and the remainder being dry-screened. In reality, flexibility of both plants would be a key to operational efficiencies.

Upon consolidation of the processing plants from Sites B and C to Site D, the production capacity would remain at a maximum of 1 000 000tpa.

The projected total annual production rate for all products would progressively increase to 1 000 000tpa, i.e. during periods of high demand. Given likely fluctuation in demand, Rocla realistically forecasts an overall average production of sand products from the Calga Sand Quarry to be in the order of approximately 550 000tpa.

2.5 PRODUCTS AND PRODUCT STOCKPILES

2.5.1 Introduction

The processing of the raw friable sandstone results in the production of two principal products, namely, concrete sand (a washed sand product) and mortar sand (a dry-screened product). Within these two broad classifications, products are also sold according to colour and with specified size grading. All blended products may include blends incorporating imported materials and washed sand.

2.5.2 Concrete Sand

The washed sand product is typically used in the manufacture of concrete and concrete products where final requirements can be adjusted during the washing process to modify the residual quantities of the silt and clay components. The washed sand is stacked via a radial stacker conveyor which allows the segregation of different final products (such as single and double washed sand) into separate stockpiles. Depending on demand for the product, additional temporary finished product stockpiles may be required. Up to 20% of the washed sand is and would continue to be used in blended products (including mortar sand) with the remainder sold as concrete sand.

2.5.3 Mortar Sand

As is currently undertaken, a proportion of the screened sand from the mortar sand plant is blended with washed sand to achieve the required grading. The blended product is then conveyed to active stockpiles and from these active stockpiles the screened mortar sand products are loaded directly into product trucks for despatch or onto nearby product stockpiles for later sale and despatch. The colour of mortar sand is the controlling factor in its sales. The principal colours of mortar sand produced at the Calga Sand Quarry are yellow and white. Up to 20% of the sand products despatched from Project Site would continue to be mortar sand.

2.5.4 Blended Products

The blended products would comprise a range of products generated by blending washed sand with imported soils and aggregate material, typically between 2mm and 10mm in size. Up to 20% of the overall products produced would be blended products. Materials imported to site for blending would, as currently, be stockpiled adjacent to the processing plants and combined with the extracted sand prior to processing to achieve the customer required specification(s) for the particular product. The specific products could include sand for asphalt, block manufacture (e.g. concrete blocks) and plasterboard.

Blending would be undertaken in a similar manner to that used for the production of the mortar sand. The respective raw materials would be initially mixed in stockpiles using a front-end loader within the stockpile area and then mixed further through the mortar sand plant. When necessary, screens would be changed to achieve the required grain size of the blended products.

2.6 WATER AND RESIDUAL SILT MANAGEMENT

2.6.1 Introduction

The sand washing process uses water to remove fine particles such as clay and silt from the sand to achieve the required size grading. As a consequence, the water discharged from the wash plant into silt storage ponds contains higher concentrations of these fine particles (as suspended solids in the water, referred to as "silt"), than can be discharged to natural drainage.

2.6.2 Water Use

The two primary uses of water at the Calga Sand Quarry are, and would continue to be, for the suppression of dust and sand washing.

Dust Suppression

Rocla would continue to operate a 12 000L capacity water cart at the Calga Sand Quarry to wet down the internal roads, hardstand surfaces and any other dust generating area at an application rate of approximately $2L/m^2$ per application. This application rate, which typically varies from every second day during winter up to eight times per day during hotter or windier days (generally during the summer months), is considered adequate given the ongoing compliance with dust deposition criteria at all dust monitoring gauges surrounding the quarry. The annual water usage for dust suppression is likely to increase as production increases (as the increased production is likely to require increased areas of disturbance on the Project Site for extraction and product stockpiling, and increased activity levels, e.g. vehicle movements on the Project Site) and has been estimated by Evans and Peck (2008) (as a component to a site water balance prepared for the Project) to be 43L per tonne of sand produced.

Based on the increased production associated with the proposed Southern Extension of the Calga Sand Quarry, and therefore increased area of disturbance, equipment operation and traffic, it is estimated that between 26MLpa and 43MLpa would be required for dust suppression. The smaller value associated with production of up to 600 000tpa and the larger value associated with production of up to 1 000 000tpa.

Sand Washing

Records held by Rocla indicate that the existing wash plant uses between 4 000L and 5 000L of water for every tonne of sand produced[3]. Of this, some water is retained within the sand product sold from the quarry, i.e. the mortar sand product contains approximately 9% moisture and the washed sand product contains approximately 5% moisture. Depending on the moisture content of the raw feed to the processing plants, this may include a small proportion of the water added through the washing process.

[3] The variability is a result of the proportion of concrete and mortar sand produced, and clay content of the raw sand.

The bulk of the water added to the wash plant is discharged with silt in silt cells and the settled water recycled through the wash plant. Rocla has undertaken tests on the wet but consolidated silt to determine the water content of this material, i.e. the proportion of water discharged as silt which is lost from the water cycle[4]. Based on these calculations, and those of Evans & Peck (2008), the water retained by the silt and effectively lost to the system has been calculated as 254L/t (approximately 5% of total water added).

Water is also lost from the system through evaporation, seepage to groundwater and retention in the sand products despatched from the Project Site. The calculated water losses for each of these actions are as follows.

- Evaporation – 6L/t.
- Seepage – 3L/t.
- Sand products – 55L/t.
- Processing waste (oversize material) – 21L/t.

Including the 43L/t of water required for dust suppression purposes, Evans and Peck (2008) estimate that approximately 208L/t of water is required to be added to the water balance. **Figure 2.10** provides a schematic illustration of the water balance (as prepared by Evans and Peck, 2008).

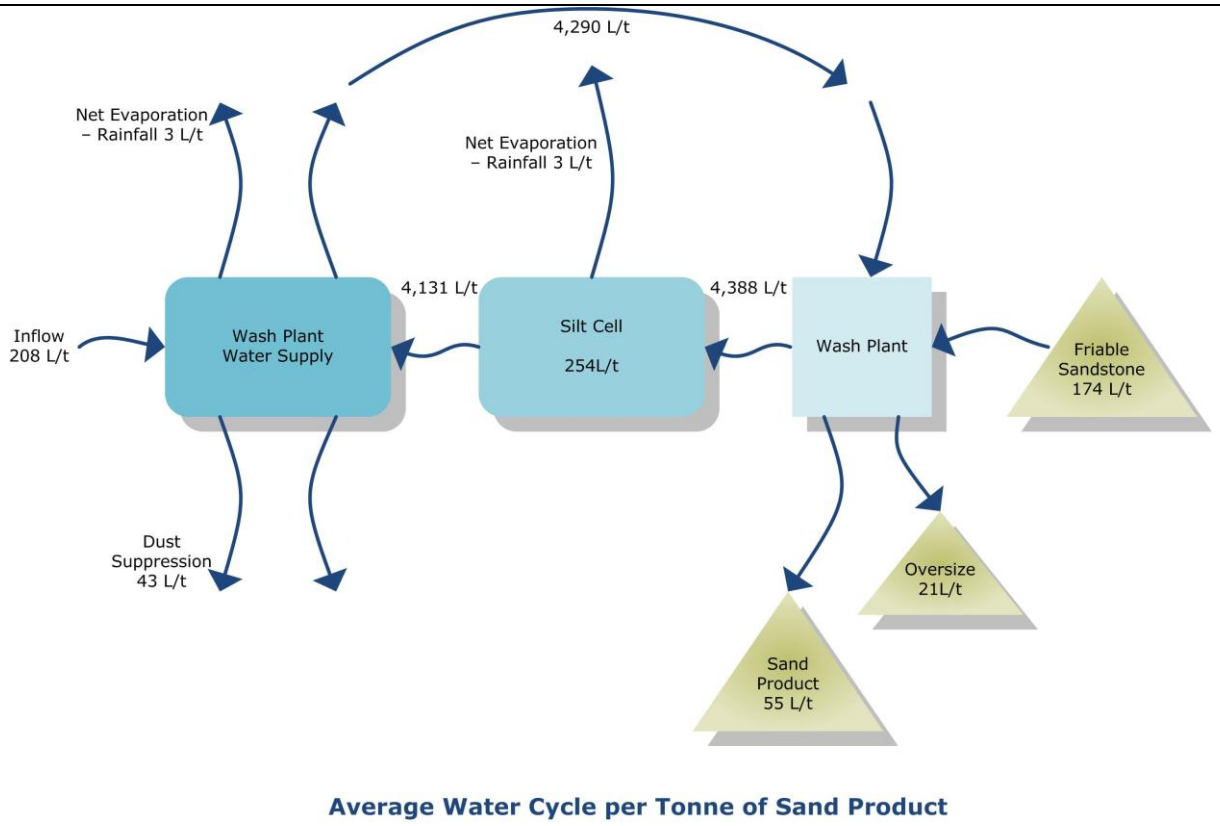

Figure 2.10
Site Water Balance

Source: Evans and Peck (2008)

[4] It is noted that the silt will dry further in the silt cell before being capped and rehabilitated; however, this drying process is effectively a result of evaporation and seepage to groundwater and therefore does not contribute any further water to recycle.

As the operation of the wash plant(s) for the existing Calga Sand Quarry and proposed Southern Extension would maintain this rate of water use and recycling efficiency, water requirements for the proposed increase in production would be as follows.

- 600 000tpa - 125ML.
- 900 000tpa - 187ML.

Before the water containing silt can be re-used through the wash plant, the silt must be removed from the water. This is currently achieved by discharging the silt containing water to storage structures where the suspended silt is allowed to settle from the water. The clarified water is then pumped back to the wash plant for reuse (see **Figure 2.10**). Following removal of the water, the settled 'residual' silt is allowed to dry and consolidate before being capped with oversize, overburden and soil as part of the final landform creation.

2.6.3 Water Sources

The 208L/t of water required for the continuing operation of the Calga Sand Quarry (see **Figure 2.10**) would be obtained from two sources.

- Rainfall and runoff collected in the various water storages and sediment basins within the Project Site. As a result of these progressive changes within the quarry, and the absence of evapotranspiration from vegetation, a much higher proportion of the incident rainfall will be converted to surface runoff than occurs with the existing landform and vegetation.
- Groundwater in-flow to the extraction area collected in the various water storages of the extraction areas. As the area of extraction increases in area and depth, the volume of water predicted to flow into the extraction area would increase.

Notably, the estimated 208L/t figure accounts for water losses through evaporation, moisture content of the sand product and seepage back to groundwater, as well as water recycled from the Project Site silt cells. A detailed assessment of the likely water surplus or deficit has been completed by Evans & Peck (2008). It is noted that all surface water collected and used on site is drawn from water pollution control structures which are exempt from the requirements of the maximum harvestable right dam capacity policy.

