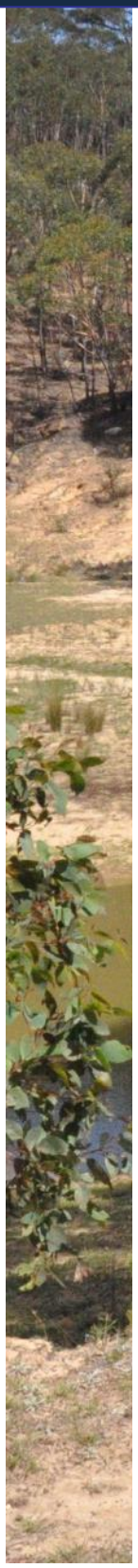
Section 2



Description of the Proposal

Preamble

This section outlines the Applicant's objectives and plans for the proposed development and operation of the Sutton Forest Sand Quarry. The sand resource is described and the proposed extraction operation, its sequence and processing activities are detailed together with the planned product transportation. This section also describes the Proposal with respect to hours of operation, infrastructure and services, site security, waste management and rehabilitation.

The Proposal is described in sufficient detail to provide the reader with an overall understanding of the nature and extent of the activities proposed, how the various activities would be undertaken and to enable an assessment of the potential impacts of the Proposal on the surrounding environment.

Details of the safeguards and mitigation measures that the Applicant would implement to protect and manage traffic, noise, groundwater, surface water, flora, fauna, air quality, visibility, Aboriginal cultural heritage, soils and other components of the local environment are presented in Section 5 of this document.

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2.1 INTRODUCTION

2.1.1 Objectives

The Applicant's principal objectives for the Proposal centre upon:

i) securing access to a long-term sand resource that would provide a range of construction materials to the Sydney, Illawarra, Southern Highlands and Canberra construction markets at a market-competitive price;

ii) supplying up to 860 000 tonnes per annum (tpa) of sand products to meet the increasing supply demands of these markets over the next 30 years and beyond, particularly as production is reduced or ceases at other existing sand sources;

iii) maximising the recovery of the regionally significant friable sandstone resources in the Penrose-Wingello area;

iv) progressively rehabilitating disturbed areas to provide for future agricultural and nature conservation land uses at the completion of operations;

v) increasing local employment levels; and

vi) operating the Quarry in a cost efficient and environmentally responsible manner.

The sand products produced would contribute towards meeting the predicted requirements for this important construction material for the building and construction industry in the southern and western sectors of the Sydney Metropolitan Area, the Illawarra, Southern Highlands, Canberra and surrounding areas. These broad objectives would be achieved by:

i) planning, extracting and processing the sand resource in a manner that maximises the quality and quantity of materials removed;

ii) undertaking all activities in an environmentally responsible manner that enables compliance with all relevant statutory requirements;

iii) planning and operating all activities in consultation with surrounding residents, businesses and the wider community; and

iv) monitoring and reviewing the operational and environmental performance of all activities.

2.1.2 Overview of the Proposal

The proposed extraction and processing areas, as shown on **Figure 2.1**, have been defined based upon the occurrence of friable sandstone within the Quarry Operations Area, and taking advantage of the local topography that would provide long term protection to control the propagation of noise to the south and limit the visibility of operational areas from the adjoining properties and the Hume Highway. An estimated 34 million tonnes of friable sandstone has been defined within the proposed extraction area and the footprint of the processing and stockpiling area. This resource is capable of yielding approximately 29 million tonnes of high quality sand products. Negligible overburden is present within the proposed extraction area as the friable sandstone in a number of areas lies directly beneath the soil.

A fixed wash plant and two mobile screening plants would be used to process the extracted raw sand to produce high quality sand products meeting nominated Australian Standards and customers' individual specifications. The principal products produced would be various grades of washed concrete sand and mortar (brickie's) sands. The fixed wash plant would be used to produce concrete sand and blended products whereas the mobile screening plants would be used to produce brickie's sand products.

The sand extraction and processing operations have been designed to optimise the recovery of sand whilst satisfying both site and surrounding environmental constraints and progressively backfilling the extraction void with the residual fines from the processing operations together with Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM) to create a free draining final landform with features that would support the ongoing agricultural and nature conservation land uses.

Figure 2.1 displays the following principal components of the Proposal.

- An extraction area covering approximately 47ha with its footprint typically between 660m AHD and 700m AHD.
- A processing and stockpiling area covering approximately 12ha incorporating a fixed wash plant involving crushing, screening, washing, dewatering and product stockpiling beneath radial and fixed stackers.
- Two mobile brickie's sand plants would ultimately be located within the northern part of the processing and stockpiling area and/or close to the active extraction area.
- A temporary topsoil and mulch stockpile area within the footprint of the extraction area for the storage of topsoil recovered from the early extraction stages and mulched timber from the areas cleared.
- Two fines storage areas to contain fines produced from the sand washing process during the first three stages of extraction.
- Two water storage dams located to the east and west of the processing and stockpiling area to provide water for dust suppression as well as a supplementary supply for the wash plant.
- A diversion drain along the southern boundary of the proposed Quarry Operations Area to divert runoff away from operational areas and capture for reuse in processing and dust suppression.
- The site weighbridge and office would be positioned adjacent to the processing and stockpiling area. One weighbridge would be constructed initially with provision for a second weighbridge, as production ramps up in the future.

The overall operational footprint would be kept as small as practicable and ultimately rehabilitated to provide for ongoing agricultural land uses and long-term nature conservation and wildlife corridor values within the local area.

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TN
MN

Long Swamp Creek
Watercourse A
See Figure 2.9
Watercourse B
Watercourse C
Watercourse D
Sediment Dam A
Sediment Dam B
Sediment Dam C
Extraction Area
Fines Storage Area 1
Fines Storage Area 2
Water Storage Dam A
Water Storage Dam B
Brickie's Sand Production Area
Bore 1
Bore 2
Weighbridge
Workshop
Wash Plant
Northeastern Barrier
Product Stockpile Area
Eastern Barrier
Southern Barrier
Temporary Topsoil and Mulch Stockpile Area
Primary Raw Feed Stockpile
Header Water Tank
Pipe
Meteorological Station
Quarry Access Road
High Pressure Gas Pipelines
Water Pipeline
Highway
Northbound On-ramp
Entry to Penrose Forest Way
Southbound Off-ramp
Hume
Overbridge

REFERENCE

- Site Boundary
- Quarry Operations Area Boundary
- Cadastral Boundary
- 700 Contour (m AHD)(Interval = 10m)
- Watercourse
- Meteorological Station
- Bore 1 Production Bore
- G High Pressure Gas Pipelines
- P Power Line
- Water Pipeline

Proposed Activities

- Limit of Extraction
- Quarry Access Road
- Quarry Interchange
- Internal Road
- Access Road
- Diversion Drain
- Processing & Stockpiling Area
- Barrier
- Water Storage / Sediment Dam
- Fines Storage Area
- Mulch and Topsoil Stockpile Area

SCALE 1:8 000 (A3)

100 0 100 200 300 400 m

Cadastral Boundary Source: © NSW Department of Finance and Services Panorama Avenue Bathurst NSW 2795 www.lpi.nsw.gov.au
Base Photography Source: LPI - 13 December 2013

Figure 2.1
INDICATIVE SITE LAYOUT

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Access to and from the Quarry Operations Area would be from the Hume Highway via the Quarry Interchange and Quarry Access Road displayed on **Figure 2.1**. Product despatch would involve the use of mainly Quad-dog trucks as well as other configurations.

At maximum production, it is proposed that products despatched from the Quarry would approach 860 000tpa. However, production during the initial stages of extraction would be lower and would increase over time to satisfy market demand.

The defined sandstone resource would be extracted in a staged manner, i.e. over eight extraction stages (Stages 0 to 7). The development consent currently being sought would enable extraction of the resource until Year 30. Assuming the predicted rate of extraction is maintained, extraction Stage 5 would be completed by Year 30. The completion of the subsequent extraction stages (Stages 6 and 7) would require an additional development consent beyond Year 30.

The information presented in the following sections presents details relating to the entirety of the proposed development so that the reader may develop an understanding of the Applicant's objectives and plans for the life of the Proposal, from site establishment and construction through to closure.

2.1.3 Approvals Required

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

1. Approval from the Minister for Planning, his or her delegate or the Independent Planning Commission as the Proposal has been classified as a "State Significant Development" under Schedule 1 (7(a)) of the *State Environmental Planning Policy (State and Regional Development) 2011*.

   The Applicant recognises that two development applications would be required for the overall Proposal. The first would be an application for extraction, processing and product despatch for a period of 30 years and commencement of backfilling the extraction void with imported VENM and ENM.

   The second application would be submitted towards the end of the initial 30 year period for ongoing extraction, processing and product despatch for a period of approximately 15 years and completion of backfilling over a further 5 years with imported VENM and ENM.

   This approach is necessary as NSW Government Policy is not to issue a development consent for a State Significant Development for in excess of 30 years.

   Should the second application not proceed, backfilling of the extraction void with imported VENM and ENM may continue beyond the initial 30 years consistent with approved rehabilitation plan. This is common practice for modern development applications.

2. An Environment Protection Licence from the Environment Protection Authority, under Section 47 of the *Protection of the Environment Operations Act 1997* for land-based extractive activities.
3. A water access licence from the Department of Industry – Crown Lands and Water under the *Water Management Act 2000* to account for the in-flow of groundwater during the sand extraction operations.
4. A water access licence from the Department of Industry – Crown Lands and Water under the *Water Management Act 2000* for the pumping of water from groundwater for use on site.
5. A Section 138 Permit from the Wingecarribee Shire Council or the Roads and Maritime Services under the *Roads Act 1993* for the roadworks within the public road network near the proposed Quarry Access Road and Quarry Interchange.

2.2 GEOLOGY AND RESOURCE ASSESSMENT

2.2.1 Regional Setting

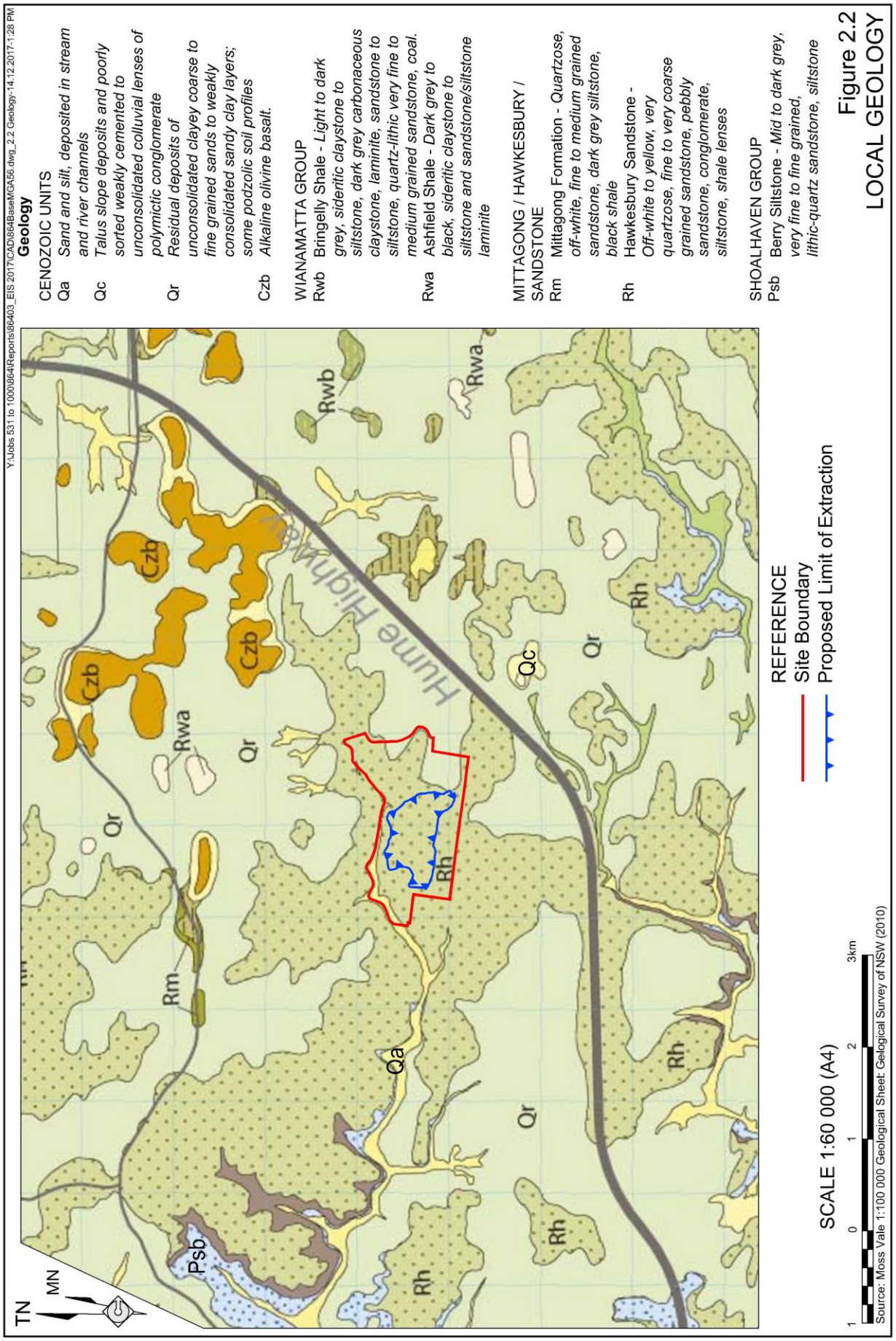
The sand resources beneath the Quarry Operations Area are located within the Hawkesbury Sandstone, a unit deposited during the Triassic Period (195 to 225 million years ago). The Hawkesbury Sandstone is the predominant sandstone unit outcropping within and around Sydney. It is noted that the Quarry Operations Area is located close to the southwestern extremity of the outcrop of the Hawkesbury Sandstone (see **Figure 2.2**) in an area identified as regionally significant by MacRae and Ferguson (1994) for the supply of sand for the Sydney construction industry, particularly given the access to the resources provided by the Hume Highway. The sandstones in the Penrose and Wingello area are sufficiently friable such that the sand grains are relatively easily disaggregated through a combination of extraction and processing operations. The considerable depth of the friable sandstones and the size gradings in the Quarry Operations Area supports its consideration as a regionally significant resource area.

2.2.2 Site Geology

Based on the results of the on-site drilling program comprising five diamond drill holes and four open holes, the Hawkesbury Sandstone beneath the Quarry Operations Area comprises friable, variously pale-coloured sandstones and clayey sands, and thin pale greyish coloured clay, with darker shale interbedded at approximately 650m AHD. The darker shale units encountered do not display significant lateral extent, reflecting a localised and lensoidal nature of the shale unit that is interpreted as being formed by a meandering watercourse.

Apart from the interbedded shale, the Hawkesbury Sandstone resource within the proposed extraction area generally displays a vertically continuous sandstone sequence. A coarse-grained sandstone and pebble conglomerate is present at the base of the Hawkesbury Sandstone which in turn is underlain by the Permian Berry Formation.

Figure 2.3 displays the locations of the nine holes drilled for the resource evaluation together with the lithology based upon the observations during resource drilling. It is noted from **Figure 2.3** that the friable sandstone targeted for extraction occurs across the entire extraction area.