2.6.4 Silt Management and Silt Cell Development Sequence

2.6.4.1 Silt Management

In order to optimise the settlement and consolidation of the residual silt, thereby reducing the time between water discharge from the wash plant and re-use, Rocla would continue its current practice of constructing a series of cells ('silt cells') within the completed stages of the extraction area. These would continue to be constructed as a series of terraced cells, with a dividing bund constructed between active cells. Two or more silt cells would be operated concurrently, with silt discharged to a consolidation cell (at higher elevation) with water eventually overflowing into a holding cell(s) from where it would be pumped back to the wash

plant or to one of the dams constructed within the completed sections of the extraction area (see **Figure 2.5**).

Cell capacity would vary according to the size of the extraction area and the proposed final landform. Currently, silt is deposited at depths of between 5m and 12m, however, in order to create a free draining landform within Stage 4, silt would be deposited up to approximately 20m in depth to fill the void created by the extraction activities. This would be achieved by creating new silt cells on top of the completed (and possibly capped) silt cells. The stability of the silt deposition area would be maintained as the downstream wall against which the silt would be deposited against the in-situ sandstone wall of the extraction stage. The remaining silt cell walls would be constructed progressively from oversize material, overburden or remnant in-situ sandstone. **Figure 2.11** presents an illustration of the proposed construction of multiple silt cells to fill the extraction area void in Stage 4.

Once the capacity of each silt cell is reached, i.e. there is no more space for additional water from the wash plant, the remaining water would be pumped out and/or allowed to evaporate. The residual silt would then be left to dry and consolidate within the cell. The surface of the completed silt cell may be left to receive a further lift of silt or alternately it may be capped with an intermediate capping. For those cells to receive an intermediate capping, capping would commence when the consolidated silt is dry enough to allow access by a bulldozer. The capping material would be gradually pushed in from the margins of the cell, forming a surface layer typically up between 1m and 2m thick. Once capped, the surface of the silt cell would be available for the construction of another silt cell (see **Figure 2.11**), rehabilitation (Section 2.13) or for use as a temporary stockpile location/working area.

2.6.4.2 Silt Cell Development Sequence

2.6.4.2.1 Stage 3

Table 2.4 provides the calculated volumes of silt that would be produced as a result of the washing of the sand from each extraction stage of the Stage 3 Calga Sand Quarry, and the available storage space for this material. The storage volume attributable to Stage 2 (Silt Cell 2c(ii)) and Stage 3/1, assumes a second silt cell is constructed over the completed, consolidated and capped original cell.

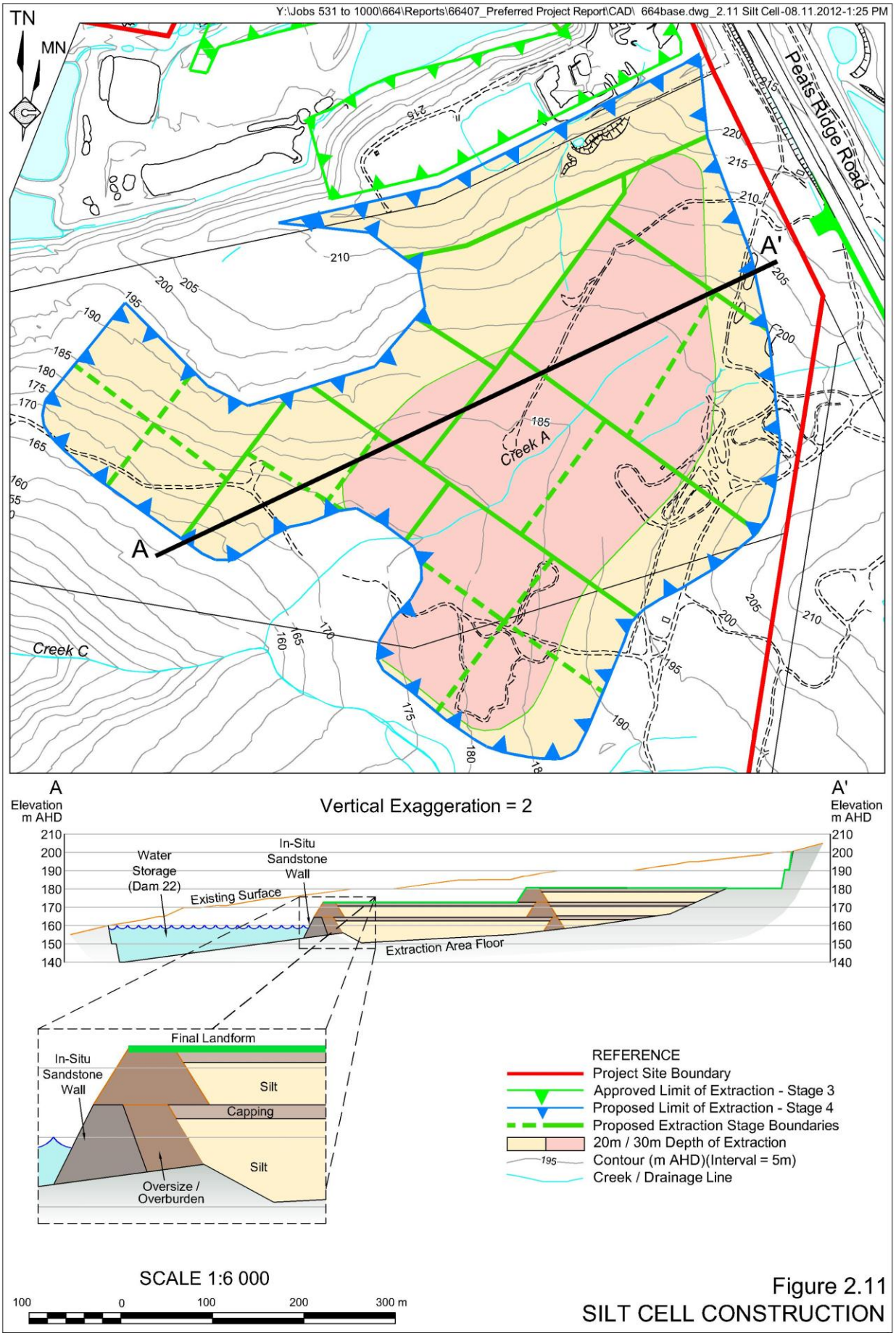

Figure 2.11
SILT CELL CONSTRUCTION

Table 2.4
Estimated Silt Produced and Available Storage – Stage 3

Extraction Stage	Silt Production			Available Storage Capacity		
	Total Area (m^2)	Friable Sandstone (m^3)	Total Silt [A, B] (m^3)	Available Depth [D] (m)	Available Area (approx.) (m^2)	Available Storage (m^3)
3/4	21 000	339 200	118 700	14	17 850	249 900
3/5	13 000	210 000	73 500	14	11 050	154 700
3/6	13 000	210 000	73 500	0		
Total		**759 200**	**265 700**			**404 600**

Note A: Assumes silt makes up 35% of friable sandstone by volume.
Note B: Assumes the volume of deposited silt includes a gravimetric water content of 117% (Evans & Peck, 2008).
Note C: Assumes wet silt in dams of 200m x 80m x 5m (which 'fluffs up' by 20%) and consolidated silt in dam of 80m x 80m x 4m. Dam 10/12 = (90m x 70m x 15m) x (available proportion = 0.65)
Note D: Based on final landform surface level 15m - 25m below pre-extraction surface level (see **Figure 2.13**).
Note E: Assumes second silt cell constructed on completed, consolidated and capped original silt cell(s).

The following assumptions were adopted for the calculation of available storage capacity presented in **Table 2.5**.

i) *The available depth*. This was estimated based on the average depth of extraction (see **Figures 2.5** and **2.6**), final landform surface level (see **Figure 2.13**), and the requirement for 1m to 2m of oversize, overburden and soil cover over silt cells. The estimated available depth was therefore conservative.

ii) *The available area*. It was assumed between 5% and 20% of each extraction stage area would be taken up by batter slopes, silt cell walls and other structures. As such, the area available was reduced by 10% for the purpose of the calculations.

iii) *The available storage*. It was assumed that the available volume (storage) within each extraction stage, calculated by multiplying the available depth by the available area, could be used in its entirety at the completion of extraction from that stage.

The comparison of the predicted volumes of silt to be produced against the available storage space, suggests that there will be sufficient storage space for the silt generated. When reviewing the predicted discharged and storage volumes, it should be noted that the volume of silt assumes the material is saturated, i.e. gravimetric water content of approximately 117%. However, over time, the water content will reduce (through evaporation and seepage) as will the volume it requires. Sufficient time will be allowed for silt shrinkage before final profiling and landform construction is undertaken (to ensure that the final landform is free draining).

2.6.4.2.2 Stage 4 and Stage 5

Using the same assumptions as for **Table 2.4**, **Table 2.5** provides the calculated volumes of silt that would be produced during each extraction stage within Stages 4 and 5 and the available storage space for this material.

Table 2.5
Estimated Silt Production and Available Storage Capacity for Stages 4 and 5

Extraction Stage	Silt Production			Available Storage Capacity		
	Total Area (m^2)	Friable Sandstone (m^3)	Total Silt [A, B] (m^3)	Average Available Depth [C] (m)	Available Area (approx.) (m^2)	Available Storage (m^3)
4/1	3.3	435 000	152 250	10	28 050	280 500
4/2	1.5	220 000	77 000	6	12 750	76 500
4/3	2.1	348 000	121 800	-	-	-
4/4	2.7	431 000	150 850	16	22 950	367 200
4/5	5.1	1 150 000	402 500	16	43 350	693 600
4/6	4.8	1 098 000	386 496	8	42 500	340 000
4/7	5.3	1 102 000	387 869	8	50 100	280 800
4/8	1.7	398 000	140 328	8	15 000	75 200
5/1	3.0	280 000	98 000	NA[D]	NA[D]	NA[D]
5/2	2.7	245 000	85 750	NA[D]	NA[D]	NA[D]
5/3	4.0	646 000	227 392	NA[D]	NA[D]	NA[D]
TOTAL	**36.2**	**6 353 000**	**2 230 235**			**2 113 800**

Note A: Assumes silt makes up 35% of friable sandstone by volume.
Note B: Assumes the volume of deposited silt includes a gravimetric water content of 117% (Evans & Peck, 2008)
Note C: Based on final landform which is free-draining to the west and southwest surface level 15m - 25m below pre-extraction surface level (see **Figure 2.13**).
Note D: NA = Not Applicable as no silts will be placed within Stage 5

Until sufficient space is created within Stage 4, silt produced from the washing of sand from Stages 4/1 and 4/2a would be placed within the silt cells of Stage 3. Acknowledging the proposed concurrent development schedule for Stages 3 and 4 presented in Section 2.3.5, the silt generated by the washing of sand from Stages 4/1 and 4/2a (~230 000m^3) would be placed within silt cells constructed within Stage 3.

Following completion of extraction from Cells W1 and S1 of Stage 4/1, Cell S1 would be available for silt cell construction, silt deposition and consolidation. The silt cell development would then generally follow the extraction sequence of **Figure 2.11**.

Rocla would review the available storage capacity within the completed cells and review the sequence of silt cell construction and silt deposition on an annual basis. The results of each review would be presented in the respective AEMRs.

Stage 5 would not be used for silt storage.

2.7 PRODUCT TRANSPORTATION

2.7.1 Introduction

The transportation of all sand and blended products produced at the Calga Sand Quarry would continue to be by road, via Peats Ridge Road and the F3 Freeway. Rocla intends to maintain its current product markets in Sydney and the Central Coast, hence retaining its currently utilised product transport routes external to, and from, the quarry.

2.7.2 Project Site Access and Internal Access Routes

2.7.2.1 Introduction

Access to the Calga Sand Quarry from Peats Ridge Road and internal access of product trucks to quarry product stockpiles would vary throughout the life of the Project to accommodate:

- the changing layout of the Project Site;
- the increased production level, and therefore increased volume of traffic; and
- the recommendations of the NSW Roads and Maritime Services (RTA) for traffic generating developments of this scale.

Considering the above, Rocla has proposed a three-phased approach to Project Site access and internal access and traffic management. The three phases are as follows.

Phase 1: Maintenance of a single Project Site entrance off Peats Ridge Road (the existing Northern Entrance) and internal access to Stages 3/1 to 3/4 and 4/1 to 4/3.

Phase 2: Construction of a new entrance to Stage 4 (the Southern Entrance). A one-way internal traffic arrangement would be maintained with all traffic entering the quarry via the Southern Entrance and exiting via the existing "Northern Exit".

Phase 3: Closure of the Northern Exit and conversion of the Southern Exit to the sole entry/exit point to the Calga Sand Quarry.

Each of the proposed three phases of Project Site traffic management are described in Sections 2.7.2.2 to 2.7.2.4 as follows.

2.7.2.2 Phase 1 – Northern Entrance/Exit Only

2.7.2.2.1 Project Site Access

The existing Northern Entrance off Peats Ridge Road would be retained and used in the current fashion until operations within the northern segment of the expanded quarry have been completed. The Northern Entrance, which is presented on **Figure 2.12a**, consists of a seagull-type intersection with a left turn deceleration lane provided for trucks entering the quarry from the south (via the F3 Freeway) and an acceleration lane for trucks exiting the quarry and heading towards the F3 Freeway to the south. This acceleration lane marks the commencement of a dual lane arrangement on Peats Ridge Road until its interchange with the F3 Freeway.

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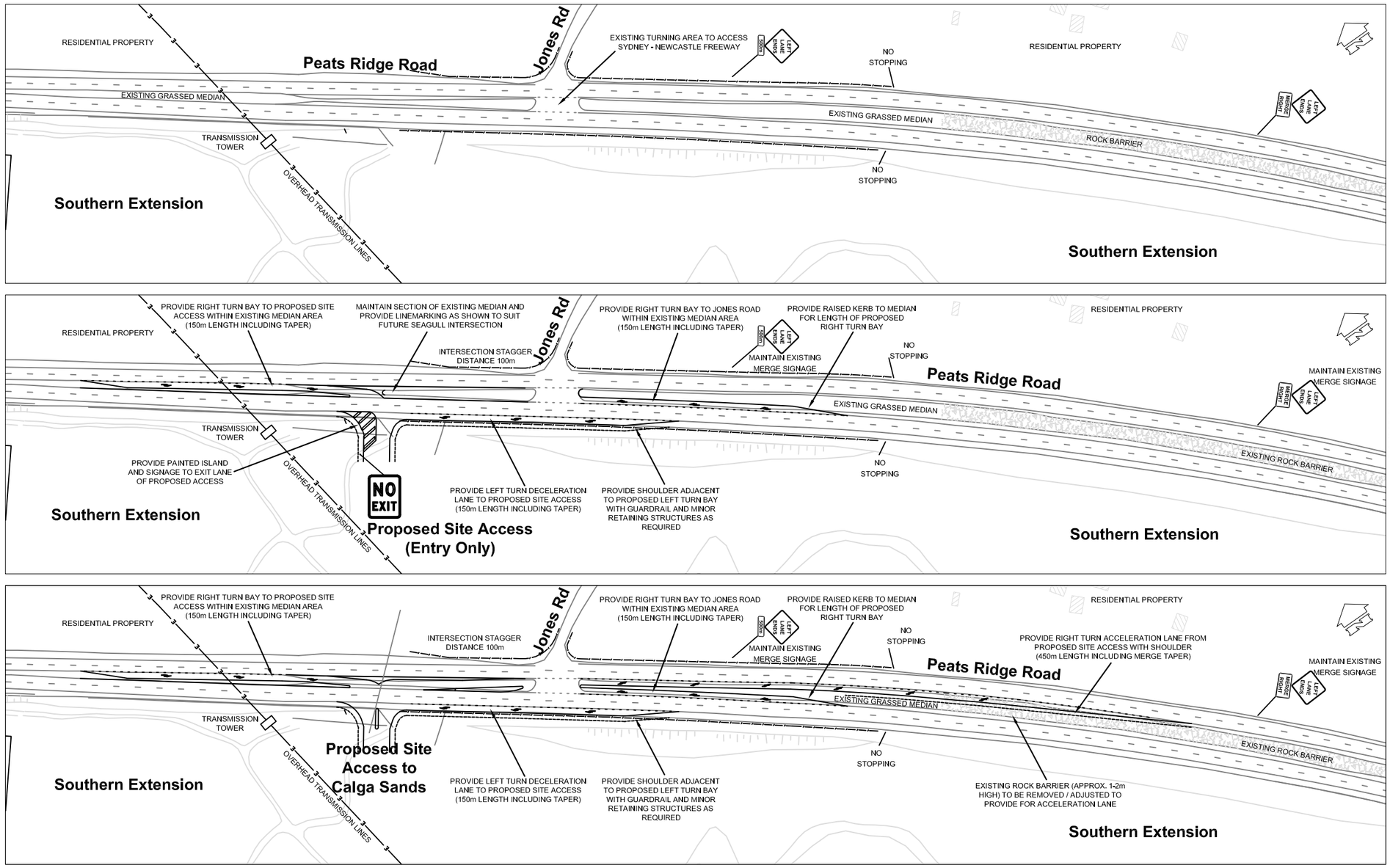

SCALE 1:2 500

25 0 25 50 75 100 125 m

Source: Modified after Transport and Urban Planning (2008) - Figures 7,8 & 9

Figure 2.12
TRAFFIC MANAGEMENT

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2.7.2.2.2 Internal Access Routes for Product Trucks

Figure 2.4 illustrates the two internal access routes that would be used by product trucks to access the quarry product stockpiles during Phase 1. The internal access routes would be developed as follows.

i) Access Road 1: represents the current alignment of the route between the Northern Entrance and product stockpiles adjacent to Processing Plant Site A. This access route would be retained for as long as the processing area remains in its current location.

ii) Access Road 2: would be constructed during the development of Stage 3/3 and would follow the eastern boundary of Lot 2, DP 229889 to the administration area of the Project Site, before descending to the quarry floor and Stage 3 processing area, via a 1:10 (V:H) slope (6^{o}) ramp, approximately along the southern boundary of Lot 2, DP 229889.

All internal access roads would be approximately 10m wide, unsealed with a compacted surface of oversize screened sandstone. In accordance with current requirements, all departing heavy vehicles would be required to pass through the wheel-wash facility prior to entering onto Peats Ridge Road. With the development of Access Road 2, the wheel-wash facility would be relocated to a point closer to the new administration area (Site B).

2.7.2.3 Phase 2 – Southern Entrance/Northern Exit

2.7.2.3.1 Project Site Access

As extraction progresses in Stage 4, the construction of an entrance to Lot 1, DP 805358 and an internal access road between the new Southern Entrance and Processing Plant Sites C and D would be completed.

The intersection of the Southern Entrance with Peats Ridge Road would be located as shown in **Figure 2.12** and would provide:

- a 150m (including taper) right turn bay on Peats Ridge Road within the existing median area of the southbound lane;
- a raised kerb to the remaining median for the right turn bay;
- a left turn deceleration lane (northbound) of 150m (including taper) to the Southern Entrance;
- a shoulder adjacent to the left turn deceleration lane and retaining structure and guardrail;
- a 150m (including taper) right turn bay on Peats Ridge Road to Jones Road within the existing median area of the northbound lane; and
- a painted island and signage on the exit lane of the internal access road from the Southern Entrance to Stage 4.

The proposed location and layout of the Southern Entrance (as it would be operated for Phase 2) is presented on **Figure 2.12b**. Following the progression of extraction to Stage 4/3 and the opening of the Southern Entrance, the layout and operation of the Northern Entrance would be altered to become an exit only. This would require:

- the painting of the existing right turn bay and conversion to a median;
- removal of left turn arrows within the existing left turn deceleration lane;
- re-marking the northbound lane to remove the left turn deceleration lane from service; and
- erection of "No Entry" signage on northbound approach to the Northern Entrance.

Figure 2.12b also presents the proposed layout of the Northern Entrance for Phase 2 operations.

2.7.2.3.2 Internal Access Routes for Product Trucks

Figure 2.5 illustrates the internal access route that would be used by product trucks to access the quarry product stockpiles during Phase 2. The "Stage 4 Access Road" would be aligned from the Southern Entrance through Stage 4/3 to minimise the disturbance caused by the route and requirement for later realignment. The Stage 4 Access Road would be approximately 10m wide, unsealed with a compacted surface of oversize screened sandstone.

All vehicles would exit the Project Site via the Northern Entrance using the Stage 3 Access Route 2, which would be converted to a one-way road. The Stage 4 Access Road (entry) and Stage 3 Access Route 2 (exit) would both be located on the ramp from surface to the quarry floor which separates Stages 3 and 4. The entry and exit lanes would be separated by bollards or some other form of road marker.

2.7.2.4 Phase 3 – Southern Entrance/Exit Only

2.7.2.4.1 Project Site Access

Following completion of extraction and rehabilitation activities on Lot 2, DP 229889 (Stage 3), access from the Northern Entrance may no longer be available to Rocla, e.g. if the property is sold following rehabilitation. As such, Rocla proposes to open the exit lane of the Southern Entrance at this time to allow for both entry and exit to Stage 4 and 5 of the Calga Sand Quarry. **Figures 2.12b** and **2.12c** present the proposed layout of the Southern and Northern Entrances for Phase 3 of the Project. Notably, a Road Safety Audit (RSA) has been completed for the intersection treatment presented on **Figures 2.12b** and **2.12c** by Roadnet Pty Ltd (Roadnet, 2009). The RSA determined that the proposed treatment *"is essentially sound and contains no serious safety issues."* The RSA has been provided to the NSW RMS and is included as **Appendix 4** of the *Environmental Assessment*.

2.7.2.4.2 Internal Access Routes for Product Trucks

Figures 2.5 to **2.8** illustrate the internal access routes that would be used by product trucks to access the quarry product stockpiles during Phase 3 transport operations.

The Stage 4 Access Road on the northern perimeter of Stage 4/3 would be retained but converted to a two-way road. The bollards or road markers would be retained in their previous location but converted to identify the adjacent two-way road on Lot 2, DP 229889 remain be developed as follows.