Y:\Jobs 531 to 1000\864\Reports\86403_EIS 2017\CAD\864BaseM\GA56.dwg_2.2 Geology-14.12.2017-1:28 PM
Geology
CENOZOIC UNITS
Qa Sand and silt, deposited in stream and river channels
Qc Talus slope deposits and poorly sorted weakly cemented to unconsolidated colluvial lenses of polymictic conglomerate
Qr Residual deposits of unconsolidated clayey coarse to fine grained sands to weakly consolidated sandy clay layers; some podzolic soil profiles
Czb Alkaline olivine basalt.
WIANAMATTA GROUP
Rwb Bringelly Shale - Light to dark grey, sideritic claystone to siltstone, dark grey carbonaceous claystone, laminite, sandstone to siltstone, quartz-lithic very fine to medium grained sandstone, coal.
Rwa Ashfield Shale - Dark grey to black, sideritic claystone to siltstone and sandstone/siltstone laminite
MITTAGONG / HAWKESBURY / SANDSTONE
Rm Mittagong Formation - Quartzose, off-white, fine to medium grained sandstone, dark grey siltstone, black shale
Rh Hawkesbury Sandstone - Off-white to yellow, very quartzose, fine to very coarse grained sandstone, pebbly sandstone, conglomerate, siltstone, shale lenses
SHOALHAVEN GROUP
Psb Berry Siltstone - Mid to dark grey, very fine to fine grained, lithic-quartz sandstone, siltstone
Figure 2.2
LOCAL GEOLOGY
Hume Highway
Czb
Rwa
Rwb
Qr
Rm
Qa
Rh
Qc
Psb
TN
MN
REFERENCE
Site Boundary
Proposed Limit of Extraction
SCALE 1:60 000 (A4)
1 0 1 2 3km
Source: Moss Vale 1:100 000 Geological Sheet: Gelogical Survey of NSW (2010)

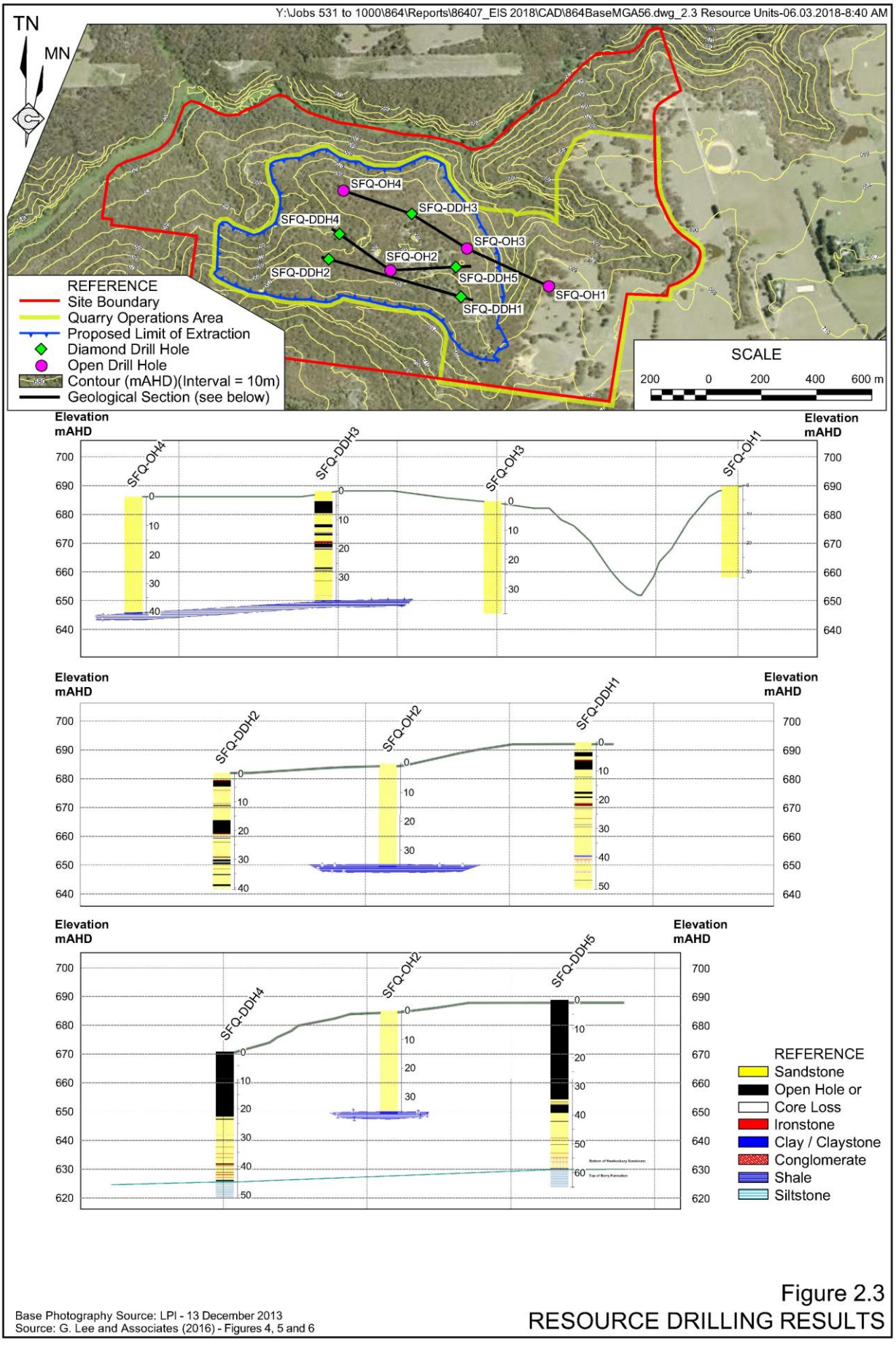


Figure 2.3
RESOURCE DRILLING RESULTS

Base Photography Source: LPI - 13 December 2013
Source: G. Lee and Associates (2016) - Figures 4, 5 and 6

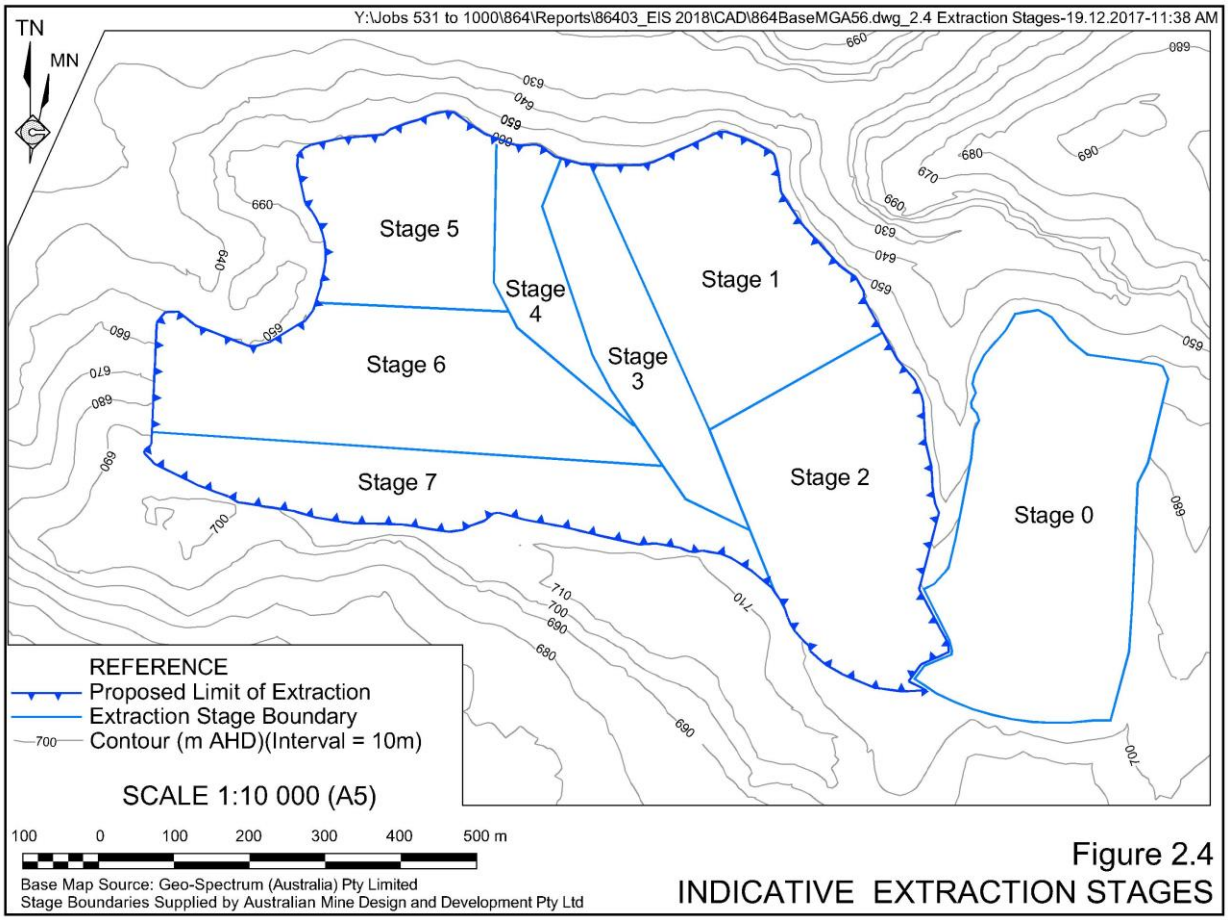
2.2.3 Resource Assessment

GLA (2016) has established that the quantity of recoverable friable sandstone within the defined processing and stockpiling area and extraction area is approximately 34 million tonnes (excluding shale, ironstone and clay).

Approximately 1.7 million tonnes of friable sandstone is present within the footprint of the processing and stockpiling area (Stage 0) and 32.5 million tonnes of friable sandstone is present within seven stages in the extraction area (displayed in **Figure 2.4**). A breakdown in the quantity of friable sandstone in each extraction stage is presented in **Table 2.1**.

Table 2.1
Estimated Friable Sandstone Resources

Stage*	Friable Sandstone Resources (Mt)
0	1.7
1	0.5
2	6.4
3	6.3
4	1.4
5	4.8
6	7.6
7	5.5
Total	**34.2**
* see **Figure 2.4**	



2.3 SITE LAYOUT

Figure 2.1 displays the locations of the main components within the Site. The environmental and social factors that were considered during the design for each of the main components are outlined as follows. Reference is provided to the relevant subsection(s) of this document that provide further information on these components.

1. Extraction Area (47ha) (Section 2.5)

   The extraction area is centred on the friable sandstone resource defined through the resource assessment with its boundaries located to limit off-site runoff.

2. Processing and Stockpiling Area (12ha) (Sections 2.6.2 and 2.6.3)

   The processing and stockpiling area is located predominantly in a cleared area and close to the extraction area to minimise haulage of raw feed from the extraction area.

3. Water Storage Dams (1.2ha) (Section 2.9.4)

   Two water storage dams are located adjacent to the processing and stockpiling area to provide both a repository for sediment-laden runoff from respective parts of the processing and stockpiling area and storage for excess water from the various dams within and beyond the Quarry Operations Area.

4. Fines Storage Areas (4.8ha) (Section 2.7.3)

   Fines Storage Area 1 (4.8ha) is located largely in a cleared area surrounded by tall vegetation to visually shield the stored fines. Fines Storage Area 2 is located within the extraction area, in the area to be developed in Stage 4, i.e. in an area that would not require the relocation of the fines until about Year 20 of the Quarry. The location of Fines Storage Area 2 within the extraction area would avoid the need to place the fines in an area requiring clearing of native vegetation or used for agricultural purposes by the landowner.

5. Topsoil and Mulch Stockpile Area (Section 2.5.3.3)

   The topsoil and mulch stockpile area is located within the extraction area in the area to be developed in Stage 6. Its location would also avoid the need to stockpile soil or mulch in an area requiring clearing of native vegetation or used for agricultural purposes by the landowner.

6. Northeastern, Eastern and Southern Barriers (2.3ha) (Section 2.4.8)

   The barriers would be located in the nominated locations principally to provide an acoustic barrier for traffic noise (northeastern barrier), noise from the wash plant (southern barrier) and noise and visibility of activities within the processing and stockpile area (eastern barrier). The southern barrier would effectively infill a depression south of the wash plant that could enable noise to be focussed in that direction.

7. Quarry Access Road (3.2ha) (Section 2.4.5)

   The Quarry Access Road is approximately 1.4km in length and follows a practical alignment for trucks travelling along the road between the weighbridge within the Quarry Operations Area and the Quarry Interchange. The Quarry Access Road comprises a dual lane section of road west of the overbridge section of the Quarry Interchange.

8. Quarry Interchange (2.4ha) (Section 2.4.6)

   The proposed Quarry Interchange would link the Quarry Access Road to the Hume Highway providing access and egress from the Site via the Hume Highway. The Quarry Interchange would comprise three single lane sections of road as follows.

   – The southbound off-ramp, comprising a single lane, grade-separated exit from the southbound lanes of the Hume Highway for vehicles accessing the Site. The southbound off-ramp would also provide access to the residences situated on Lot 12 DP241054 and Lots 3 and 4 DP253435, southbound vehicles accessing the Kingsbury VC Rest Area and Penrose Forest Way.

   – The northbound on-ramp, comprising a single lane, at-grade entry to the northbound lanes of the Hume Highway for all vehicles exiting the Site and the residences situated on Lot 12 DP241054 and Lots 3 and 4 DP253435.

   – The overbridge, comprising a single lane, two span overbridge over the Hume Highway and linking the southbound on-ramp with the Quarry Access Road for vehicles entering the Site and accessing the residences situated on Lot 12 DP241054 and Lots 3 and 4 DP253435.

9. Various Water Management Structures

   A range of sediment dams, diversion dams and related structures would be positioned close to the proposed areas of activity that would generate sediment-laden runoff.

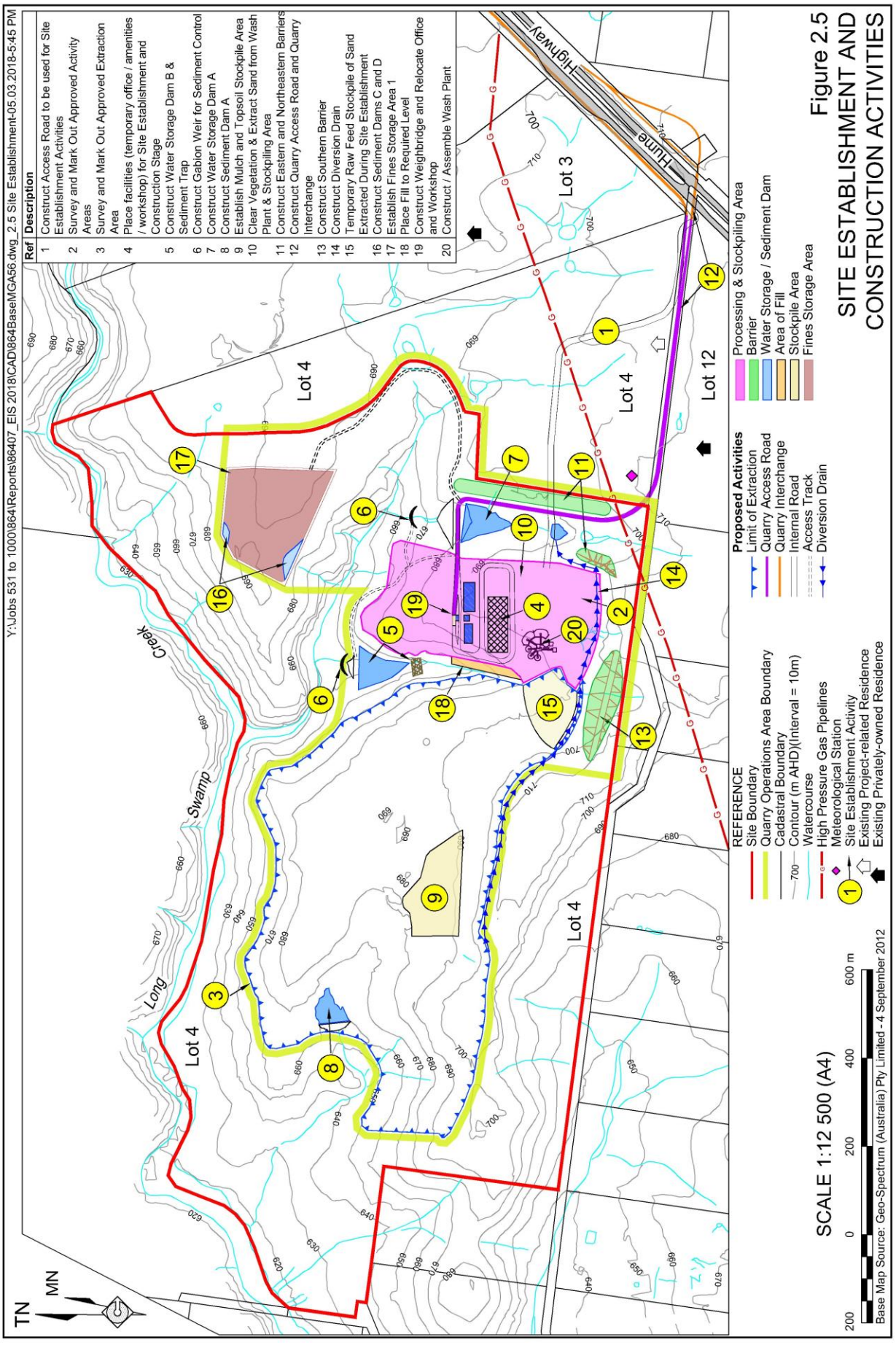
Further discussion about the environmental and social factors that were taken into account during the design of the Proposal are presented in Section 7.2.1.

Overall, the indicative combined area of disturbance within the Site after 30 years of operation would be approximately 75ha with approximately 63.2ha of remnant or regenerating native vegetation removed.

2.4 SITE ESTABLISHMENT AND CONSTRUCTION STAGE

2.4.1 Introduction

During the first 12 months following project commencement, a range of site establishment and construction activities would be undertaken to enable sand production to commence. A total of 20 site establishment and construction activities and their locations are displayed on **Figure 2.5**. The activities listed on **Figure 2.5** are generally arranged in the order in which they would be undertaken, although some activities may be undertaken concurrently and/or involve the commencement of preliminary works earlier in the site establishment and construction stage.