Figures 2.6 and **2.8** illustrate the internal access route that would be used to access Stage 5. This road would effectively be a southerly continuation of the Stage 4 Access Road which follows the perimeter of Stages 4/7 and 4/8, before joining an existing power line easement to the eastern most point of Stage 5/1. This "Stage 5 Access Road" would be approximately 10m wide with a 4m high acoustic bund (10m wide at its base) constructed on the eastern side through cut and fill works. Based on the anticipated extraction sequence, this access road would not be required nor constructed for at least 15 years.

As there would be no processing undertaken within Stage 5, this road would be strictly for haul trucks, quarry mobile equipment and Rocla's light vehicles. Signage would be installed to prevent access of product trucks to this area.

2.7.3 Internal Road Network

2.7.3.1 Designated Access Roads

Access between Stages 4 and 5 would be via a designated access road, the alignment of which is presented on **Figure 2.1**. This access road would skirt the eastern boundary of the Stage 4 extraction area, before following the power line easement which traverses the Project Site and then skirting the northern boundary of Stage 5. By aligning the road in this fashion, the edge effect of the construction of a road within a vegetated area would be minimised. In addition, the alignment of the road within the power line easement has been delineated to avoid the known locations of two threatened flora species. The alignment would be re-assessed and delineated prior to construction to ensure the identified flora is avoided. Based on the anticipated extraction sequence, this access road would not be required nor constructed for at least 15 years.

The access road would be constructed as a two way road within a corridor not exceeding 10m in width. The corridor edge would be defined by the placement of steel posts, concrete bollards or some other physical barrier. Signage would be installed where relevant to identify shared access of the road with mobile equipment.

2.7.3.2 Additional Internal Haul Roads

In addition to the access routes for road registered product trucks transporting products from the quarry, roads within the Project Site would be required for internal access between operational areas by light vehicles, earthmoving machinery and internal haulage of raw materials.

The internal roads are and would continue to be temporary and reflect the day-to-day position of the active extraction area(s). Wherever practicable, they would be formed on the margins of the extraction areas to minimise the amount of re-positioning. The formation of the internal roads would usually involve a bulldozer simply pushing a new route to the desired area and completion of the final surface with a grader.

Throughout all stages of development and extraction, the unsealed internal roads would be regularly maintained with watering for dust suppression, as required.

2.7.3.3 "Glenworth Valley" Access Road Corridor

Rocla has made provision for a corridor across the southern side of the Project Site to allow an access road to be constructed between Darkinjung Road and the "Glenworth Valley" property to the west of the Project Site. Provision for this corridor was negotiated between Rocla and the owner of the "Glenworth Valley" property in exchange for inclusion of a 44.7ha area of the property within a biodiversity offset strategy for the Project. As far as practicable, the access road has been aligned within the corridor along existing tracks on Lot 2, DP 805358, and to avoid identified threatened flora and Aboriginal heritage sites. The approval for, and construction of the access road itself does not form part of the Project.

2.7.4 Product Transport Routes

Virtually all of Rocla's products are destined for either the Sydney or Central Coast markets. This would require the trucks carrying the final products to travel southwards from the quarry entrance along Peats Ridge Road to the Calga Interchange and onto the F3 Freeway.

Minor quantities of sand products (<0.5%) are occasionally supplied to the Peats Ridge/Mangrove Mountain area which would require product trucks to turn northwards from the quarry onto Peats Ridge Road.

2.7.5 Product Vehicle Types and Traffic Levels

Product trucks entering and leaving the quarry would be typically single body tippers with trailers or semi-trailers, usually of 25t to 33t capacity, and similar to those currently used. All products would be delivered by transport contractors either to Rocla or its customers. Larger capacity B-double trucks may be used from time to time to deliver products from the site as well as smaller capacity trucks of 12t to 18t may also transport products from the quarry for local users. Overall, Rocla expects the average product load would remain comparable with the current average of 29t.

The scheduling of trucks entering and exiting the Project Site reflects the 2½ to 3 hour return trip time for trucks between the quarry and Sydney markets. **Table 2.6** presents a summary of projected average truck movements across a typical working day for a standard 25t to 30t capacity truck, both at 400 000tpa (as currently approved) and the proposed 1 000 000tpa.

In order to import additional raw friable sandstone from nearby excavations and neighbouring properties as well as soil and fine aggregates, a small number of trucks would enter and exit the Project Site. The frequency of these movements would depend on demand for the product at any given time but it is unlikely that the maximum number of truck movements, as provided in

Table 2.6, would be increased given the likely emphasis upon back-loading the bulk of trucks delivering the imported raw materials.

Table 2.6
Projected Truck Movements (Average) – Monday to Saturday

	Current (Stage 3) - 400 000tpa		Proposed (Stages 3 & 4) - 600 000tpa		Proposed (Stages 3, 4 & 5) - 1 000 000tpa	
	Monday to Friday	Saturday	Monday to Friday	Saturday	Monday to Friday	Saturday
5:00am to 7:00am	14	8	21	12	35	20
7:00am to 9:00am	18	10	27	15	45	25
9:00am to 11:00am	18	6	27	9	45	15
11:00am to 1:00pm	18	4	27	6	45	10
1:00pm to 3:00pm	12	2	18	3	30	5
3:00pm to 6:00pm	10	2	12	3	20	5
6:00pm to 8:00pm	6	-	6	3	12	5
8:00pm to 10:00pm	4	-	6	3	8	5
Total*	100	32	144	54	240	90
Av. tonnes per day	1 450	464	2 088	783	3 480	1 305
* One truck movement equates to a single, one-way journey, i.e. a round trip equates to two truck movements. Average load of sand = 29t.						
Source: Rocla Materials Pty Ltd						

In addition to the number of truck movements per day, there would also be a limited number of staff, visitor and supplier's light vehicles. This currently equates to approximately 15 vehicles per day or 30 movements per day. It is likely this number would approximately double as production increases to 1 000 000tpa.

2.8 INFRASTRUCTURE

2.8.1 Stage 3

For the duration of Stages 3/2 and 3/3, the existing administration area, which incorporates the site offices and weighbridge, lunch room, first aid, parking and ablutions would remain in its existing location. With the completion of Stage 3/3 and relocation of the site access road, the administration area, as well as the workshop and refuelling facilities, would be relocated to the floor of the Stage 2 Quarry Area within Site B. This area would also incorporate parking areas for trucks and mobile plant, staff and visitor parking, the weighbridge and tip-off bins.

2.8.2 Stage 4 and Stage 5

The consolidation of the processing plants into a single area within Stage 4/3, would include the relocation of the administration facilities, maintenance facilities, weighbridge and fuel storage area.

2.9 SERVICES

2.9.1 Introduction

The current services used on site are summarised below, and while it is proposed to increase production to 1 000 000tpa, it is anticipated that, with the exception of some minor disruption as a result of the relocation of the administration area and processing plant, there would be no alteration to the current services provided to the operation.

2.9.2 Power

Electricity is supplied to the quarry by an 11kV power line. A pole-mounted transformer is located adjacent to the Project Site's eastern boundary. It is proposed to extend the power line to the site of the additional and 1 000 000tpa processing plants, however, a diesel-powered generator may be required as an interim measure while an extension of the power line is undertaken.

2.9.3 Telephone

The quarry is presently serviced by four telephone lines to the existing office. The relocation of the administration area would require the relocation of the existing lines.

2.9.4 Water Supply

Potable water for the existing quarry is supplied from a bore on the Project Site immediately east of the existing weighbridge and office, i.e. within Stage 3/4. Rocla would develop one of the perimeter bores as a source of potable water immediately prior to the removal of the existing bore during the extraction of Stage 3/4.

Surface water dams, supplemented by water which seeps into the extraction area of the quarry, are the only other source of water on the Project Site and would be used for the sand washing, in the wheel-wash facility and for dust suppression activities.

2.9.5 Fuels and Lubricants

A fuel storage area and refuelling bay would be constructed at the southwestern corner of the relocated administration area (Site B). This would be constructed in accordance with the design specification nominated within Australian Standard (AS) 1940-2004: The Storage and Handling of Flammable and Combustible Liquids. Lubricants and greases would be stored within the workshop area in either self-bunding containers or within suitably contained areas.

A similar storage area and refuelling bay would be constructed during the relocation of the administration and facilities area at Sites C and D (see **Figure 2.1**).

2.9.6 Sewage and Effluent Disposal

The sewerage system located on the Project Site comprises an envirocycle septic system which is discharged to an on-site absorption area. A new system would be installed and maintained in the new administration areas, in accordance with Gosford City Council requirements. Approval for each system would be sought from Gosford City Council or a qualified certifier.

2.10 HOURS OF OPERATION AND PROJECT LIFE

2.10.1 Hours of Operation

The proposed operating hours would be as follows.

Extraction and Processing	Monday to Friday	6:00am to 10:00pm
	Saturday	6:00am to 6:00pm
Product Transportation	Monday to Friday	5:00am to 10:00pm
	Saturday	5:00am to 10:00pm

The only change between the existing hours of operation (Stage 3) and proposed hours of operation (Stages 3, 4 and 5) would be the introduction of limited extraction activities between 8:00pm and 10:00pm Monday to Friday and 4:00pm and 6:00pm Saturday, and a six further hours of operation between 4:00pm and 10:00pm Saturday, for product transportation.

As is currently the case, extraction activities would not extend beyond 6:00pm Monday to Friday unless the extraction activities are undertaken at least 10m below the natural surrounding ground level and noise levels are compliant at all surrounding residences.

When necessary, maintenance activities may be carried out outside the above hours although the activities would be confined to routine, low noise activities such as oil changes, minor welding and servicing of equipment.

2.10.2 Project Life

Based upon the predicted production of up to 13.2 million tonnes of sand, with production from the proposed Southern Extension of between 400 000tpa and 1 000 000tpa, the Calga Sand Quarry could theoretically operate for between 14 and 33 years. Considering the likely fluctuation in sales over such an extended period of time and a projected average annual production of approximately 550 000tpa, the Calga Sand Quarry is anticipated to operate for a further 25 years. However, for the purposes of the project application an overall project life of 30 years is proposed which would incorporate the period of final rehabilitation beyond the end of extraction operations.

2.11 WASTE MANAGEMENT

2.11.1 Production By-products

2.11.1.1 Overburden and Clay/Shale

With the exception of a deeper section of surface clay identified over Stage 3, exploration drilling has indicated there is only limited overburden above the friable sandstone targeted by Rocla within Stages 3, 4 and 5. Based on the surveyed thickness of clay over the Stage 3 sandstone and a conservative estimate of 1m of overburden over the remainder of the Project Site, it has been estimated that approximately 900 000m^3 of overburden would be removed during Stages 3, 4 and 5.