Y:\Jobs 531 to 1000\864\Reports\86407_EIS 2018\CAD\864BaseMGA56.dwg_2.5 Site Establishment-05.03.2018-5:45 PM
Ref Description
1 Construct Access Road to be used for Site Establishment Activities
2 Survey and Mark Out Approved Activity Areas
3 Survey and Mark Out Approved Extraction Area
4 Place facilities (temporary office / amenities / workshop) for Site Establishment and Construction Stage
5 Construct Water Storage Dam B & Sediment Trap
6 Construct Gabion Weir for Sediment Control
7 Construct Water Storage Dam A
8 Construct Sediment Dam A
9 Establish Mulch and Topsoil Stockpile Area
10 Clear Vegetation & Extract Sand from Wash Plant & Stockpiling Area
11 Construct Eastern and Northeastern Barriers
12 Construct Quarry Access Road and Quarry Interchange
13 Construct Southern Barrier
14 Construct Diversion Drain
15 Temporary Raw Feed Stockpile of Sand Extracted During Site Establishment
16 Construct Sediment Dams C and D
17 Establish Fines Storage Area 1
18 Place Fill to Required Level
19 Construct Weighbridge and Relocate Office and Workshop
20 Construct / Assemble Wash Plant
Lot 4
Lot 3
Lot 12
Highway
Hume
Creek
Swamp
Long
Proposed Activities
Limit of Extraction
Quarry Access Road
Quarry Interchange
Internal Road
Access Track
Diversion Drain
Processing & Stockpiling Area
Barrier
Water Storage / Sediment Dam
Area of Fill
Stockpile Area
Fines Storage Area
REFERENCE
Site Boundary
Quarry Operations Area Boundary
Cadastral Boundary
Contour (m AHD)(Interval = 10m)
Watercourse
High Pressure Gas Pipelines
Meteorological Station
Site Establishment Activity
Existing Project-related Residence
Existing Privately-owned Residence
TN
MN
SCALE 1:12 500 (A4)
200 0 200 400 600 m
Base Map Source: Geo-Spectrum (Australia) Pty Limited - 4 September 2012
Figure 2.5
SITE ESTABLISHMENT AND CONSTRUCTION ACTIVITIES

The principal activities to be undertaken during this stage would be as follows.

i) The marking out of all component areas to be disturbed during the site establishment and construction stage.

ii) Vegetation clearing and soil removal within the approved areas for buildings, Quarry Access Road, Quarry Interchange, internal roads, part of the processing and stockpiling area, Fines Storage Area 1, Sediment Dams A, B and C, Water Storage Dams A and B and the southeastern section of the Stage 1 extraction area. Vegetation clearing and stockpiling of soils would also be undertaken within an area set aside within the extraction area.

iii) Extraction and stockpiling of friable sandstone from the footprint of part of the processing and stockpiling area to allow for the construction of the wash plant. Some minor fill would also be placed to establish a suitable level area.

iv) Bulk earthworks to create the northeastern, eastern and southern barriers.

v) The construction of the Quarry Access Road and Quarry Interchange.

vi) Construction and assembly of the wash plant.

vii) Construction of the water storage dams and a range of water management structures.

viii) Construction of the weighbridge, temporary site offices, workshop and amenities adjacent to the processing and stockpiling area.

Access to the Site from the Hume Highway during the site establishment and construction stage would be via the existing entrance to Lot 4 DP253435, as displayed on **Figure 2.5**. Details of the traffic generated during the site establishment and construction stage is outlined in Section 2.8.1.

Despatch of sand products would begin once the weighbridge and required facilities have been constructed (Activity viii above) which is estimated to occur approximately 12 months after project commencement. Sand products despatched would initially comprise sand extracted from the footprint of the processing and stockpiling area that is not required for ongoing site establishment activities.

2.4.2 Component Mark Out

Prior to commencing any vegetation clearing or earthworks, the Applicant would commission a surveyor to identify the boundaries of the key component areas within the Site and position substantive posts (painted) to record key locations. Posts would be positioned at corners of all component areas and along boundaries at a distance / spacing that allows visibility of the next post. Each of the surveyed locations would be located on all relevant plans / figures within the Environmental Management Plans and Sub-plans, etc. prepared for the Proposal.

2.4.3 Vegetation Clearing

Vegetation clearing in areas to be developed during the site establishment and construction stage would be either chainsaw felled or cleared using a bulldozer. The opportunity for the collection of available seed for rehabilitation purposes would occur immediately after the

vegetation is felled. A number of the small tree limbs and tree trunks would be set aside within designated areas within the extraction area 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 used for agricultural activities (e.g. fence posts), cut into manageable log lengths or mulched/chipped for future internal or external use and preferentially stockpiled within the area set aside within the extraction area for temporary topsoil and mulch storage.

Understorey vegetation such as grasses, low shrubs and forbs would be retained in combination with the soil resources in each area being prepared for sand extraction and stockpiled for future rehabilitation activities. These materials would ultimately be placed onto areas of the final landform requiring revegetation.

2.4.4 Soil Removal

The soil in each area cleared of its vegetation during the site establishment and construction stage would be stripped following removal of the larger vegetation. The Applicant would remove approximately 0.2m of topsoil, where present, focusing upon the recovery of the seed-bearing material.

The topsoil recovered from the processing and stockpiling area would be preferentially used to stabilise the constructed / filled slopes on the margins of the processing and stockpiling area and the adjacent barriers.

The Applicant would remove topsoil from within the footprint of the Quarry Access Road alignment and place it on constructed roadside batter slopes.

All excess topsoil recovered from the areas disturbed during the site establishment and construction stage would be placed within the mulch and topsoil stockpile area for future use in rehabilitation activities.

Further details on the soil stockpiling practices are included in Section 5.10.9.

2.4.5 Quarry Access Road Construction

The Quarry Access Road would be constructed from within the Quarry Operations Area advancing in a southerly direction towards the boundary of the Quarry Operations Area before turning east towards the Quarry Interchange and the Hume Highway. All construction would be undertaken by a contractor who would be required to undertake all activities in accordance with the approved Erosion and Sediment Control Plan.

The Quarry Access Road would be constructed with a 7.5m wide sealed pavement with 0.75m wide shoulders. Local widening would be used to accommodate the out-bound and in-bound lane separation and U-turn bay. Whilst all opportunities would be taken to utilise topography, cut sections would be utilised ,where suitable, to maximise natural attenuation of road traffic noise. Any cut and fill batters would typically be 1:4 (V:H).

An acoustic barrier would be constructed/erected adjacent to the Quarry Access Road to limit traffic noise at the residences on Lot 12 DP241054 and Lot 4 DP253435. The barrier (a fence or combination of an earthen bund and fence) would be constructed to achieve an effective height of approximately 3.8m above the road surface.

The emphasis in the construction of the Quarry Access Road would be upon:

1. positioning the road to minimise the extent of tree removal yet retaining a suitable horizontal alignment;
2. optimising cut sections where suitable to maximise noise attenuation through design;
3. minimising fill yet retaining a suitable vertical alignment.

Once the full length of the Quarry Access Road is constructed, the road surface would be formed using appropriate road pavement materials and sealed. Asphalt may be used on specific sections of the road, subject to detailed design. The exact timing of the road sealing would be determined in conjunction with the program for the construction and sealing of the new roadworks associated with the Quarry Interchange.

2.4.6 Quarry Interchange

The site establishment works would include construction of the Quarry Interchange and involve the construction of the following components.

- Construction of the southbound off-ramp and approach to the overbridge. This would also include modifications to the arrangements for southbound vehicles entering the Kingsbury VC Rest Area and Penrose Forest Way.
- Construction of a single lane, two span overbridge crossing the Hume Highway. Works would include construction of piers and abutments.
- Construction of a northbound on-ramp to enable trucks exiting the Quarry Access Road to enter the northbound lanes of the Hume Highway at a suitable speed so as not to disrupt traffic flow. This would also include installation of signage on the Hume Highway south of the on-ramp warning of heavy vehicles entering the highway.

The construction activities on the public road network would be undertaken in accordance with a Section 138 permit issued by either Wingecarribee Shire Council or RMS.

Details of the proposed road construction activities and road widening are provided in Section 5.1.3.

2.4.7 Preliminary Friable Sandstone Extraction

The Applicant would recover approximately 1.7 million tonnes of friable sandstone from the footprint of the processing and stockpiling area commencing during the site establishment and construction stage (Stage 0).

Ultimately, the extraction of this material would create three pads of different elevations. The central pad would be excavated first to a level of approximately 680m AHD for the wash plant and stockpile area. The upper pad would be excavated next to approximately 690m AHD for use as the primary raw feed stockpile area. Finally, the third or lower pad would be excavated to an elevation of approximately 660m AHD for use as the brickie's (mortar) sand production area.

During the site establishment and construction stage, the friable sandstone recovered from the central pad (680m AHD) would be placed within a temporary raw feed stockpile established within the southeastern section of the Stage 1 extraction area for use in the wash plant and potentially a mobile brickie's sand plant positioned nearby.

The friable sandstone extracted from the central and upper pads of the processing and stockpiling area would provide the raw feed requirements for the initial 3 years of sand production.

A proportion of the material extracted during site establishment and construction stage would be used to construct the filled area of the processing and stockpiling area, the three on-site barriers and the water storage dam embankments.

2.4.8 Barriers

The Applicant would use a proportion of the friable sandstone extracted from the processing and stockpiling area to construct three earthen barriers.

- Southern Barrier: this barrier would be located to the south of the processing and stockpiling area with a crest elevation of approximately 710m AHD. The southern barrier which would be vegetated with native grasses, shrubs and trees would assist in mitigating noise impacts arising from Quarry activities.
- Eastern Barrier: this barrier would be located to the east of the processing and stockpiling area with a crest elevation at least 5m above natural ground level. The eastern barrier which would be vegetated with native grasses and shrubs and would assist in mitigating visual and noise impacts arising from the activities within the processing and stockpiling area.
- Northeastern Barrier: this barrier would be constructed adjacent to the Quarry Access Road, immediately east of Water Storage Dam A. The barrier would be up to 10m high with the alignment of the barrier turning south adjacent to the Water Storage Dam A with the barrier continuing south for approximately 360m. The northeastern barrier would comprise a combination earthen wall with a vertical panel barrier or fence on top. The earthen wall would be vegetated with native grasses and shrubs to assist in mitigating visual impacts arising from traffic movement along the Quarry Access Road. The southern end of the barrier would blend into the natural topography before the Quarry Access Road turns eastward.

2.4.9 Sediment Dams

A total of three sediment dams would be constructed during the early stages of the site establishment and construction stage to manage sediment-laden runoff generated within the disturbed areas. Water captured within these dams would be used for dust suppression activities, pumped to the water storage dam or released subject to the satisfaction of the relevant water quality criteria.

2.4.10 Wash Plant

The bulk of the wash plant would be fabricated off site and brought to site for assembly on concrete footings. Once the concrete footings are set, assembly is expected to occur over a period of approximately 4 -10 weeks.

2.4.11 Water Storage Dams

The Applicant would construct two water storage dams immediately east (Water Storage Dam A) and west (Water Storage Dam B) of the processing and stockpiling area from materials excavated within the processing and stockpiling area in accordance with the required engineering design. The combined storage of Water Storage Dams A and B would not exceed the Maximum Harvestable Rights Capacity of 13.8ML. Whilst the crest of the embankment of Water Storage Dam A would be used for the western-most section of the Quarry Access Road east of the weighbridge, measures (e.g. pipe culverts) would be installed in Water Storage Dam A to allow discharge once the combined capacities of Water Storage Dams A and B have reached the Maximum Harvestable Rights Capacity. The storage area of each dam would be cleared of vegetation and topsoil, profiled and lined with a suitable material to minimise seepage and water losses. Construction of the dam embankments would commence following the installation of downstream sediment controls (see Section 5.3.3).

2.4.12 Quarry Infrastructure Area

The Applicant would establish a temporary site office, workshop, fuelling area, vehicle parking and amenities for the construction workforce at the commencement of the site establishment and construction stage. These facilities would be placed immediately south of the long-term weighbridge, office and workshop.

The bulk of these facilities would be relocated to the areas displayed on **Figure 2.5** once the required landform for new facilities is excavated/constructed. The Applicant would also install a weighbridge and laboratory prior to the despatch of the first sand products.

2.5 EXTRACTION OPERATIONS

2.5.1 Introduction

Extraction operations would be undertaken using conventional extraction techniques involving ripping, pushing, loading and haulage of the extracted friable sandstone. The Applicant does, however, also intend to blast some areas of sandstone within the lower benches, where the sandstone becomes less friable and where the fragmentation from the blasting would save considerable effort through conventional ripping.

The proposed extraction area covers approximately 47ha. It is estimated that this area, together with sand extracted during the site establishment and construction stage, would yield approximately 34 million tonnes of friable sandstone which, after processing, would yield approximately 29 million tonnes of sand products.

2.5.2 Extraction Area Design

Figure 2.6 displays the layout of the extraction area and the nearby processing and stockpiling area, i.e. displaying the overall limit of extraction, final extraction faces and final elevations, prior to rehabilitation.

The extraction area has been designed to maximise the recovery of the friable sandstone through the development of a series of horizontal benches typically at 10m intervals (vertically) and both active and final extraction faces set back at 70° from the horizontal. **Figure 2.6** also displays the design of the terminal northern and southern extraction faces within the extraction area. The extraction area has been designed to extract the sandstone resource to a floor elevation of approximately 630m AHD. The northern terminal extraction benches would be typically approximately 5m wide, i.e. from 630m AHD to 660m AHD. The southern terminal extraction benches would be approximately 5m wide from 630m AHD to 670m AHD increasing in width to approximately 25m between 670m AHD to 700m AHD. The wider terminal benches would be above the final backfilled landform (see Section 2.13.3) and allow effective revegetation, whereas the narrower 5m benches on both the northern and southern side of the extraction area would occur at levels that would ultimately be covered as that section of the extraction area is backfilled (see Section 2.13.3).

The development of the extraction area in a series of benches would provide the flexibility for the Applicant to operate concurrently on a number of benches to produce the range of sand products and to satisfy individual customer requirements through selective extraction and/or blending.

2.5.3 Extraction Activities

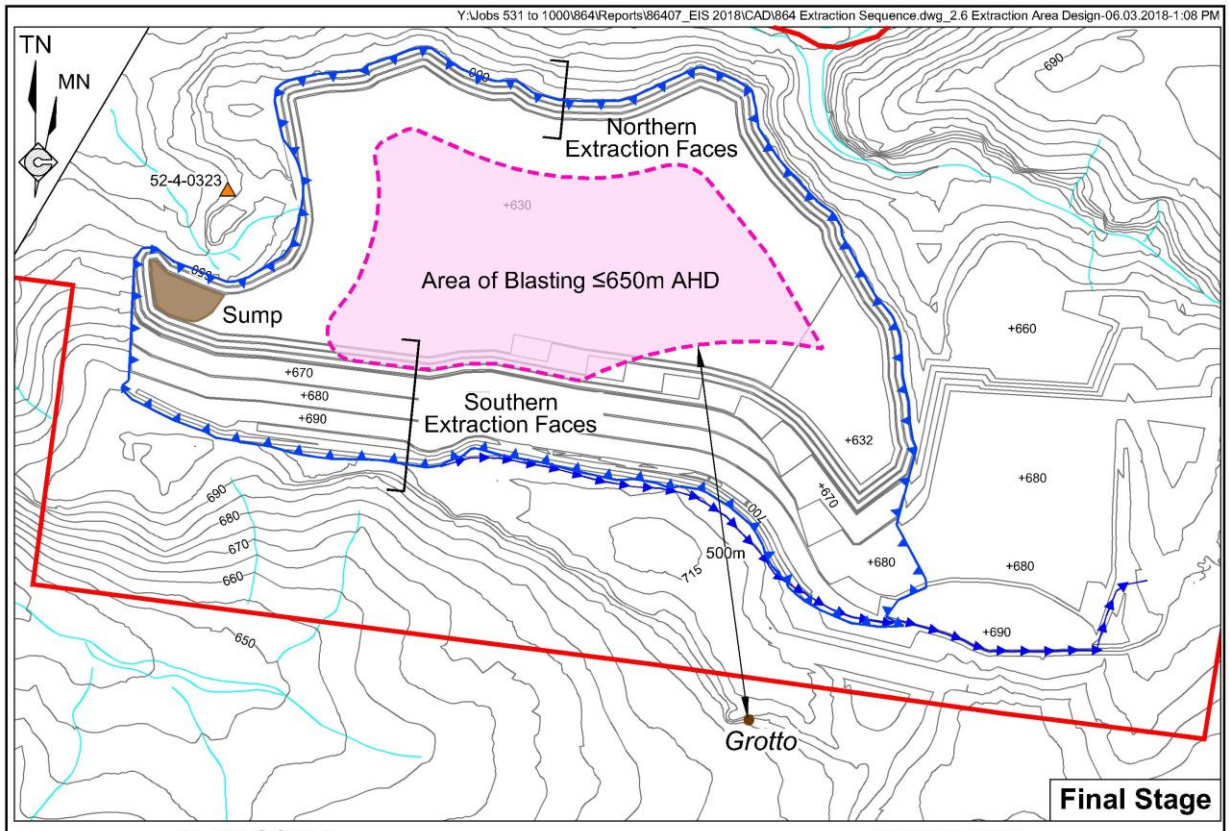
2.5.3.1 Introduction

The activities and procedures to be used in the extraction of sand within the Quarry Operations Area have been selected to:

- maximise the recovery of sand;
- minimise noise propagation from the Site; and
- contain all sediment-laden water within the nominated areas.

Extractive activities would initially be undertaken within the processing and stockpiling area and progress to the extraction area. It is, however, noted that extraction within the extraction area would commence prior to the completion of extraction within the processing and stockpiling area to ensure there is continuity of friable sand production and opportunities to extract the range of materials, particularly if blending is required.

This subsection reviews the extraction operations in both the processing and stockpiling area and the extraction area.

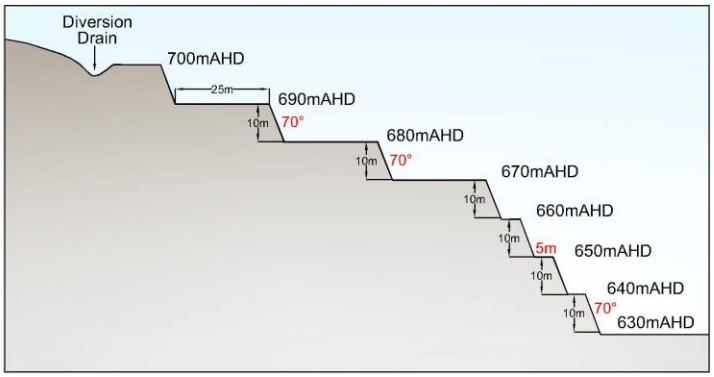


PLAN SCALE

100 0 100 200 300 400 500 m

Base Map Source: Geo-Spectrum (Australia) Pty Limited
Design Source: Australian Mine Design and Development Pty Ltd

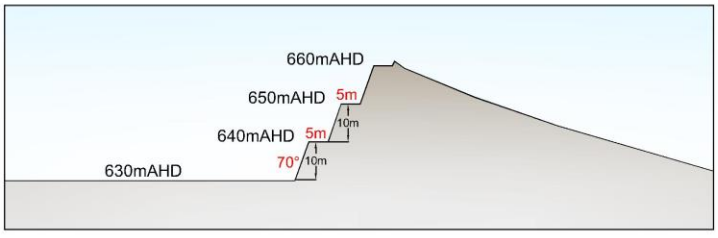
REFERENCE
- Site Boundary
- Proposed Limit of Extraction
- Blasting Zone
- Indicative Final Sump Location
- Watercourse
- Diversion Drain
- Extraction Face
- 700 Contour (m AHD)(Interval = 5m)
- +685 Spot Height (m AHD)
- 52-4-0323 Heritage Site



Southern Extraction Face

SECTION SCALE

20 0 20 m



Northern Extraction Face

Figure 2.6
EXTRACTION AREA
CONCEPTUAL DESIGN

2.5.3.2 Processing and Stockpiling Area

The extraction activities within the processing and stockpiling area would commence during the site establishment and construction stage (Stage 0) which has previously been introduced in Section 2.4.7.

The depth of friable sandstone extraction within the processing and stockpiling area would vary from a few metres to almost 20m. All of this material would be suitable for ripping, pushing up and haulage to the wash plant. The close proximity of some of the active extraction area to the plant may see some of the ripped and pushed up raw feed being conveyed to the plant by front-end loader. This may particularly be the case from the elevated southern pad that would ultimately become the raw feed stockpile area.

Extraction would proceed within the processing and stockpiling area until the required final elevation displayed on **Figure 2.6** is reached.

2.5.3.3 Extraction Area

The extraction operations within the extraction area would involve the following sequential activities.

1. Identification and definition of the approved extraction area and individual extraction stages (progressively).
2. Installation of the required surface water, erosion and sediment controls.
3. Vegetation removal.
4. Soil removal.
5. Overburden removal (if present).
6. Extraction of friable sandstone.
7. Delivery of friable sandstone to the processing and stockpiling area.

Identification and Definition of Extraction Stages

Prior to the commencement of any activities within each extraction stage, the internal stage boundaries (see **Figure 2.4**) would be identified and defined with a series of clearly visible posts positioned at regular intervals around the nominated extraction stage.

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 vegetation clearing activities. These controls would be required to prevent any sediment-laden runoff from flowing into the local tributaries of, or directly towards, Long Swamp Creek.

Those stages requiring activity adjacent to steeper slopes (i.e. the northern and eastern limits of the extraction area) would have a road cut into the slope at the required elevation. The road surface would be sub-horizontal so that the camber would direct runoff toward an open drain on the extraction area side of the road. Runoff collected in the drain would be collected in sumps and managed on site to prevent discharge of potentially disturbed runoff to adjacent watercourses.

The central element of the surface water management and erosion and sediment control within the extraction area would be the excavation of one or more sediment control sumps at the topographically lowest point(s) of the proposed area(s) to be disturbed, with catch banks constructed to divert runoff from disturbed areas to these locations. The sediment control sumps would be designed and maintained for the life of each stage to ensure that no water containing unacceptable levels of suspended solids is discharged from the operational areas. Beyond the end of Stage 2, the active extraction area would be able to drain internally to one or more active sediment control sumps. All water accumulating in the sediment control sumps on the margin of the extraction area would be preferentially used for filling the on-site water truck used for dust suppression on the internal unsealed roads. Any surplus water from these active sump(s) within the floor of the extraction area would be pumped back to either of the water storage dams.

Vegetation Removal

Vegetation covering areas required for each 12 month period of operations would either be chainsaw felled or cleared using a bulldozer. After any recoverable timber or viable seed is obtained, the felled vegetation would be mulched and directly transferred onto areas of the final landform requiring revegetation or stockpiled within the temporary mulch and topsoil storage area within the extraction area. The vegetation clearing practices would be consistent with those adopted throughout the site establishment and construction stage (see Section 2.4.3).

Understorey vegetation such as grasses, low shrubs and forbs would be removed in combination with the soil resources in each area being prepared for sand extraction and stockpiled for future rehabilitation activities and/or directly transferred to an area to be revegetated.

Soil Removal

The soil in each area cleared of its vegetation would be stripped following removal of the larger vegetation. Small shrubs and groundcovers would be removed with the topsoil. In those areas where soil is present within the extraction area, the Applicant would remove approximately 0.2m of topsoil, where present, focusing upon the recovery of the seed-bearing material.

The soil removal practices throughout the life of the Proposal would generally be consistent with those adopted throughout the site establishment and construction stage (see Section 2.4.4). However, during the later stages of extraction, emphasis would be placed directly transferring any subsoil and topsoil to the active revegetation area, thereby minimising double handling and maximising the opportunity for germination of the native seed retained in the topsoil.

Overburden Removal

Following removal of topsoil and subsoil, and if present, the limited quantities of clayey overburden would be removed from above the surface of the friable sandstone using a bulldozer. Any overburden removed would be pushed up into stockpiles and loaded into haul trucks and either stored within the footprint of the extraction area or transferred directly to completed sections of the extraction area for final landform construction.

Extraction of Friable Sandstone (Raw Feed)

The Applicant proposes to target the recovery of friable sandstone through the use of a bulldozer to rip and push up ripped sandstone. The pushed-up friable sandstone would be loaded into a haul truck by an excavator or front-end loader for delivery to the processing plants. As the sandstone within the lower benches (at or below 650m AHD) become less friable, the sandstone would either be cross-ripped or blasted. **Figure 2.6** displays the indicative area in which blasting would be undertaken within the extraction area. This area is typically set back between 80m and 130m from the proposed limit of extraction and no closer than 500m of the Grotto within "Penrose Park". The Applicant has had experience in blasting sandstone with the typical blast design involving the following.

- Burden/Spacing: 2.4m x 2.5m
- Hole Diameter = 89mm
- Bench Height = 10m (+1m subdrill)
- Maximum Instantaneous Charge = 50kg to 200kg
- Powder factor = 1.1kg/m^3

The Applicant anticipates that typical blasts would generate between 25 000t to 40 000t of fragmented material per blast. In any one year, the Applicant anticipates it may be necessary to initiate up to twelve blasts, with blasting generally occurring no more than once per week (excluding misfires).

Delivery of Raw Feed to the Processing Area

The raw feed would be delivered to either the raw feed stockpile area immediately south of the wash plant or the brickie's sand production area by 50t articulated haul trucks. The route travelled to the raw feed stockpiling area by the haul truck would vary depending on the prevailing stage of extraction, however, all trucks would exit the extraction area at its southeastern corner. The trucks delivering raw feed for washing would either unload directly into the hopper feeding the wash plant or to a defined area within the raw feed stockpile area. Raw feed being delivered to the brickie's sand production area would be stockpiled east of the mobile plant.

Extraction activities would initially focus on the recovery of the friable sandstone from the establishment of the processing and stockpiling area and a section of the Stage 1 extraction area. Once the processing and stockpiling area has been established, the Applicant would commence activities within the remaining sections of Stage 1 of the extraction sequence. Once Stage 1 is completed, extraction operations would progress through the subsequent extraction stages.

2.5.4 Extraction Sequence

Extraction would commence with the recovery of raw feed from within the processing and stockpiling area which is referred to throughout this document as Stage 0. Once the raw feed is recovered from the 680m AHD and 690m AHD pads within the processing area, extraction would commence within the extraction area, i.e. within Stage 1. Extraction would continue concurrently during Stage 1 with the extraction required to form the lower 660m AHD pad within the processing and stockpiling area (Stage 0).

Figure 2.7 displays the extraction area layout at the completion of Stages 1, 2, 3, 4, 5, 6 and 7. During Stage 1, extraction would progress to an elevation of 680m AHD with a sediment control sump established on the northern side of the area extracted. During Stage 2, the Applicant would develop benches from 690m AHD to 630m AHD to provide access to the full range of sandstone resources for that and subsequent stages.

By the completion of Stage 2, a low-point in the extraction area of 630m AHD would create a sump for the internal collection of drainage within the extraction area until the end of Stage 4 when backfilling of previously extracted areas would require its repositioning within the floor of the extraction area. Minor variations to the sequence would be necessary from time to time to accommodate localised variations in the quality/colour of the friable sandstone, particularly that extracted to produce brickie's sand.

It is noted that the Applicant expects that, at the cessation of the current development consent being sought, the extent of extraction operations would be approximately at the end of Stage 5 as shown on **Figure 2.7**.

Figure 2.8 displays a series of indicative sections through the processing and stockpiling area and the extraction area presenting the development sequence.

Table 2.2 lists the indicative operational years for each of the eight extraction stages within the Quarry Operations Area, i.e. based on the projected average production levels.

Table 2.2
Indicative Operational Years for Extractive Operations

Extraction Stage*	Indicative Years of Operation#
0	1-3
1	4
2	5-11
3	12-20
4	21-22
5	23-28
6	29-38
7	39-45
* See **Figure 2.7** # Based upon an average extraction rate of 820 000tpa (and sales of 700 000tpa)	

2.5.5 Mobile Equipment

Table 2.3 lists the mobile earthmoving equipment proposed for use at three rates of annual product despatch. These rates of product despatch are discussed further in Section 2.5.6.

Table 2.3
Mobile Earthmoving Equipment Fleet*

Equipment	Number Annual Sales 430 000tpa	700 000tpa	860 000tpa	Use/Activity
Bulldozer (Komatsu 475 or similar)	1-2	2-4	3-4	Friable sandstone extraction (ripping/ pushing), site works (e.g. tree clearing).
Excavator 45t (PC 450 or similar)	1-2	2-3	3-4	Friable sandstone extraction and haul truck loading.
Haul truck 50t (Hitachi B50D or similar)	1-2	1-2	2-3	Raw material haulage to processing area.
Front-end loader (WA 500 or similar)	2-3	3-5	4-5	Haul truck and product truck loading.
Hydraulic Drill Rig (Atlas Copco ROC Series)	1	1	1	Drilling blast holes (typically for 3 - 4 days every one to two months).
Grader (Cat 140 M or similar)	1	1	1	Haul road construction. Hired for occasional use.
Water Truck (Minimum 12 000L)	1	1	1	Dust suppression activities.
Powerscreen Chieftain or similar	1	1-2	1-2	Brickie's sand production.
Front-end loader (Volvo L120 or similar)	1	1-2	1-2	Loading of brickie's sand plant.
* Note: All equipment would be periodically replaced/refurbished with better equipment of a similar capacity and noise rating.				
Source: Sutton Forest Quarries Pty Ltd				

2.5.6 Extraction Rates

Extraction of raw feed would commence within the processing and stockpiling area to create the required landforms in that area. Approximately 1.7 million tonnes of friable sandstone would be recovered from this area, which would be used for site establishment works and the remaining balance as raw feed for brickie's sand or wash plants.

It is assumed that 90% of products despatched from the Quarry would be washed sand products. For planning purposes, it has also been assumed that 14% of material would be removed as fines or oversize and would be stockpiled within the Site. For the purpose of assessment of operational noise, air quality and transport impacts, operational scenarios are based on product sales of:

- 430 000tpa (from 500 000tpa friable sandstone extracted)
- an estimated average product despatch level of 700 000tpa (from 820 000tpa friable sandstone extracted); and
- a maximum of 860 000tpa of products (from 1 Mtpa of friable sandstone extracted).

The maximum product despatch rates would be approached during periods of high demand from the construction and building industry and has been conservatively applied for the assessment of potential environmental impacts (that is, maximum traffic levels, noise emissions and dust generation).

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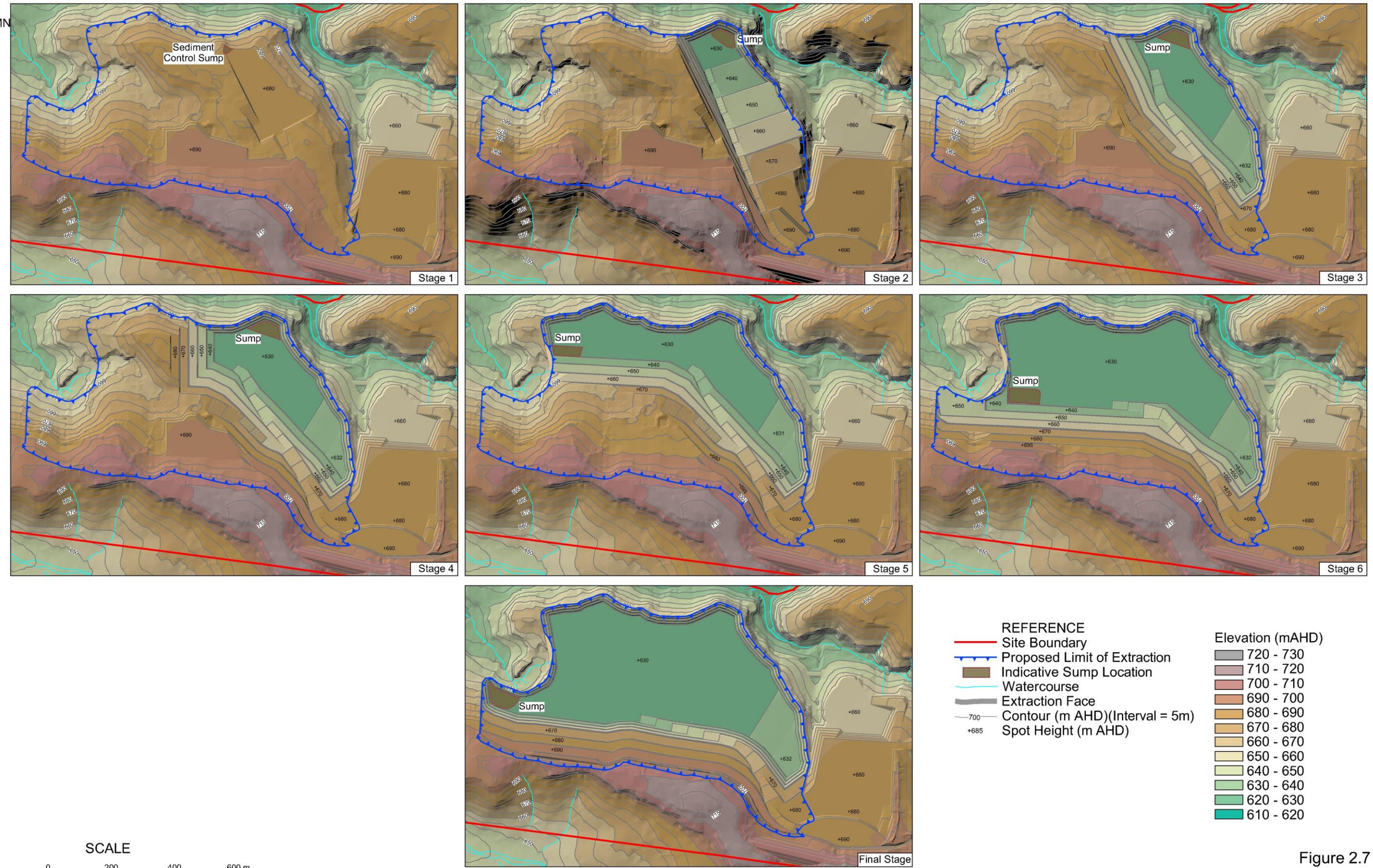
TN
MN