As noted above, significant volumes of clay/shale have been encountered within Stage 3 of the Calga Sand Quarry, both as overburden and distinct lenses within the sandstone resource. The geological logs prepared by Koncek in 2006 suggest these clay/shale lenses also exist within the proposed Stage 4 and 5 of the Southern Extension. While not identified in every drill hole, where identified these lenses varied in thickness from 1m to 3m. In order to estimate the volume of clay/shale likely to be recovered from Stages 4 and 5, an average clay/shale lens was assumed for each extraction stage based on the geological logs prepared by Koncek. On this basis, it is estimated that 245 000m^3 of clay/shale would be recovered from the proposed Southern Extension.

Both the overburden and clay/shale would continue to be used in conjunction with oversize material, in the construction of acoustic bund walls, silt cell walls and to cap consolidated silt cells. Overburden and oversize used as a capping medium for the consolidated silt cells would typically be placed in layers approximately 1m to 1.5m thick.

When the overburden or clay/shale is not required for immediate use, it would be stored in temporary stockpiles on the quarry floor.

2.11.1.2 Oversize Management

The oversize material generally comprises harder material separated during the screening or washing process. It typically represents approximately 5% of the total quantity of raw friable sandstone feed to the mortar sand plant and wash plant. It is proposed to continue the current management practice of using the oversize material, in combination with overburden, in the capping of silt cells and the construction of the dam walls for the silt cells.

Assuming oversize continues to represent 5% of the total sand and sandstone resource, it is anticipated approximately 38 000m^3 of oversize material remains to be produced from Stage 3 and 320 000m^3 would be produced within the proposed Southern Extension (Stages 4 and 5).

2.11.1.3 Residual Silt Management

The management of residual silt was described in Section 2.6. Through consideration of the raw and washed density of the sand at the Calga Sand Quarry, and the relative density of silt (1.22t/m^3), Rocla has calculated that for every 1m^3 of sandstone washed, 0.35m^3 of silt is produced. It is anticipated that between 80% and 90% of the raw sand would ultimately be

washed and therefore, the total volume of silt that would be generated by the Project would approximate the following.

- Stage 3: 270 000m^3.
- Stage 4: 1 820 000m^3.
- Stage 5: 410 000m^3.

Depending on the annual production rate, this would equate to between approximately 95 000m^3 and 165 000m^3 per year, depending upon the annual production rate (600 000tpa and 1 000 000tpa).

2.11.2 Non-Production Wastes

2.11.2.1 Domestic Wastes and Maintenance Consumables

General domestic waste would continue to be segregated into recyclable and non-recyclable materials and removed from site by a licensed contractor. Any other waste generated would be removed to a facility licensed to receive these materials.

2.11.2.2 Waste Oils and Filters

Waste oil and filters would continue to be collected and removed by licensed recycling operators. Should fuel leaks or spillages occur outside these areas, the contaminated material would be either remediated on site or removed by a licenced contractor, as per the Quarry's Pollution Incident Emergency Response Management Plan.

2.12 EMPLOYMENT

Rocla currently employs eight persons full-time to undertake all normal tasks on site. As production increases to 1 000 000tpa, it is proposed to employ a further 11 persons full-time. Based on truck drivers completing an average of three return trips to and from the quarry each day, the transportation of products from the Calga Sand Quarry would continue to generate an equivalent of 24 additional full-time jobs. **Table 2.7** compares existing direct and indirect employment and that which would be required when production reaches 1 000 000tpa.

Temporary increases in employment levels would continue to occur for large scale maintenance activities or other specialist activities such as the use of an excavator on the Project Site to modify the silt cells. Additional persons would be employed to assist in the relocation of the processing plants and administration area.

Table 2.7
Indicative Employment

Position/Function	No. Employed	
	Current Approved (400 000tpa)	Proposed (1 000 000tpa)
Direct Quarry Employment		
Quarry Manager	1	1
Weighbridge Officer	1	1
Processing Plant Operators	1	4
Mobile Equipment Operators	5	13
Total	**8**	**19**
Indirect Transport Employment		
Truck Drivers	16	40
Source: Rocla Materials Pty Ltd		

2.13 REHABILITATION

2.13.1 Introduction

Rocla is committed to an integrated approach to rehabilitation of all the areas currently disturbed and planned to be disturbed within the Project Site. Current techniques used for the rehabilitation of the quarry perimeter, benches, acoustic bund walls, silt cells and floor would continue to ensure final land use objectives are met.

Unless otherwise specified in the following sub-sections, rehabilitation of the Stage 1 to Stage 3 quarry areas would be completed in the manner approved by DA 94-4-2004.

2.13.2 Rehabilitation and Final Land Use Objectives

The following objectives have been adopted when developing the rehabilitation procedures for the Project Site.

- To produce a stable final landform able to support a range of alternative final land uses.
- To provide a number of water storages for future users of the land, e.g. to facilitate agricultural or horticultural activities.
- To minimise the environmental impact of all site earthworks associated with environmental controls and rehabilitation activities.
- To optimise the use of available overburden and soil as a substrate for vegetation.
- To achieve a stable and functional drainage system at the site under extreme rainfall events.

2.13.3 Final Landform

2.13.3.1 Introduction

Figure 2.13 presents the proposed final landform of the Calga Sand Quarry, illustrating the proposed final topography and drainage.

Sections 2.13.3.2 to 2.13.3.4 describe the significant features of the proposed final landform of the approved Calga Sand Quarry (Stage 3), and the proposed Southern Extension (Stages 4 and 5).

2.13.3.2 Stage 3

The final landform would be free draining with a gently sloping floor to the southwest approximately 10m to 20m below the pre-extraction landform. Drainage would be designed to provide runoff to both retained dams within the final landform (Dams 7a and 7b/c) and the catchment of Cabbage Tree Creek.

Internal drainage of the final landform would be controlled along two separate channels.

1. A broad, southwest/northeast-oriented central channel through Stages 3/1 and 3/2, which would, in turn drain to two dams (Dams 7a and 7b/c) adjacent to the western margin of the Stage 1 quarry (Channel 1).
2. Maintenance of the existing southern channel flowing approximately east to west along the southern perimeter of the quarry (Channel 2).

2.13.3.3 Stage 4

The final landform would be an extension of the landform created for Stage 3, i.e. a free draining landform to the southwest, with the upper 10m to 20m of the eastern and southeastern extraction faces retained (see **Figure 2.13**). The created extraction faces around the retained archaeological site SA1 would also remain as faces at the end of the Project life (see detail on **Figure 2.13**).

Internal drainage of the final landform would be controlled along two separate channels.

1. From the northern perimeter of Stage 4, water would be drained (via Channel 3) to the retained water storages of W1, W2 and W3 which would be combined to form Dam 21.
2. Rainfall and runoff from the southern half of Stage 4 would be drained to the retained water storage of W4 (via Channel 4), which has been renamed Dam 22.

The slope of the northeastern section of Stage 4, i.e. where the final quarry floor elevation exceeds 170m AHD, would be created by the final quarry floor and replicate that of the surface topography. The slope of the remainder of Stage 4, where the silt cells and water storage cells are to be constructed, would be shallower and created by the profiling of the consolidated, capped and profiled silt cells and retained quarry faces. Gentle undulations and depressions would be created through final profiling of the surface to divert rainfall and runoff to designated drainage channels.

The access ramp into Stages 3 and 4, constructed along the boundary between Stages 3 and 4 would be retained creating a slight ridge-like formation in the final landform. This ridge would act to segregate rainfall and runoff between the two separate properties, i.e. separate drainage to Channels 2 and 3.

The final landform of Stage 4 would be vegetated with predominantly native groundcover species and (final land use permitting), trees and other native species along the final internal drainage channels.

2.13.3.4 Stage 5

The final landform would be water holding and drain to a water storage against the western face of Stage 5/1 (Dam 20). The retained quarry faces would be profiled in a similar way to that described for Stage 4 (see Section 2.13.3.3) to create a slope of approximately 1:3 (V:H) (which approximates the surrounding landform (see **Figure 2.13**).

The final landform of Stage 5 would be vegetated with native tree and shrub species with a fire trail style access track retained to allow access to the water storage.

2.13.4 Potential Final Land Uses

2.13.4.1 Stage 4

The final landform of Stage 4 (**Figure 2.13**) would provide a number of beneficial attributes for a variety of future uses. These include:

- close proximity to the F3 Freeway and Calga Interchange;
- large areas of comparatively flat land;
- the substantial store of surface water resources in site dams; and
- the presence of reticulated power.

Possible land uses could include poultry sheds/ poultry enterprises, hydroponic/horticultural enterprises and/or nurseries, a sporting venue (e.g. a polo/camp drafting area), bulky goods/commercial centre (subject to re-zoning).

Areas of the final landform not amenable to one or more of these pursuits such as the quarry walls, benches and perimeter, would be revegetated with native tree, shrub and grass species. Trees would also be planted around the water storage dams retained in the final landform to create a natural shelter in the event stock may graze on the final landform.

2.13.4.2 Stage 5

Given its much smaller size, relative isolation from Stage 4 and proximity to Popran National Park, it is proposed the primary final land use for Stage 5 would be nature conservation. As described in Section 2.13.3.4, the final landform would be designed to hold water, making it available for fire suppression purposes and therefore very valuable locally, where such large storages of water are not currently available.

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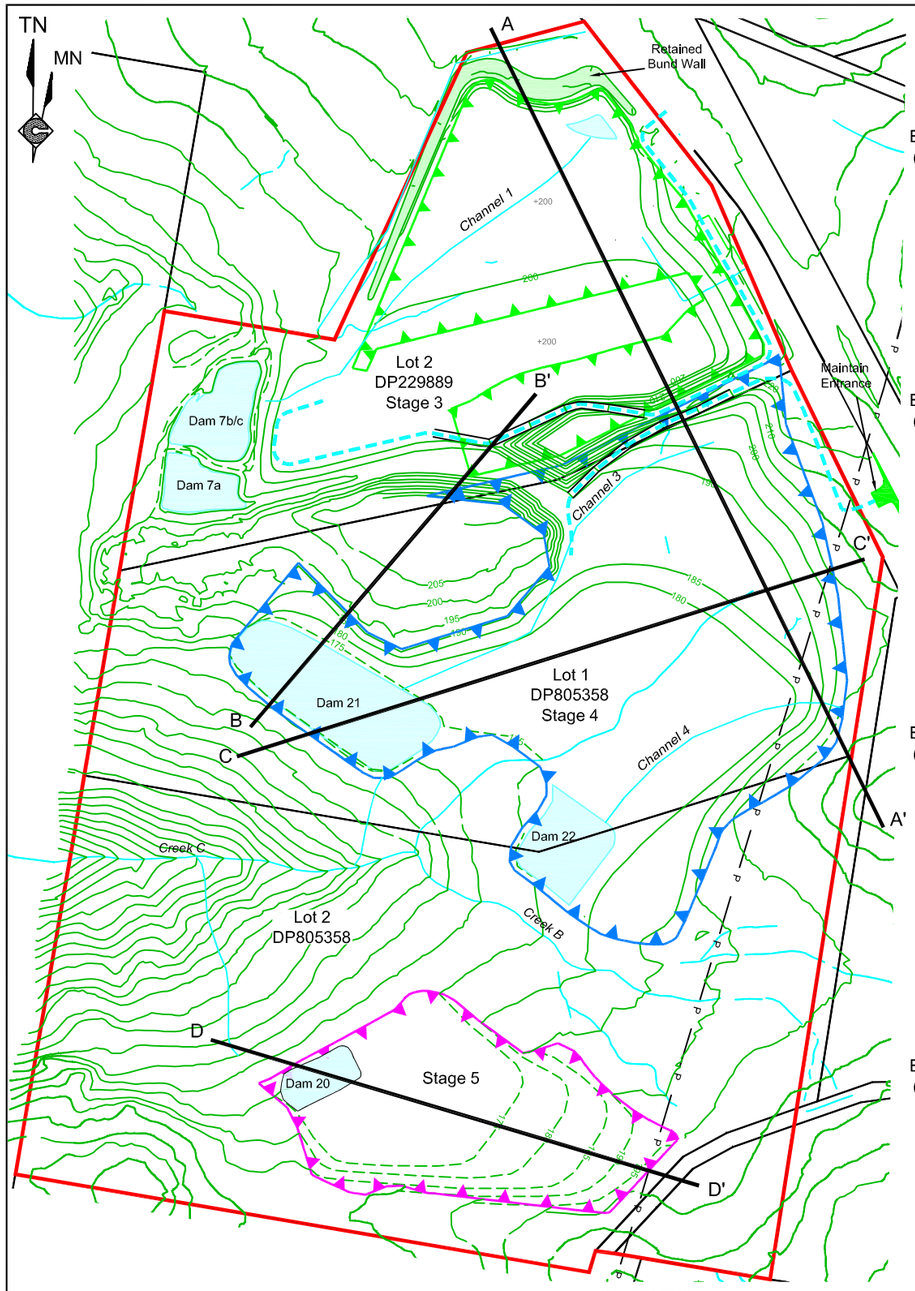

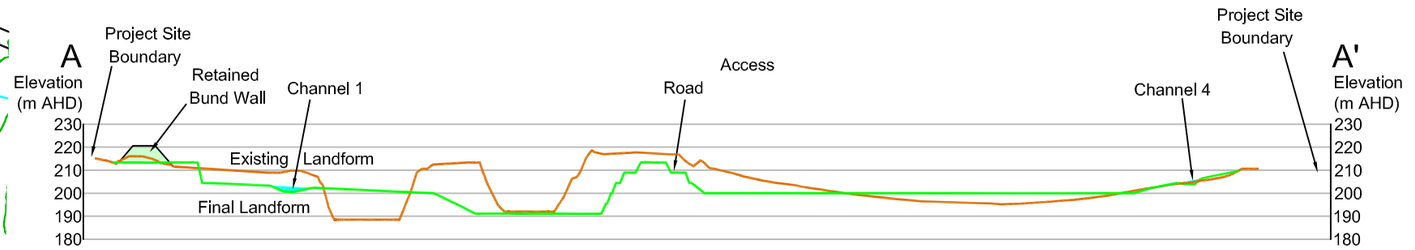

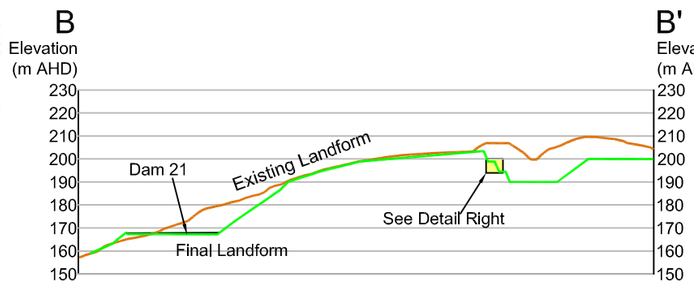

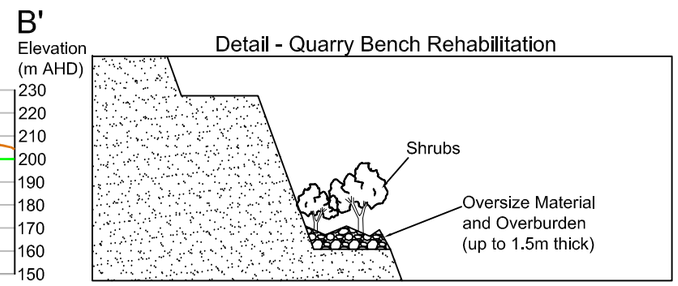

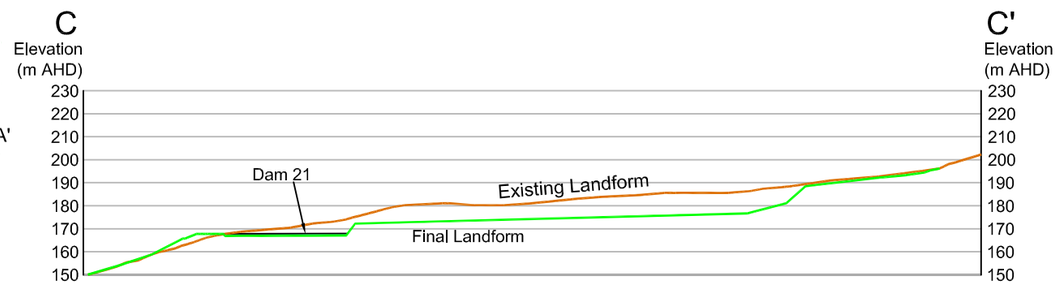

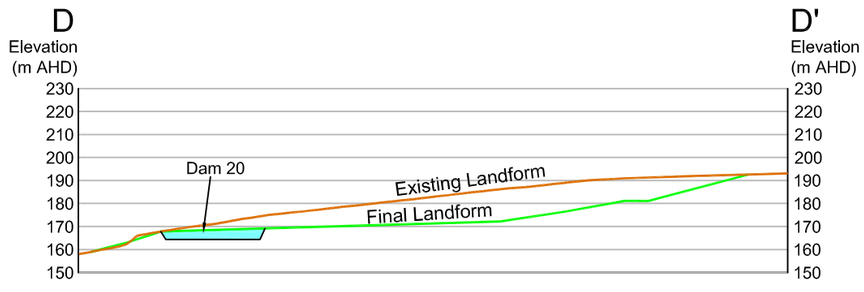

REFERENCE
- Project Site Boundary
- Internal Road
- Cadastral Boundary
- Existing Contour (m AHD)(Interval = 5m)
- Proposed Contour (m AHD)(Interval = 5m)
- Creek / Drainage Line
- Dam / Water Storage
- Sealed Road
- Unsealed Road / Track
- Power Line

PLAN SCALE 1:8 000
100 0 100 200 300 400 m

SECTION SCALE 1:6 000
(Vertical Exaggeration = 2)
100 0 100 200 300 m

Figure 2.13
FINAL LANDFORM
AND REVEGETATION

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2.13.4.3 Compliance with Strategic Land Uses Objectives

2.13.4.3.1 Draft Central Coast Regional Strategy

In recognition of the population and economic growth within the Central Coast region of NSW (stretching from Gwandalan and Doyalson in the north, to Patonga in the south and Bucketty and Mangrove Creek to the west), the draft Central Coast Regional Strategy (CCRS) was produced by the Department of Planning in 2006 for the period to 2031. The objective of the CCRS is to provide a framework for the continued development of the region's economy, infrastructure, transport systems and services without compromising the varied and important biodiversity values of the region. The proposed rehabilitation and final land uses of the Project Site are therefore required to comply with the strategic environmental and economic aims of the CCRS.

The CCRS recognizes the following key environmental challenges for the region, with a brief description of how the proposed final landform and land uses assist strategically in addressing each.

1. To provide a sustainable long-term water supply providing a balance between future development and important conservation values.

   The final landform proposed for the Project Site would include significant water storage areas which would benefit future land uses. Importantly, however, environmental flows (of both ground and surface water) would be maintained to Cabbage Tree Creek, such that the vegetation communities relying on this water supply would not be adversely affected.

2. To improve the identification, protection and enhancement of natural environments including significant biodiversity corridors, regionally significant vegetation, coastal lakes and estuaries, and landscape values.

   The vegetation of the Project Site has been mapped in detail with species, communities and habitats of particular conservation significance identified. The Project Site, in particular the Stage 5 extraction area, would be rehabilitated to re-establish the occurrence of these species, communities and habitats.

   The land use of the rehabilitated Stage 5 extraction area has been proposed as "nature conservation" and would be linked to areas of native vegetation protected either through a long-term conservation arrangement over the land or within the NSW National Parks system (Popran National Park).

3. To improve the understanding of Aboriginal cultural heritage values and incorporating this information within land use planning and natural resource management processes.

   The identified artefacts of Aboriginal heritage identified on the Project Site would be excluded from those areas disturbed throughout the life of the Project.

4. To accepting the value of rural lands as food-producing lands and ensuring the long term protection of these assets.

   The proposed use of the final landform for horticultural or agricultural industry indicates acceptance of the value of rural lands within the region and provides for the protection of these assets.

The CCRS also considers the evolution of the Central Coast economy and highlights that a key strategic issue for the region will be increasing the level of employment self-containment. The proposed final land use of the Project Site for high intensity horticultural or agricultural industries would meet the strategic requirements for development within the region with reference made to page 24 of the CCRS where it is written:

> *"Agriculture makes a significant contribution to the Central Coast's economy. Several agricultural activities have the potential to increase the Region's domestic and export markets, including horticulture, particularly the high technical area of commercial plant propagation. The main agricultural areas on the Central Coast such as the Central Coast plateaus and Wyong valleys have good access to supply fresh produce to local and Sydney markets."*

2.13.4.3.2 Popran National Park Plan of Management

A review of the Popran National Park Plan of Management identified the park is required to be managed in accordance with a number of general and specific objectives. Of relevance to the proposed final land use of the Project Site is the following specific management objectives:

> *"management of Popran National Park as part of a system of parks and reserves which together conserve the biodiversity and catchment values of the lower Hawkesbury River and provide a vegetation and wildlife link between the national parks to the east and west"*

By conserving significant areas of native vegetation on the Project Site (within a defined biodiversity offset area) and rehabilitating the Stage 5 extraction area for "nature conservation", the link between National Parks to the east and west would be maintained.

2.13.5 Rehabilitation Procedures

2.13.5.1 Introduction

Rocla has committed to a progressive rehabilitation program at the Calga Sand Quarry with the results of each years rehabilitation activity documented in an Annual Environmental Management Report.

The rehabilitation procedures to be adopted would vary depending on the nature of the disturbance, the final landform and the future land use. Given the different intended final land uses for Stages 3 and 4 compared with Stage 5, the rehabilitation procedures for the Project are described separately for Stages 3 and 4 (Section 2.13.5.2), and Stage 5 (Section 2.13.5.3).

The rehabilitation procedures provided in these sub-sections have intentionally been presented as a broad outline of the approach to be taken to the rehabilitation of each of these areas. The

specific timing, location and method of rehabilitation would continue to be documented in each Annual Environmental Management Report. Where appropriate, the necessity for refinements in rehabilitation procedures would be identified. These refinements would be regularly assessed in turn by Rocla in consultation with their rehabilitation consultants, Council and State government agencies.