SCALE
200 0 200 400 600 m

Base Map Source: Geo-Spectrum (Australia) Pty Limited
Design Source: Australian Mine Design and Development Pty Ltd

Figure 2.7
INDICATIVE
EXTRACTION SEQUENCE

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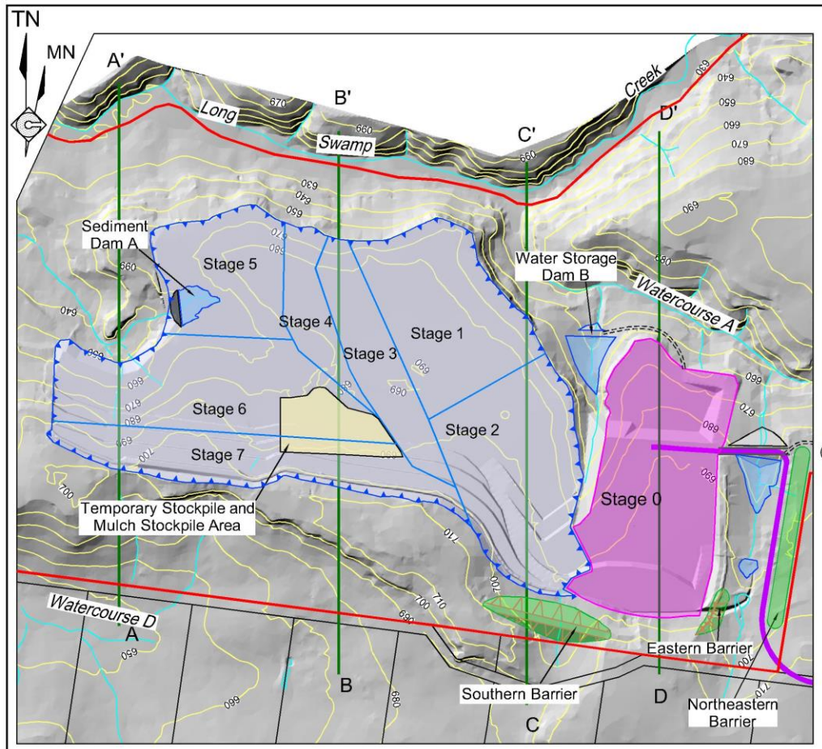

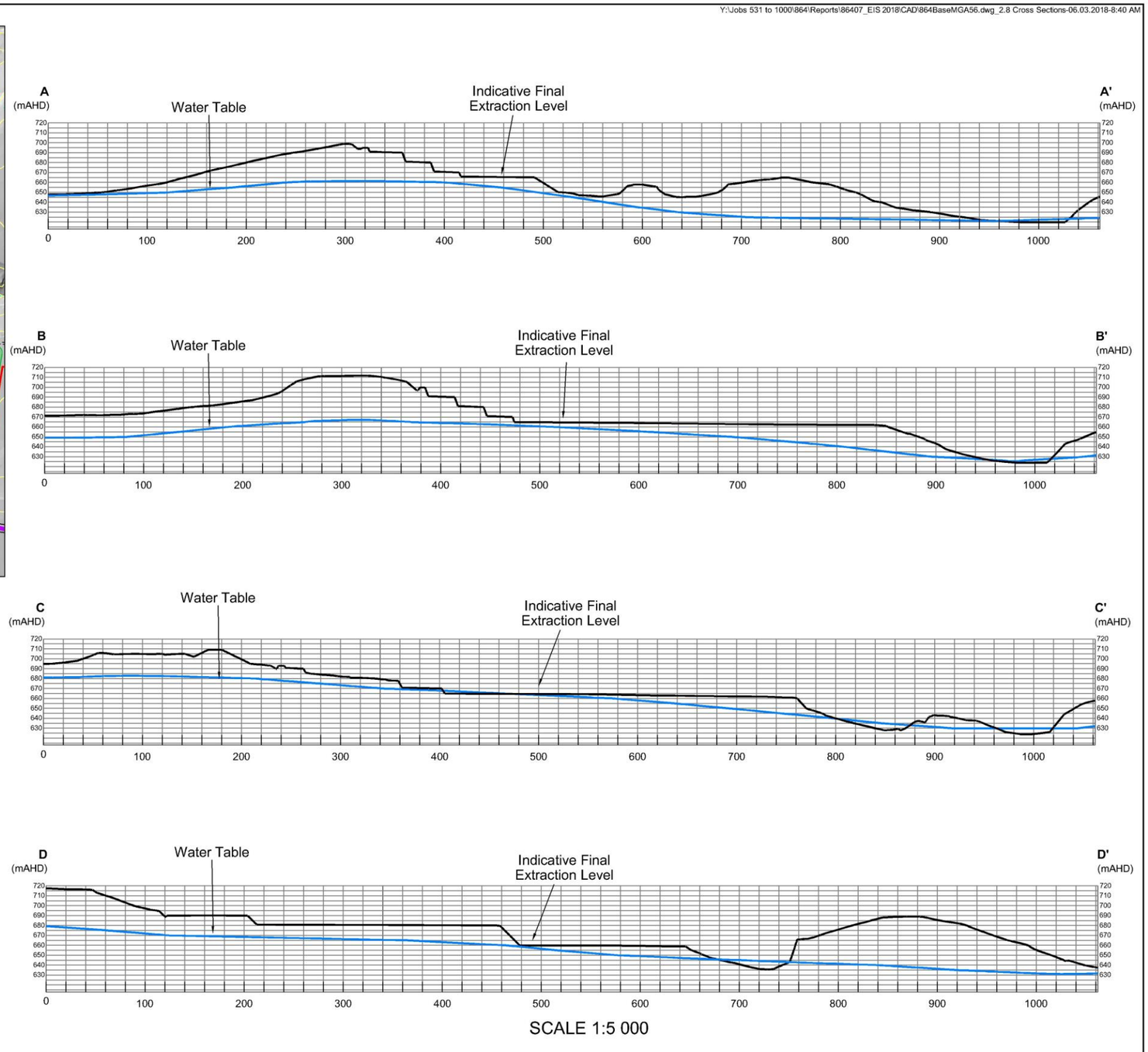

REFERENCE
- Site Boundary
- Cadastral Boundary
- Watercourse
- 700 Contour (m AHD)(Interval = 10m)

Proposed Activities
- Limit of Extraction
- Extraction Stage Boundary
- Quarry Access Road
- Internal Road
- Access Road
- Processing & Stockpiling Area
- Barrier
- Water Storage / Sediment Dam
- Mulch and Topsoil Stockpile Area

Note: The indicative levels displayed on these sections are the levels at the end of sand extraction and prior to backfilling to create the final landforms displayed on Figures 2.17 and 2.18

SCALE 1:5 000

SCALE
200 0 200 400 600 m

Base Map Source: Geo-Spectrum (Australia) Pty Limited - 4 September 2012

Figure 2.8
INDICATIVE FINAL EXTRACTION LEVELS AND WATER TABLE

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2.6 PRODUCTS, PROCESSING OPERATIONS AND PRODUCT STOCKPILING

2.6.1 Products

Introduction

The processing of raw feed would result in the production of two principal types of products namely:

i) washed sand products, i.e. concrete, plastering and tiling sands; and

ii) brickie's sand (a dry-screened product that is blended with washed sand).

Within these broad classifications, sand products are sold according to quality and size grading.

Concrete, Plastering and Tiling Sands

The washed sand products are largely used in the manufacturing of concrete and concrete products where the proportion of silt and clay is largely removed. Plastering and tiling sands are produced with specific size gradings. The washed sand products would be stacked via a radial stacker conveyor which allows the segregation of different final products into separate stockpiles.

Brickie's (Mortar) Sand

The dry screened sand from the brickie's sand plant (typically <3mm) is used principally by bricklayers for use in mortar as the sand contains approximately 15% silt and clay which assists in the workability of the mortar. In the event the required silt and clay content in the dry-screened sand is greater than that required, the dry-screened sand would be blended with washed sand to achieve the required proportion of silt and clay. The blended product would either be loaded directly into product trucks for despatch or onto product stockpiles within the processing and stockpiling area for later sale and despatch. Up to 10% of the sand products despatched from the Quarry could be brickie's sand.

2.6.2 Processing Operations

Introduction

The raw feed would be processed using either a washing or dry screening process. The washing process (to produce washed sand products) is designed to remove or reduce the proportion of silt and clay in the sand to acceptable levels and the dry screening process (to produce brickie's sand) is designed to remove the sandstone fragments typically coarser than approximately 3mm.

Figure 2.9 displays the indicative layout of the processing and stockpiling area.

Fixed Wash Plant

Figure 2.10 displays the indicative layout of the fixed wash plant.

The plant would vary in height to a maximum of 12m above the 680m AHD floor level with the more elevated components being the cyclones and the ends of product conveyors.

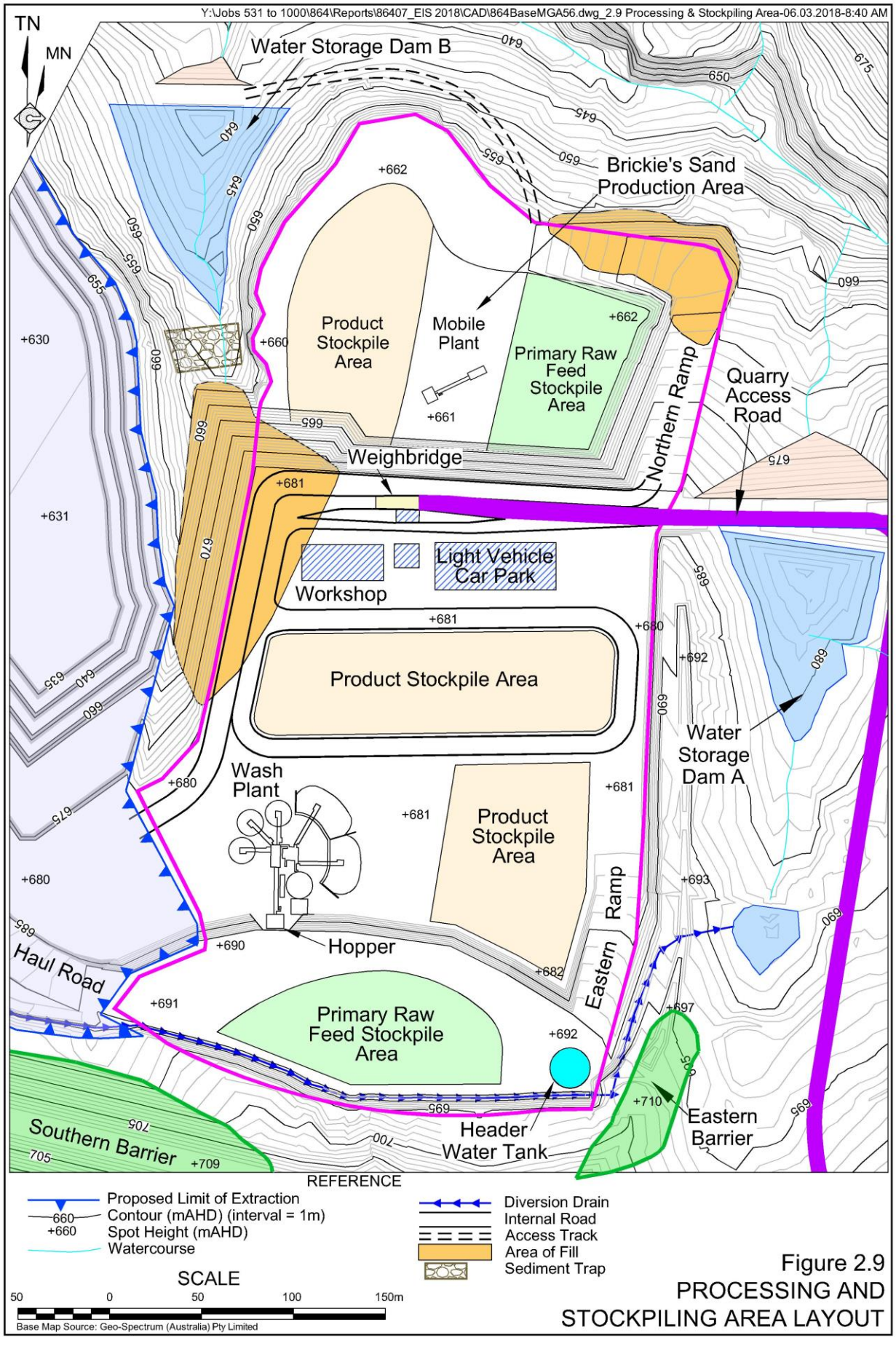

Figure 2.9
PROCESSING AND STOCKPILING AREA LAYOUT

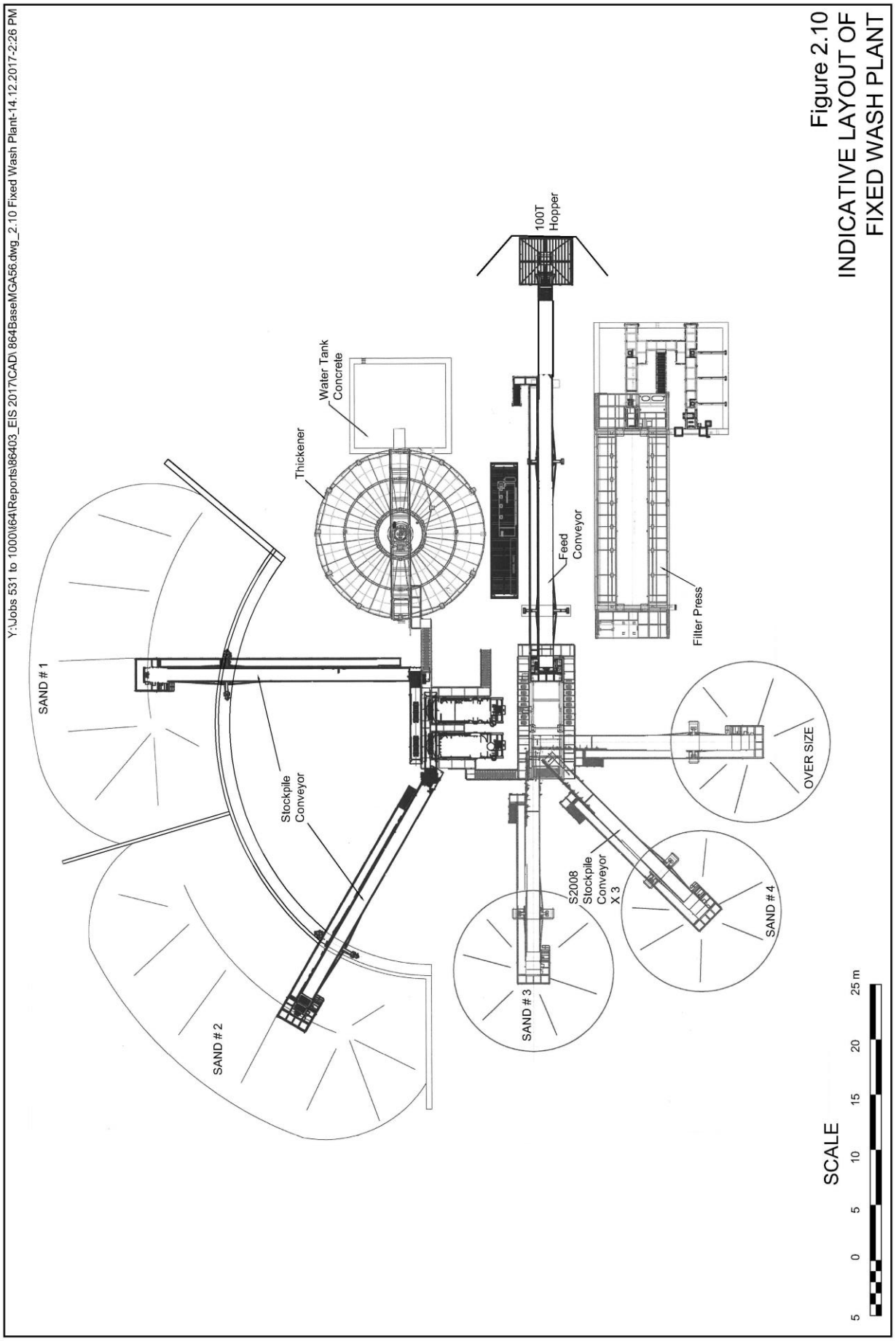
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Figure 2.10
INDICATIVE LAYOUT OF
FIXED WASH PLANT
100T Hopper
Water Tank Concrete
Thickener
Feed Conveyor
Filter Press
SAND # 1
Stockpile Conveyor
OVER SIZE
S2008 Stockpile Conveyor X 3
SAND # 4
SAND # 3
SAND # 2
SCALE
5 0 5 10 15 20 25 m

The process through the wash plant would require raw feed to be loaded into the feed hopper either directly from haul trucks or by a front-end loader recovering raw feed from the raw feed stockpile after which it would be screened with the oversize (>6.7mm) reporting to a primary crusher. Water would be added to assist to convey the materials through a range of subsequent processes to remove the silt and clay. Once the silt and clay are removed, the sand slurry would be dewatered through cyclones and stacked in conical piles beneath conveyors or one of two radial stackers. All silts and clays (referred to as "fines") removed from the raw feed would be recovered via a two-stage process involving a thickener and a bank of filter presses. This process would maximise the recovery of water for re-use in the wash plant. The management of the fines is discussed further in Section 2.7.