2.13.5.2 Rehabilitation Procedures for Stages 3 and 4

The proposed final land use for the Stages 3 and 4 would be determined closer to completion of the Project, however, it is anticipated that it would suit some form of horticultural industry, sporting facility or bulky goods storage facility. The rehabilitation of Stages 3 and 4 has been designed with these targeted land uses in mind.

Procedures for the rehabilitation of earth bund walls, the extraction area perimeter, silt cells, quarry floor and extraction benches are described as follows.

2.13.5.3 Earth Bund Walls

A 5m high earth bund wall, topped by a 2m high colour bond fence, has been constructed around Stage 3 of the Calga Sand Quarry. A series of temporary earth bund walls (of 5m in height) would be constructed around the perimeter of each extraction stage within Stages 4 and 5. In all cases, the walls were, or are to be constructed to reduce the noise levels received at surrounding residences.

Vegetation on the Stage 3 bund wall, including grasses, native shrubs and tree saplings, is now well established. It is proposed therefore, to retain this earth bund wall, and the established vegetation, although the colour bond fence may be removed from the Stage 3 bund wall (if it can be done without adversely impacting the established vegetation).

The temporary bund walls constructed within the proposed limit of extraction would be removed and the material used for rehabilitation as Stage 4 is developed. The bund walls external to the extraction area would also be excavated with the material contained used for rehabilitating the completed sections of the quarry[5].

2.13.5.4 Extraction Area Perimeter

The quarry perimeter is effectively the area directly beyond the top of the terminal extraction faces. This includes any disturbed land either side of the earth bund walls described previously.

Where an external acoustic bund is excavated and used for silt cell capping or other rehabilitation purposes, up to 0.5m of subsoil (if available) and between 0.1m and 0.15m of topsoil would be spread. The area would be ripped and covered with vegetation mulch and where possible, covered with any broken tree trunks and branches cleared as part of pre-stripping activities. All activity would be aimed at minimising erosion whilst providing a suitable micro-climate for seed germination. Depending on the success of recolonisation by surrounding vegetation, the area may be hand seeded with local native species. Where

[5] A small portion of each bund may be retained to act as a safety bund around the sections of the final landform where quarry faces are to be retained.

appropriate, tubestock would generally be planted in a random pattern generally 1.5m apart with a slow release fertiliser tablet suitable for native vegetation placed into each tubestock hole.

In order to manage the revegetation of the extraction area perimeter, and all other components of the Project Site to be rehabilitated, procedures for the management of vegetation clearing, seed collection and revegetation would be prepared.

2.13.5.5 Silt Cells

As described in Section 2.6.4, the silt generated from the wash plant would be stored on the quarry floor in a series of silt cells. These cells would be between 10m and 12m deep and capped using overburden, clay/shale and/or oversize material from the extraction operation. Rocla proposes to progressively rehabilitate these cells in a sequence designed to be concurrent with the staged development extraction plan, documented in Section 2.3.3.

On completion of each cell, the silt would be allowed to dry and consolidate after which it would be capped with overburden and oversize material to a depth of up to 2.0m to stabilise the surface of each cell. As noted in Section 2.6.4, the overburden and oversize would be pushed in from the outside of each silt cell to progressively create a stable surface for further overburden and oversize placement.

After the silt cells are capped, and providing they are not required for any other land use, the capped surface would be covered with a layer of topsoil to a depth of up to 0.15m. Where practicable, this topsoil would be directly transferred from an active stripping area elsewhere within the Project Site. The topsoil would be ripped and revegetated to accommodate the planned future land use.

As illustrated on **Figure 2.13**, the final floor of the Stage 3 and 4 extraction areas would be gently to moderately sloped to the west or southwest. The consolidation and capping of the silt cells would retain this final slope to the west or southwest with the floor of the Stage 3 final landform merging with the sloping topography to the west. The depth of extraction within Stage 4 of the proposed Southern Extension, and lack of sufficient quantities of overburden and other waste materials to backfill the created void, prevents the creation of a similarly merged landform. Rather, a final face of approximately 10m to 13m in height would be retained at the extraction area perimeter surrounding the Aboriginal heritage site Calga SA1, i.e. northern extraction face of Stage 4/1, western extraction face of Stage 4/2 and southern extraction face of Stages 4/3 and 3/3b.

Extraction Area Floor

A large proportion of the extraction area floor would be covered by silt cells. In those areas where silt cells are not present, overburden, clay/shale and/or oversize material would be used to raise the elevation of the final landform to maintain the desired gently sloping land profile. If available, up to 0.5m of subsoil previously stripped from the extraction area would be placed over the profiled surface, followed by approximately 0.15m of topsoil which would be lightly ripped.

On preparation of the desired slope, final profiling activities would be completed over the entire extraction area floor to create the nominated drainage channels, which would eventually be

vegetated using native grass, shrub and tree species. These drainage channels would be constructed to prevent erosion of the soil spread over the final landform.

Final land use permitting, it is envisaged that the vegetation progressively established on the rehabilitated extraction area floor (including silt cells) would provide for bands of native vegetation interspersed with open areas that would be suitable for agricultural/horticultural use or as a sporting or recreational facility. The bands of native vegetation would generally be located along the alignment of recreated drainage lines, thereby maximising the potential successful establishment of the vegetation and providing natural erosion and sedimentation control within the drainage lines (see **Figure 2.13**).

Extraction Benches

Extraction benches would be retained along the northern perimeter of the Stage 3 extraction area, and eastern and southeastern perimeter of Stage 4. The rehabilitation of the extraction benches would involve the placement of up to 1.5m of oversize and overburden and the profiling of the placed material to ensure drainage flows toward the back of the bench and along to defined drop-down points. Straw and/or previously cleared vegetation mulch, would be used to cover the placed material and provide the ideal microclimate for hydro-seeding or hand seeding with the species currently used for revegetation and presented in **Table 2.8**. Planting would generally be undertaken in autumn to maximise the survival rates. These materials would be placed in the nominated location whilst access is available from the adjoining extraction floor prior to the removal of the material to create the nearby 70° face.

Table 2.8
Revegetation Species for Extraction Benches

Hardenbergia violaceae	*Banksia robur*	*Eucalyptus gummifera*
Kennedia rubicunda	*Banksia spinulosa*	*Eucalyptus haemostoma*
Acacia suaveolens	*Xanthorrea australis*	*Kunzea capitata*
Acacia terminalis	*Themeda australis*	*Kunzea ambigua*
Acacia ulicifolia	*Angophora costada*	*Kunzea parvifolia*
Banksia serrata	*Angophora hispida*	*Lomandra longifolia*
Banksia ericifolia	*Eucalyptus eximia*	

Source: Rocla Materials Pty Ltd 2003 and 2004 Plan of Management for the Calga Sand Quarry

2.13.5.6 Rehabilitation Procedures for Stage 5

The proposed final land use for Stage 5 would be nature conservation, and for eventual incorporation into the biodiversity offset area for the Project (see Section 2.14). The rehabilitation of Stage 5 has been designed with these targeted land uses in mind.

Procedures for the rehabilitation of the extraction area perimeter, quarry floor and extraction benches are described as follows.

2.13.5.7 Extraction Area Perimeter

The rehabilitation procedures would be the same as those to be implemented for Stages 3 and 4. That is, where a steep extraction face is retained, the overburden contained within the acoustic

bund would be excavated and used for rehabilitation of the extraction area, the perimeter would be ripped and the final slope reduced to approximately 1:3 (V:H). Subsoil (if available) and topsoil previously stockpiled on site would be placed to a depth of approximately 0.5m and 0.15m respectively and the area would be ripped and covered with straw, vegetation mulch or previously cleared and broken vegetation. Depending on the success of recolonisation by surrounding vegetation, the area may be hand seeded with local native species indicative of the surrounding environment. Where appropriate, tubestock would generally be planted in a random pattern typically approximately 1.5m apart with a slow release fertiliser tablet suitable for native vegetation placed into each tubestock hole.

Extraction Area Floor

Overburden, clay/shale and/or oversize material would be progressively placed on the floor of the completed extraction stages to create a gently sloping landform towards the final western face of the extraction area. If not provided by the extraction and fill activities, further excavation would be completed to construct the large dam proposed for the final landform of Stage 5.

The final landform would be profiled to create a main drainage line to this dam, with a topsoil layer of 0.15m spread over the profiled surface. The drainage line would be rock lined to prevent erosion of the soil and revegetated with native tree, shrub and grass species. Vegetation mulch, and broken vegetation stockpiled following the initial clearing activities over Stage 5, would be spread over the topsoil to encourage the natural regeneration of vegetation.

Depending on the success of vegetation regeneration and colonisation, the area would be selectively hand seeded with local native species indicative of the surrounding environment to achieve the required species diversity. Where appropriate, tubestock would generally be planted in a 1.5m grid pattern with a slow release fertiliser tablet suitable for native vegetation placed into each tubestock hole.

2.13.6 Decommissioning and Removal of Infrastructure

After the completion of the extraction and processing operations, all infrastructure would be removed from the Project Site. With the exception of the retained Stage 4 and Stage 5 Access Roads, all internal roads and tracks would be closed, cross-ripped and covered with previously cleared, broken and stockpiled vegetation.

2.13.7 Management of Weeds and Rehabilitation Monitoring

Rocla intends to maintain its current weed management strategy, which involves selective weed spraying programs, predominantly during the spring months.

Specific rehabilitation monitoring procedures and schedules would be included in a Vegetation Management Plan for the Project, however, Rocla notes that it would continue to use the services of a rehabilitation consultant to monitor the revegetation of completed areas of the quarry and the spread of noxious weeds.

Rocla would continue to document completed and planned rehabilitation work in each Annual Environmental Report.

2.14 BIODIVERSITY OFFSETS

2.14.1 Introduction

Biodiversity offsets represent a method by which an impact on biodiversity is compensated or "offset" by the conservation of similar biodiversity values elsewhere. There are currently no direct guidelines or criteria for designing and/or implementing a biodiversity offset strategy and therefore the style of offset may vary from direct conservation of native vegetation/habitat to contributions to ongoing conservation programs or research.

This notwithstanding, for the purposes of this *Environmental Assessment*, the proposed biodiversity offset has been considered against the guidelines for the assessment of biodiversity offset proposals in NSW provided in the *Principles for the use of Biodiversity Offsets in NSW* presented as Appendix II of the *Guidelines for Biodiversity Certification of Environmental Planning Instruments – Working Draft* published by the Department of Environment and Climate Change in April 2007 (DECC, 2007). DECC (2007) indicated that whatever form the offset takes, in order to adequately compensate for the disturbance, the offset must:

1. address impacts remaining after mitigation or prevention measures have been undertaken;
2. meet all regulatory requirements;
3. never reward ongoing poor performance;
4. complement other government programs such as national parks and reserves;
5. be underpinned by sound ecological principles;
6. aim to result in a net improvement in biodiversity over time;
7. be enduring, i.e. they must offset the impact of the development for the period that the impact occurs;
8. be agreed upon prior to the impact occurring;
9. be quantifiable, i.e. the impacts and benefits must be reliably estimated;
10. be targeted, i.e. they must offset the impacts on a "like for like or better" basis;
11. be located appropriately, i.e. they must offset the impact in the same region;
12. be supplementary, i.e. beyond existing requirements and not already funded by another scheme; and
13. be enforceable, i.e. through development consent conditions, licence conditions, covenants or a contract.