The wash plant area would be fitted with fixed lights to operate during the night-time period with all lighting being strategically located to avoid any direct light emissions towards surrounding residences. Reliance would be placed on strategically placed lighting and reflective signage and directions for truck drivers to approach the product stockpiling area of a night time.

Mobile Brickie's Sand Plants

The dry screening process for the brickie's sand (including blending with washed sand) would be undertaken using initially, one simple mobile screening plant (e.g. Powerscreen Chieftain or equivalent) which would operate at approximately 85tph to 120tph. An additional mobile screening plant would be added to enable production to increase to the average annual brickie's sand production of 70 000 tonnes. Each mobile brickie's sand plant would comprise:

- a feed hopper;
- a vibrating screen, which is used to separate the oversize (>3mm) from the sand products; and
- a radial stacker to distribute the screened sand to stockpiles.

The mobile brickie's sand plants would be located either within the processing area itself or positioned in close proximity to the active extraction area.

Operating Capacity and Production Rates

The design throughput of the wash plant would be approximately 300tph of raw feed yielding approximately 260tph of sand products. The Applicant is satisfied this capacity would meet anticipated demand for the various washed sand products, although a small proportion of the washed sand may be used for blending to achieve the preferred size grading of the brickie's sand products.

The dry screening plant(s) would operate at up to 85tph to 120tph yielding approximately 73tph to 103tph of brickie's sand, following the removal of up to 14% of the feed being comprised of oversize material.

2.6.3 Product Stockpiling

The Applicant would establish a product stockpiling area around the fixed wash plant. The base of the product stockpiling area would be established at approximately 680m AHD although local variations would occur to assist drainage from the stockpile. Front-end loaders would be used to relocate the sand products from the conical stockpiles beneath the product conveyors into a series of dedicated product stockpiles positioned around the plant.

2.7 WATER AND FINES MANAGEMENT

2.7.1 Water Use and Management

The two primary uses of water at the Quarry would be for sand washing and the suppression of dust in the extraction area, the permanent unsealed roads and around the processing and stockpiling area.

Sand Washing

The sand washing process uses water to remove fine particles ("fines") comprising silt and clay from the sand to achieve the required size grading. The wash plant would use up to 5 000L of water for every tonne of sand washed with an estimated 24 300L of make-up water required per hour as a proportion of the wash water would be retained within the sand products sold from the Quarry and the fines recovered from washing. The mortar sand products typically contain approximately 8% moisture and the washed sand products contain approximately 6% moisture when sold. It is noted that a proportion of moisture in the raw feed is typically approximately 8% to 10%. That is, in most cases, the products would contain less moisture than the in situ raw material.

The bulk of the make-up water added to the wash plant would be recovered directly from the filter press and thickener tank and recycled through the wash plant. The residual fines recovered from the filter press would have a moisture content of approximately 10% to 15%.

On-site Dust Suppression

The Applicant proposes to use a combination of automated fixed sprinklers and a water truck to achieve the required level of dust suppression within the Quarry Operations Area.

Automated fixed sprinklers would be positioned around the key operational areas within the processing and stockpiling area and adjacent to the permanent haul road into the extraction area, including the upper pad used for the primary raw feed stockpile area. The sprinkler system would be extended progressively as the operational areas and permanent haul road is extended.

The Applicant would also operate a 12 000L capacity water truck to wet down the short-term internal roads on the extraction area floor and any other dust generating area (not covered by a fixed sprinkler) at an application rate of up to approximately 0.5L/m^2 per application. The frequency of watering would vary from typically once per day during winter up to eight times per day during hotter or windier days (generally during the summer months). It is estimated that up to 12ML/year would be required for dust suppression.

Fines Production

Approximately 14% of the raw feed processed through the wash plant would be removed from the sand products. The materials removed would comprise oversize (approximately 3%) and fines (approximately 11-14%).

In total, the Applicant envisages approximately 5 million t / 3 million m^3 of oversize and fines would be generated throughout the life of the Proposal, i.e. assuming approximately 14% oversize and fines removed from approximately 34 million tonnes of raw feed washed and a density of 1.7t/m^3.

A proportion of the water used during the washing process would also be lost as a result of evaporation from water storages on the Site. The Applicant estimates that a further 4% of water would be lost through evaporation. In total, approximately 95L of water would be lost per tonne of washed sand from the cycle through evaporation and retention in the sand products and silt.

Water Requirements

In total, the operation of the wash plant would have make-up water requirements of 73ML per annum. The total annual requirements for water is estimated to be 85ML per year once annual dust suppression requirements are included.

2.7.2 Oversize Management

The oversize generated within the wash plant would be either sold as a fill material or used within site rehabilitation. A stockpile of the material would be maintained within the product stockpile area for loading and despatch. Any excess oversize not sold would be segregated and stored within the temporary topsoil and mulch stockpile area until it is required for rehabilitation of the final landform. In the longer term, once backfilling of the excavated area has commenced, the excess oversize would be placed directly into the active backfilling area.

2.7.3 Fines Management

The filter cake produced following the sand washing process would initially be placed within Fines Storage Area 1, located north of the processing and stockpiling area (see **Figure 2.11**). This area would store up to approximately 350 000m^3 of fines (see **Figure 2.11**) which would be sufficient for approximately 6 years of initial sand production. The area is largely cleared but would be stripped of its remaining vegetation and topsoil. Sediment Dams B and C would be constructed on the southern and northern sides of the area respectively to collect sediment-laden water draining from the area. An upslope diversion bank would also be constructed on the upslope boundary of this area to direct upslope runoff this area. **Figure 2.11** displays the placed fines would be placed up to 8m high (when dry) within the Fines Storage Area 1. These materials would be delivered by haul truck, stockpiled and stacked by excavator.

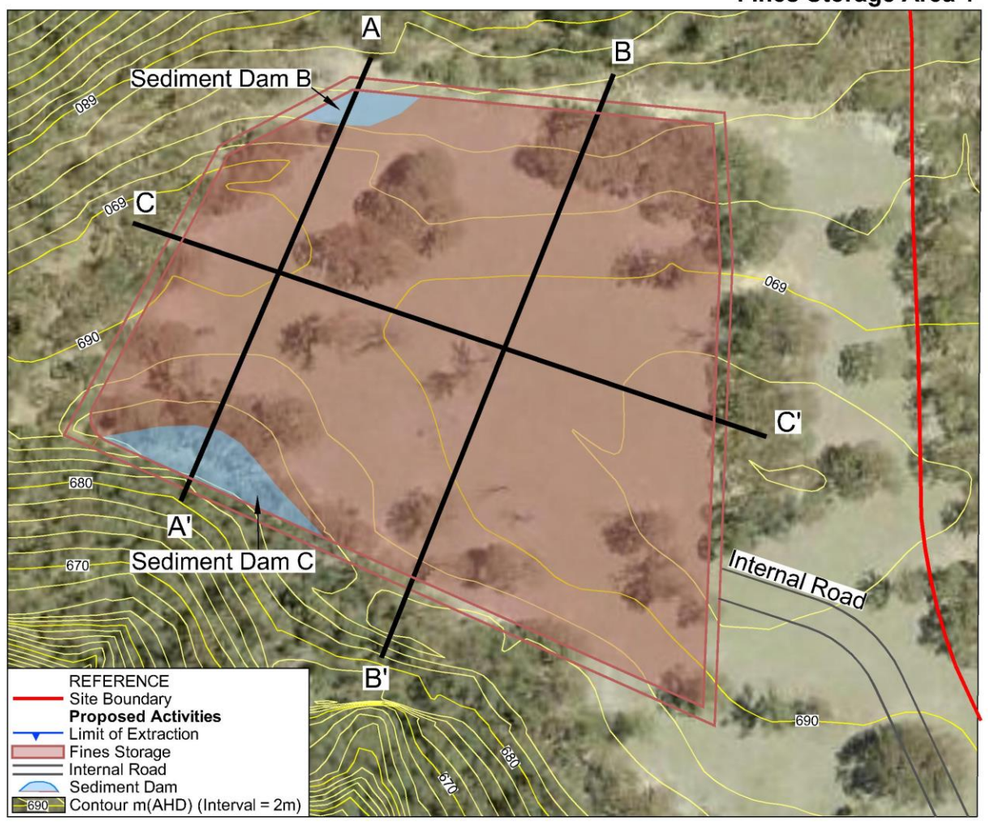
Once Fines Storage Area 1 has reached capacity, fines would be stored in a temporary fines storage area (Fines Storage Area 2). This fines storage area would be situated within the extraction area footprint (see **Figure 2.1** and **Figure 2.11**) with a capacity to store approximately 340 000m^3, equating to approximately 5 years of fines produced. This fines storage area would also provide a contingency storage for fines slurries during any period when the filter press is out of service. This would prevent the unnecessary suspension of production activity. The fines slurry area would be on the eastern side of the fines storage area, with all decant water being reclaimed in Sediment Dam A for recycling.

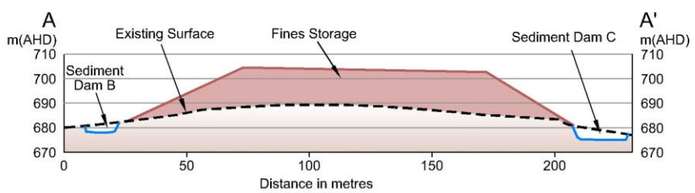
Once extraction is sufficiently advanced, the fines stored in Fines Storage Area 2 would be relocated progressively and used as backfill during Stage 4 of Quarry operations. The filter cake would be placed directly within completed sections of the extraction area. The filter cake would be transported to the extraction area using haul trucks on their return trip for the wash plant (i.e. backloading). The filter cake would be used in the progressive rehabilitation of the extraction area to create a final landform (see Section 2.13.3).

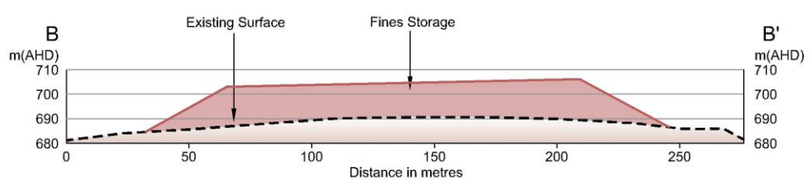
Y:\Jobs 531 to 1000\864\Reports\86403_EIS 2017\CAD\864BaseMGA56.dwg_2.11 Fines Storage-14.12.2017-2:26 PM

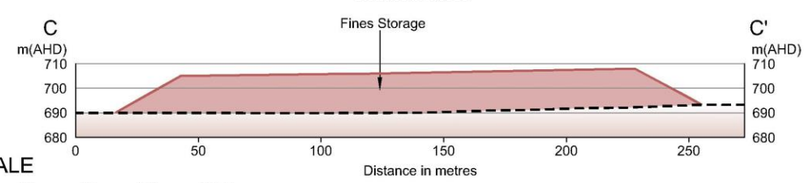
TN
MN

Fines Storage Area 1





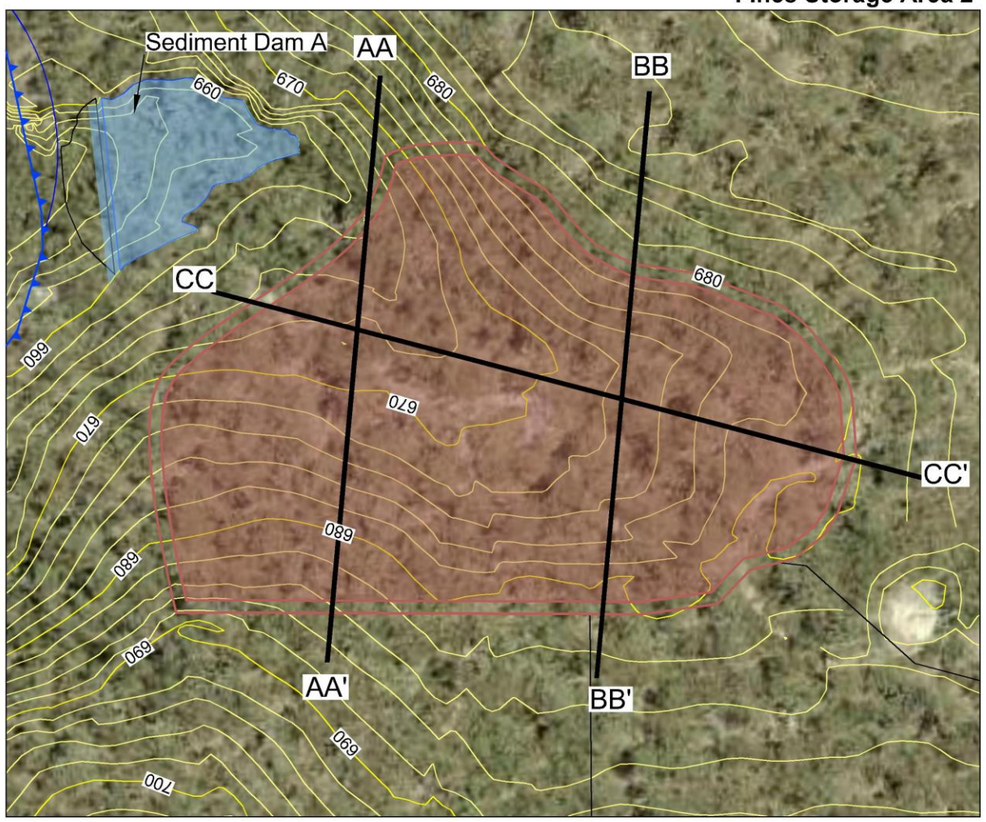


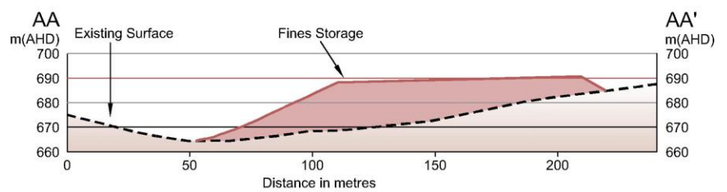


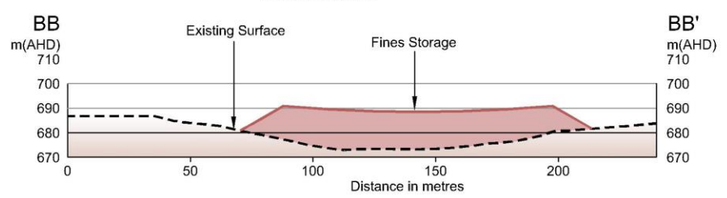
SCALE
25 0 25 50 75 100 125 m

Base Photography Source: LPI - 13 December 2013

Fines Storage Area 2







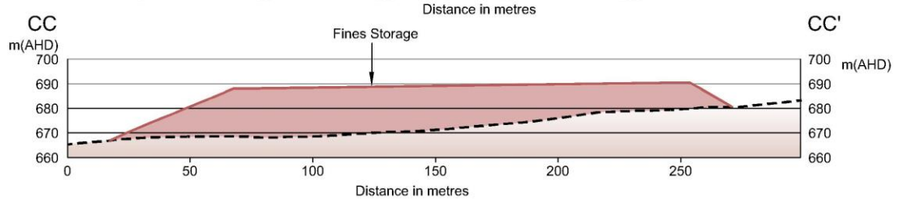


Figure 2.11
FINES STORAGES

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2.8 ACCESS, TRAFFIC AND PRODUCT TRANSPORTATION

2.8.1 Site Establishment and Construction Stage

2.8.1.1 Access

Access for all vehicles during the bulk of the site establishment and construction stage would be via the existing entrance to Lot 4 DP253435 directly from the Hume Highway (see **Figure 2.5**). From the entrance to Lot 4 DP253435, all vehicles would travel via a new all-weather road to be constructed across Lot 4 to the proposed processing and stockpiling area (see **Figure 2.5**). A suitably designed concrete slab would be required to armour this route where it crosses the easement containing two high pressure gas pipelines (Moomba – Wilton and Moomba – Sydney) and water pipeline (Wingecarribee – Goulburn).