2.14.2 The Proposed Calga Biodiversity Offset Strategy

Figure 2.14 presents the proposed offset strategy for the proposed Southern Extension of the Calga Sand Quarry which would compensate for the Project-related disturbance by conserving vegetation and habitat of similar biodiversity value. In order to achieve an offset ratio of 3.4:1, Rocla initially proposes to include the Stage 5 extraction area as part of the offset for Stage 4, i.e. until a replacement area of suitable vegetation can be located and acquired. Approximately 56.0ha of the offset is to be provided by vegetation unaffected by the Project on the Project Site itself and will be set aside for permanent conservation purposes. It is proposed to supplement this vegetation with 41ha of native vegetation on the neighbouring "Glenworth Valley" property[6].

Table 2.9 presents a direct comparison of the vegetation to be disturbed and conserved, which ultimately provides an offset ratio of 3.4ha of conservation for every 1ha disturbed.

Table 2.9
Vegetation Clearance and Offsets

Page 1 of 2

	Vegetation Disturbance				Biodiversity Offset				
					On-site			Off-site	
Vegetation Community	**Stage 4**	**Stage 5**	**Access Roads**	**Total Area**	**North**	**South**	**East**	**Glenworth Valley#**	**Total Area**
E103 Gahnia-Banksia Swamp	0.4	0	0.0	**0.4**	0.0	0.0	0.0	0.0	**0.0**
E2 Sandstone Ranges Gully Rainforest	0	0	0.0	**0.0**	0.5	0.0	0.0	0.8	**1.3**
E20 Dharug Footslopes Apple Redgum Forest	0	0	0.0	**0.0**	0.0	0.0	0.0	3.3	**3.3**
E25 Hawkesbury Peppermint Apple Forest	0	0	0.0	**0.0**	11.3	0.0	0.0	19.2	**30.5**
E26 Exposed Hawkesbury Woodland	8.4	4.1	0.7	**13.2**	8.0	2.4	1.0	19.1	**30.5**
E26a Hawkesbury Rock Pavement Heath	0	0	0.0	**0.0**	0.9	0.1	0.0	0.8	**1.8**
E29 Hawkesbury Banksia Scrub-Woodland	8	3.1	0.4	**11.5**	0.1	0.3	4.0	0.0	**4.4**
E29a Hawkesbury Banksia Scrub-Woodland (Scrub)	4.4	4.2	0.0	**8.6**	2.5	0.0	0.0	0.0	**2.5**
E29b Hawkesbury Banksia Wet Scrub	1	0	0.1	**1.1**	0.0	0.0	0.0	0.1	**0.1**
E54 Sandstone Hanging Swamp	0	0	0.0	**0.0**	0.6	0.0	0.0	1.4	**2.0**
Xr Disturbed - Canopy Only	0.3	0	0.1	**0.4**	0.0	0.0	0.0	0.0	**0.0**
Xs Disturbed - Regrowth	2.1	0.1	0.6	**2.8**	0.1	0.0	0.0	0.0	**0.1**
Unmapped (exotics)	7.5	0.2	0.0	**7.7**	5.3	0.0	2.0	0.0	**7.3**
Total (ha)*	32.1	11.7	1.9	**45.7**	29.3	2.8	7.0	44.7	**83.8**
Total (native only)	22.2	11.4	1.2	**34.8**	23.9	2.8	5.0	44.7	**76.4**

[6] Rocla has an agreement with the owner of the "Glenworth Valley" property for the incorporation of the 41.0ha of native vegetation in the Project's Biodiversity Offset Strategy.

Table 2.9 (Cont'd)
Vegetation Clearance and Offsets

	Vegetation Disturbance			Biodiversity Offset			
				On-site		Off-site	
Vegetation Community	**Stage 4**	**Access Roads**	**Total Area**	**Areas to be Retained**	**Stage 5**	**Glenworth Valley**	**Total Area**
E103 Gahnia-Banksia Swamp **GWD**	0.4	0.0	**0.4**	0.0	0.0	0.0	**0.0**
E2 Sandstone Ranges Gully Rainforest **RS, LS, FGWD**	0.0	0.0	**0.0**	0.5	0.0	0.8	**1.3**
E20 Dharug Footslopes Apple Redgum Forest	0.0	0.1	**0.1**	0.0	0.0	3.2	**3.2**
E25 Hawkesbury Peppermint Apple Forest **LS**	0.05	0.5	**0.55**	11.3	0.0	18.8	**30.1**
E26 Exposed Hawkesbury Woodland **LS**	7.2	1.1	**8.3**	19.9	3.0	15.8	**38.7**
E26a Hawkesbury Rock Pavement Heath **LS**	0.0	0.0	**0.0**	1.0	0.0	0.9	**1.9**
E29 Hawkesbury Banksia Scrub-Woodland **LS**	9.5	0.5	**10.0**	9.6	2.8	0.0	**12.4**
E29a Hawkesbury Banksia Scrub-Woodland (Scrub)	4.6	0.1	**4.7**	4.4	3.1	0.0	**7.5**
E29b Hawkesbury Banksia Wet Scrub	1.0	0.1	**1.1**	0.1	0.0	0.1	**0.2**
E54 Sandstone Hanging Swamp **RS, LS, GWD**	0.0	0.0	**0.0**	0.0	0.0	1.4	**1.4**
Xr Disturbed- Canopy Only	0.3	0.1	**0.4**	0.0	0.0	0.0	**0.0**
Xs Disturbed - Regrowth	2.0	0.8	**2.8**	0.2	0.1	0.0	**0.3**
Unmapped (exotics)	4.55	0.2	**4.75**	3.9	0.7	0.0	**4.6**
Total (ha)*	**29.6**	**3.5**	**33.1**	**50.9**	**9.7**	**41.0**	**101.6**
Total (native only)	**25.05**	**3.3**	**28.35**	**47.0**	**9.0**	**41.0**	**97.0**
Offset: Clearing Ratio 101.6ha:28.35ha				**3.42**			

* Excludes unmapped vegetation

\# Does not include the areas of the "Glenworth Valley" property within the nominated access road corridor

Note: RS – denotes communities regarded as Regionally Significant
LS – denotes communities regarded as Locally Significant
GWD – denotes communities regarded as Groundwater Dependent
FGWD – denotes communities regarded as Facultative Groundwater Dependent
East – refers to Southeast and Northeast Offset Areas
West – refers to West and Southwest Offset Areas

The adequacy of the proposed Calga Biodiversity Offset Strategy against the 13 guiding principles of biodiversity offsets of DECC (2007) is recorded in the document entitled "Biodiversity Offset Strategy – Calga Sand Quarry Southern Extension – prepared by Cumberland Ecology (May 2012).

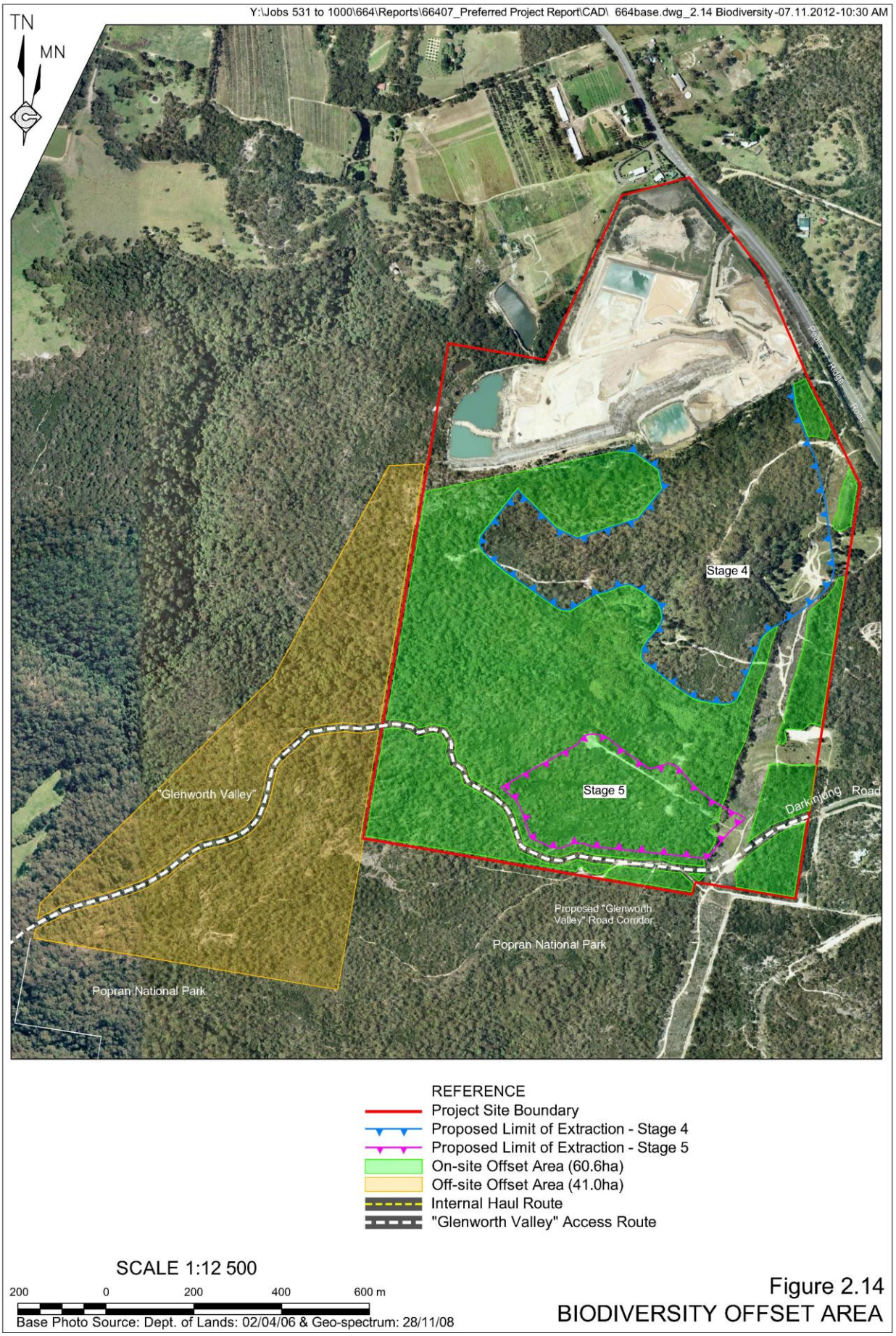

Figure 2.14
BIODIVERSITY OFFSET AREA