The construction of the Quarry Interchange would generate a range of additional traffic travelling to and from that area. The Applicant's appointed contractor would establish an off-road parking area for all earthmoving equipment near the current entrance to the Kingsbury VC Rest Area in accordance with the Section 138 Permit issued by the Wingecarribee Shire Council or RMS.

2.8.1.2 Traffic Types and Levels

The Proposal would generate a range of traffic during the 12 month site establishment and construction stage. Vehicles travelling to and from the Site during this period would include a small number of low loaders delivering earthmoving equipment and plant components, semi-trailers and truck and dog trailers delivering construction materials and equipment, concrete agitators and small vehicles. For the purposes of assessing traffic-related impacts during the site establishment and construction stage, the following traffic levels are envisaged.

- Low loaders delivering earthmoving equipment and wash plant components – up to 2 per day on up to 5 days (0 to 4 movements per day).
- Semi-trailers / truck and dog trailers delivering road pavement and hardstand materials – 3 to 15 per day on up to 15 days (6 to 30 movements per day).
- Concrete agitators – up to 10 per day on the days footings are poured, i.e. on approximately 5 days (0 to 20 movements per day).
- Occasional trucks delivering fuel (0 to 2 movements per day).
- Light vehicles – 10 to 20 per day (20 to 40 movements per day).

2.8.2 Operational Stages

2.8.2.1 Access

For its operational life, access to the Site from the Hume Highway would occur via the new Quarry Interchange and the Quarry Access Road.

Quarry Interchange

The Quarry Interchange would be designed in accordance with Austroads design guidance and would comprise three sections (refer **Figure 2.12**), namely a single lane off-ramp for southbound vehicles entering the Site; a single lane overbridge over the Hume Highway for vehicles entering the Site; and a northbound on-ramp for vehicles exiting the Site.

- **Southbound off-ramp** – This section of the Quarry Interchange would comprise the exit from the southbound lanes of the Hume Highway for vehicles accessing the Site, the residences situated on Lot 12 DP241054 and Lots 3 and 4 DP253435, the Kingsbury VC Rest Area and Penrose Forest Way. Vehicles entering the southbound off-ramp exit lane would diverge into either the at-grade entry (right) to the Kingsbury VC Rest Area and Penrose Forest Way or the grade separated ramp (left) to the overbridge for those vehicles continuing onto the Site and the residences situated on Lot 12 DP241054 and Lots 3 and 4 DP253435. The southbound off-ramp would be designed to meet appropriate design guidance relating to deceleration, sight distances and signage and would be constructed within the Hume Highway road reserve, Lots 11 and 12 DP1199557 and Lot 46 DP751284.
- **Overbridge** – This section of the Quarry Interchange consists of a single lane, two span overbridge over the Hume Highway for vehicles entering the Site or accessing the residences situated on Lot 12 DP241054 and Lots 3 and 4 DP253435. The overbridge would be constructed upon supporting piers with vertical abutments.
- **Northbound on-ramp** – This section of the Quarry Interchange would be approximately 860m long and would provide an at-grade entry and merge with the northbound lanes of the Hume Highway for all vehicles exiting the Site, Lot 12 DP241054 and Lots 3 and 4 DP253435. The northbound on-ramp would be approximately 860m long to enable laden trucks exiting the Site to enter the northbound lanes of the Hume Highway at a sufficient speed so as not to disrupt the flow of through traffic on the Hume Highway. The northbound on-ramp would be constructed within Lot 30 DP813662 (owned by RMS) and designed to meet appropriate design guidance relating to acceleration, sight distances, signage and merging. Vehicles entering Lots 1 and 2 DP253435 would be required to cross the northbound on-ramp however, when exiting these properties, vehicles would be able to utilise the northbound on-ramp prior to entering traffic on the Hume Highway. This would represent an improvement to the existing arrangements for vehicles exiting these properties as there is currently no merge lane with vehicles directly entering the Hume Highway upon exiting the shared driveway.

Quarry Access Road

The Quarry Access Road would be the sole access between the Quarry Interchange and the Quarry Operations Area for the operational life of the Proposal and would be constructed to carry trucks up to 26.5m in length. The road would extend from the western end of the new overbridge to the weighbridge within the Quarry Operations Area, a distance of approximately 1.4km. The Quarry Access Road, would extend along the Crown Road Reserve between Lot 4 DP253435 and Lot 12 DP241054 prior to entering the Quarry Operations Area (refer **Figure 2.13**).

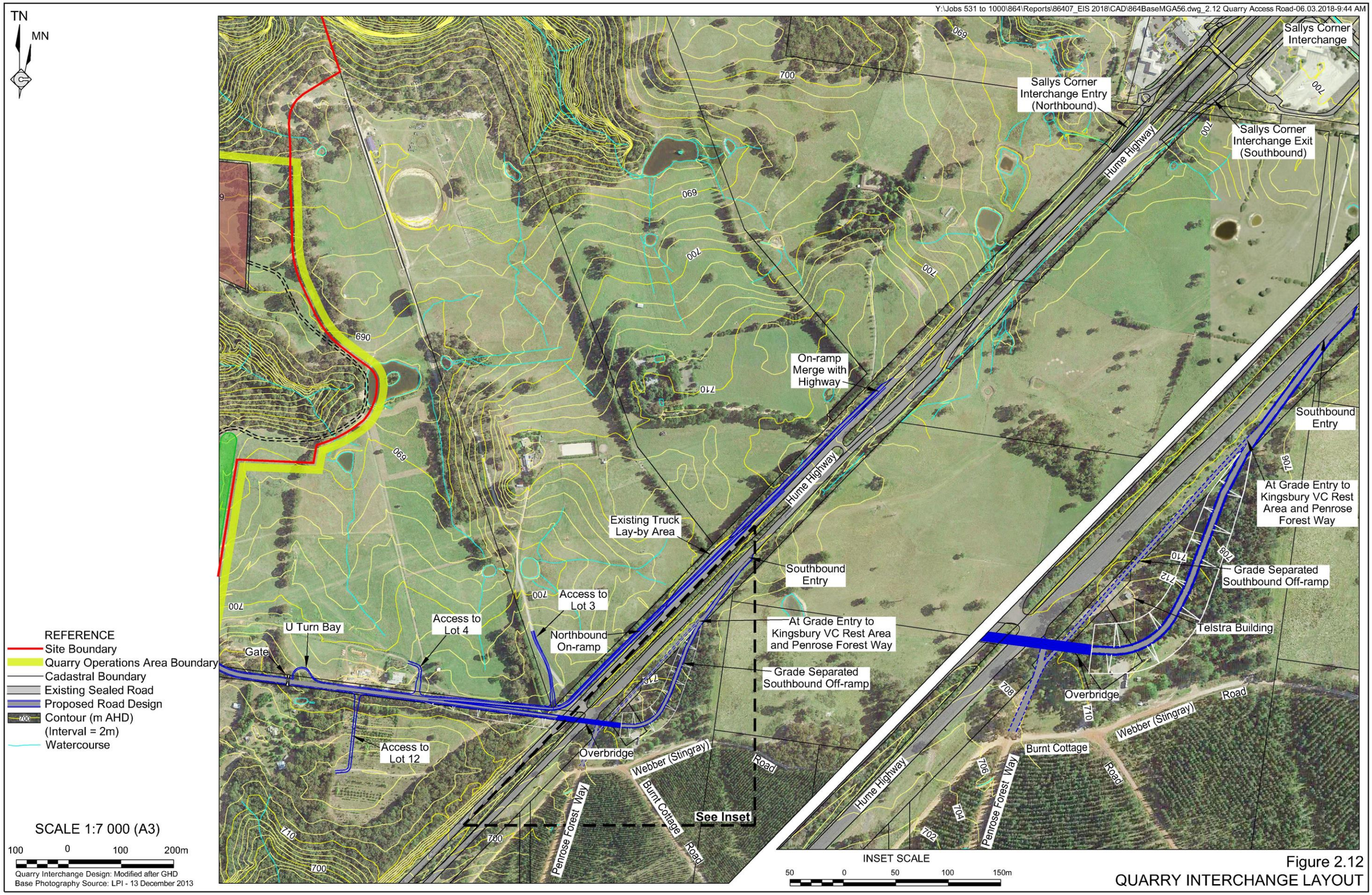

Figure 2.12
QUARRY INTERCHANGE LAYOUT

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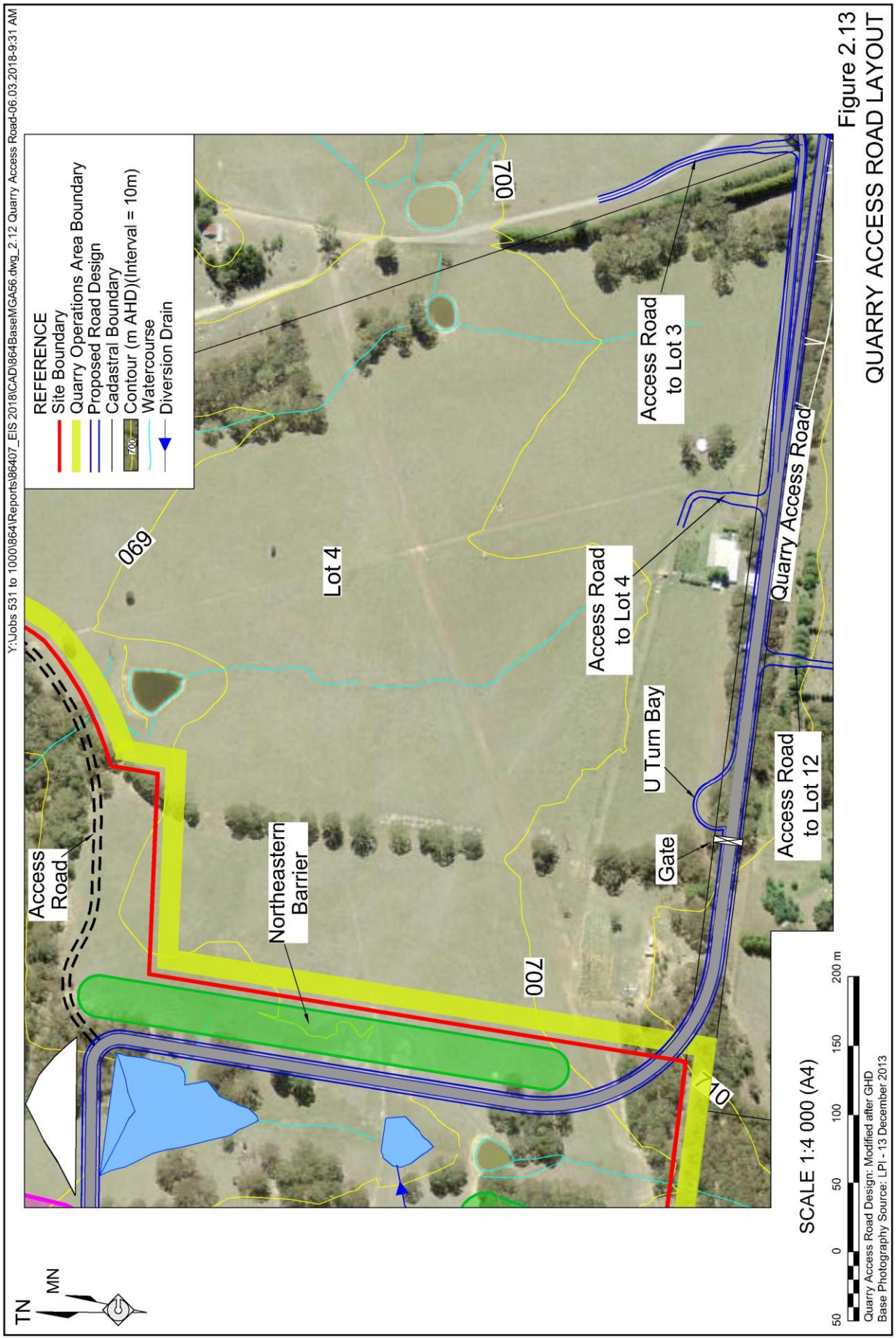


Figure 2.13
QUARRY ACCESS ROAD LAYOUT
Y:\Jobs 531 to 10001\864\Reports\86407_EIS 2018\CAD\864BaseMGA56.dwg_2.12 Quarry Access Road-06.03.2018-9:31 AM
REFERENCE
Site Boundary
Quarry Operations Area Boundary
Proposed Road Design
Cadastral Boundary
Contour (m AHD)(Interval = 10m)
Watercourse
Diversion Drain
700
069
Lot 4
Access Road to Lot 3
Access Road to Lot 4
Quarry Access Road
U Turn Bay
Gate
Access Road to Lot 12
Access Road
Northeastern Barrier
700
700
10
TN
MN
SCALE 1:4 000 (A4)
50 0 50 100 150 200 m
Quarry Access Road Design: Modified after GHD
Base Photography Source: LPI - 13 December 2013

The design of the Quarry Access Road would utilise topography and cut sections along its alignment, where possible, to maximise the attenuation of road traffic noise however, an acoustic barrier would also be constructed to limit traffic noise at the residences on Lot 12 DP241054 and Lot 4 DP253435. The Quarry Access Road would also be used by the owners of Lot 4 DP253435 and Lot 12 DP241054 to directly access their properties. Due to the inbound and outbound lane separation on the Quarry Access Road, access to the residence on Lot 3 DP253435 would be via a U-turn bay (refer **Figure 2.12**) near the entrance to the Site that would be constructed for this purpose as well as to provide recourse for those vehicles mistakenly entering the Quarry Access Road. The Quarry Access Road would also include a range of mitigation works such as cattle grids, fencing and planting part of its construction. This is considered an improvement for these owners and occupiers as they currently access their properties directly from the Hume Highway.

2.8.2.2 Operational Stage

For the purpose of the traffic and transport assessment (Section 5.1), the Applicant anticipates that at least 70% of the sand products would be despatched from the Site using 19m truck and dog trailers (4-axle, 37 tonne capacity). A further 25% would be transported using 19m truck and dog trailers (3-axle, 33 tonne capacity) with the remaining 5% of product being transported by rigid trucks (12 to 18 tonne capacity). Other trucks such as smaller rigid vehicles and trucks licenced for Higher Mass Limits (up to 26.5m) would also make up a small proportion of Quarry traffic. For the purposes of calculating average daily truck movements, an average of 35t has been used, whilst sales and transport operations are proposed to occur seven days a week, an average of 300 days per year for sales has been utilised to account for Sundays and Public Holidays when it is considered unlikely that sales and delivery to customers on these days would be a regular occurrence.

Table 2.4 presents the forecast daily truck traffic generation arising from the despatch of sand products for average and maximum scenarios i.e. for the average and maximum sales. In addition to the truck movements presented in both tables, the Applicant anticipates that up to 12 additional truck movements per day (6 return trips) would be required for the delivery of production consumables (e.g. fuel) and maintenance equipment to facilitate quarry production.

Table 2.4
Forecast Daily Truck Traffic Generation from Product Sales*

	Product Sales	
Traffic Scenario	**700 000 tpa (Average)**	**860 000 tpa (Maximum)**
Average	67 laden trucks	83 laden trucks
	134 truck movements	166 truck movements
Maximum	134 laden trucks	166 laden trucks
	268 truck movements	332 truck movements
* Note: An additional 12 truck movements per day could occur arising from the delivery of quarry consumables and for maintenance activities.		

The majority of truck movements would be planned during periods that avoid the Sydney Metropolitan Area peak traffic periods. From an hourly perspective, it is envisaged the busiest period would be between 4:00am and 6:00am with up to 50 truck movements (25 loads) per hour when the maximum production despatch of 860 000tpa is achieved. It is recognised that

fewer trucks would be despatched throughout the latter stages of the day, however, it is proposed that the maximum rate of laden trucks departing the Site would not exceed 25 per hour throughout any hour of the day. The maximum hourly rate of despatch may also be required for large scale local deliveries when smaller capacity trucks are used.

2.8.2.3 VENM/ENM Importation

The Applicant proposes to import VENM/ENM for use as backfill to create the final landform within the extraction area. All VENM/ENM would be imported in trucks travelling to the Site to collect a load of sand products. The practice of backloading would therefore not result in any additional truck movements for the Proposal.

2.8.3 Product Transport Routes

All laden trucks departing the Site would travel northwards from the new northbound on-ramp at the end of the Quarry Access Road and enter the northbound lanes of the Hume Highway (see **Figure 2.12**). **Figure 2.14** displays the proposed transport routes for the delivery of sand products from the Site. The Applicant proposes that, on average, approximately 95% of laden trucks would travel north towards the Sydney market with fewer numbers of trucks destined for the Illawarra, Southern Highlands, Goulburn and Canberra.

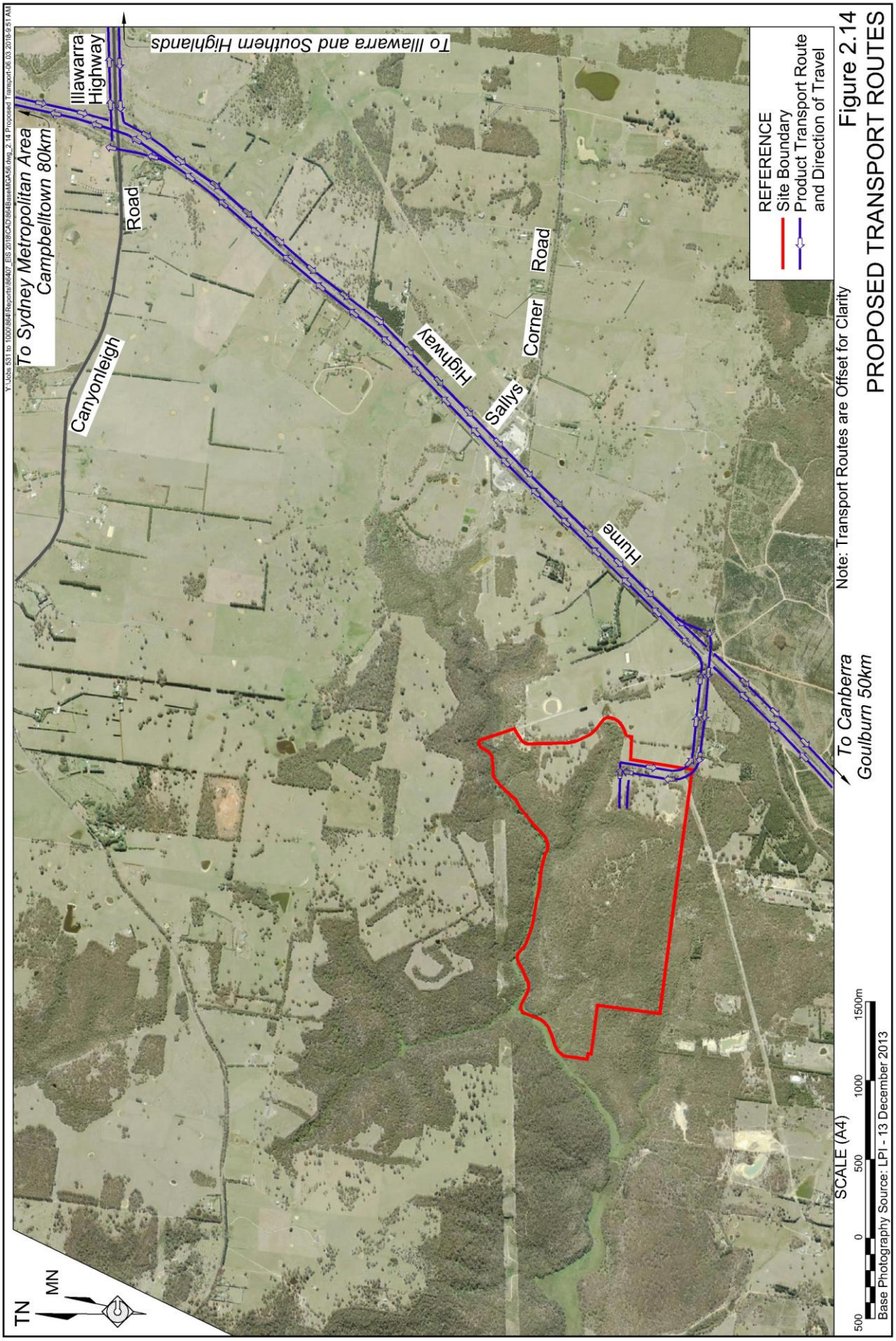
Trucks destined for Sydney would travel northwards along the Hume Highway beyond the Illawarra Highway whereas trucks destined for the Illawarra and Southern Highlands would turn eastwards along the Illawarra Highway. Those trucks destined towards Goulburn and Canberra would use the Hume Highway/Illawarra Highway interchange to effectively undertake a "U" turn and return southwards along the Hume Highway. Use of this interchange would be required for no more than 5% of laden product despatch and return journeys.

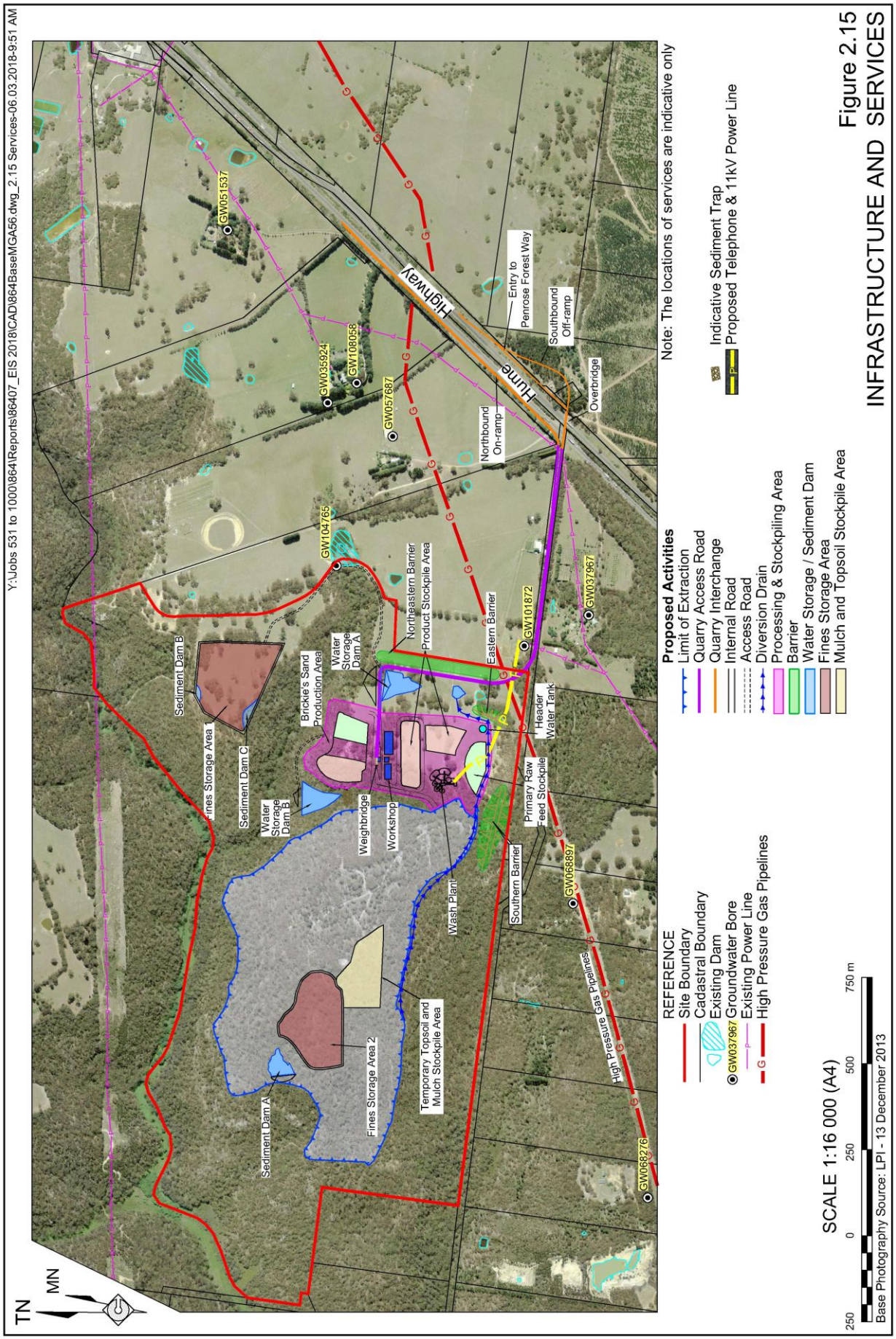
Unladen trucks travelling to the Site from Sydney, the Illawarra and Southern Highlands would approach the Quarry Interchange from the north via the new southbound off-ramp and cross the Hume Highway at the new overbridge and enter the Quarry Access Road. Unladen trucks travelling to the Site from Goulburn or Canberra would use the Hume Highway/Illawarra Highway interchange to approach the Quarry Interchange via the southbound lane of the Hume Highway and enter the Quarry Access Road via the new overbridge.

2.9 INFRASTRUCTURE, UTILITIES AND SERVICES

2.9.1 Introduction

Quarrying operations would require a site office, light-vehicle car park, laboratory, lunchroom, weighbridges, workshop, fuelling area, first-aid, amenities and training facilities. The proposed services that would be used on site are summarised below. Plans of all buildings would be prepared and submitted to Wingecarribee Shire Council with the applications for Construction Certificates. **Figure 2.15** displays the locations of the proposed site infrastructure and services.


To Illawarra and Southern Highlands
Illawarra Highway
To Sydney Metropolitan Area
Campbelltown 80km
Canyonleigh Road
Hume Highway
Sallys Corner Road
To Canberra
Goulburn 50km
REFERENCE
Site Boundary
Product Transport Route and Direction of Travel
Figure 2.14
PROPOSED TRANSPORT ROUTES
Note: Transport Routes are Offset for Clarity
SCALE (A4)
500 0 500 1000 1500m
Base Photography Source: LPI - 13 December 2013
TN
MN


Y:\Jobs 531 to 1000\864\Reports\86407_EIS 2018\CAD\864BaseMGA56.dwg_2.15 Services-06.03.2018-9:51 AM
TN
MN
Highway
Hume
Entry to Penrose Forest Way
Southbound Off-ramp
Overbridge
Northbound On-ramp
GW051537
GW035924
GW106058
GW057687
GW104765
GW037967
GW101872
GW066897
GW068276
Sediment Dam B
Fines Storage Area
Sediment Dam C
Water Storage Dam B
Brickie's Sand Production Area
Water Storage Dam A
Northeastern Barrier
Product Stockpile Area
Eastern Barrier
Header Water Tank
Primary Raw Feed Stockpile
Weighbridge
Workshop
Wash Plant
Southern Barrier
High Pressure Gas Pipelines
Temporary Topsoil and Mulch Stockpile Area
Fines Storage Area 2
Sediment Dam A
Note: The locations of services are indicative only
Indicative Sediment Trap
Proposed Telephone & 11kV Power Line
Proposed Activities
Limit of Extraction
Quarry Access Road
Quarry Interchange
Internal Road
Access Road
Diversion Drain
Processing & Stockpiling Area
Barrier
Water Storage / Sediment Dam
Fines Storage Area
Mulch and Topsoil Stockpile Area
REFERENCE
Site Boundary
Cadastral Boundary
Existing Dam
GW037967 Groundwater Bore
Existing Power Line
High Pressure Gas Pipelines
SCALE 1:16 000 (A4)
250 0 250 500 750 m
Base Photography Source: LPI - 13 December 2013
Figure 2.15
INFRASTRUCTURE AND SERVICES

2.9.2 Power

During the site establishment and construction stage, all electrical power on site would be generated by diesel-fuelled generators. The bulk of the Site would be progressively converted to the use of mains power with an 11kV power line to be established from the nearest transformer located near the on-site meteorological station.

2.9.3 Telephone

The Site would be serviced by telephone lines to the office. On-site communications would be undertaken by two-way radio and mobile phones.

2.9.4 Water Supply

Water required for sand processing and dust suppression would be drawn from a range of surface water and groundwater sources within and near the Quarry Operations Area. Surface water would be collected from catchments within the Site, including the active sumps within the extraction area. Two water storage dams would be constructed with a combined capacity of approximately 13.8ML to collect surface water runoff under the maximum harvestable right provisions of the *Water Management Act 2000*. Additional water would be sourced from either the existing groundwater bore (Bore 1) (GW 104765) near the Farm Dam (**Figure 2.15**) to access water from aquifers within the Hawkesbury Sandstone as part of a licensed allocation or from a third party under a commercial supply agreement during periods when reliance cannot be placed on the use of surface water. During such periods, groundwater would be pumped directly to the header water tank (**Figure 2.9**) to provide make-up water for processing and dust suppression. At all other times, water for operational purposes would be drawn from the water storage dams or sumps.

2.9.5 Fuels and Lubricants

Diesel fuel would be stored on site in self-bunded above-ground tanks (nominally 20 000L in capacity) located adjacent to the workshop (see **Figure 2.1**). All 205L or 20L hydrocarbon drums when not in use would be secured in one or more shipping containers. All fuelling of mobile equipment would either be conducted within a bunded, concrete hardstand area or defined areas within the extraction area.

Chemicals, lubricants and greases would be stored within the workshop area in either self-bunded containers or within suitably contained and sealed areas. All chemicals used on site would be stored within the workshop area in designated storage areas and cupboards in accordance with relevant Australian Standards and manufacturers' specifications. Material safety data sheets would be maintained for all chemicals used / stored on site.

2.9.6 Sewage and Effluent Disposal

All sewage would be captured on site and treated in an aerated wastewater treatment system before being disposed into subsurface absorption trenches or beds or irrigation area. The wastewater treatment system would be located at least 40m from any drainage depression or similar water management structure.

2.10 HOURS OF OPERATION AND PROPOSAL LIFE

2.10.1 Hours of Operation

Table 2.5 lists the proposed hours of operation for a range of activities that would be undertaken on site throughout the life of the Proposal.

Table 2.5
Proposed Hours of Operation

Activity	Monday to Friday	Saturdays	Sundays or Public Holidays
Site Establishment and Construction[1]	6:00am to 10:00pm	6:00am to 10:00pm	Nil (unless required for external roadworks)
Extraction Operations	5:00am to 10:00pm	5:00am to 10:00pm	5:00am to 10:00pm
Blasting Operations (as required)	9:00am to 5:00pm	9:00am to 5:00pm	Nil
Processing Operations	24 hours / day	24 hours / day	24 hours / day
Product Despatch	24 hours / day	24 hours / day	24 hours / day
Maintenance	24 hours / day	24 hours / day	24 hours / day

1. Site establishment and construction activities beyond 6:00pm, Monday to Saturdays would be restricted to those activities that are not audible at surrounding residences.

The hours nominated in **Table 2.5** are those that the Applicant would operate within, not that they would be operating throughout the entire nominated periods. That is, the nominated hours would provide the flexibility needed to undertake all site activities when required. The proposed operating hours are consistent with standard operating hours for site establishment and construction, extraction operations, maintenance and blasting activities at sites that are sufficiently distant from neighbours and/or have incorporated sufficient mitigation measures to achieve the required levels of compliance. The extended hours of operation for the processing (when needed) and product despatch are justified on the basis of the projected demand for the sand products, particularly during periods of high demand and given that the proposed operations would be sufficiently mitigated to satisfy all relevant technical criteria, especially predicted maximum noise levels which would remain well below the sleep disturbance criteria (see Section 5.4.7). The flexibility achieved by the proposed operating hours would be important in order that the Applicant can respond to large volume or urgent orders from its customers.

2.10.2 Life of the Proposal

At the proposed rate of extraction and processing, the overall operational life of the Sutton Forest Sand Quarry would be greater than 30 years. The Applicant anticipates that the Stage 5 extraction activities would be completed within 30 years. As such, the Applicant is currently seeking development consent to conduct quarrying activities for 30 years, with the expectation that a further development consent would be applied for before the end of the 30 year term to extend the operational life of the Quarry for the completion of the Proposal.

Rehabilitation activities would require a further 4 to 5 years to complete, beyond the cessation of extraction and processing activities, principally to accommodate the delivery of the required quantity of VENM/ENM to complete the construction of the final landform.

2.11 WASTE MANAGEMENT

2.11.1 Introduction

The wastes generated on site would either be production by-products or non-production wastes. No waste for landfilling would be imported onto the Site as part of this Proposal, other than the importation of "clean fill" (VENM and ENM) for use in site rehabilitation.

2.11.2 Production By-products

2.11.2.1 Overburden

There is limited overburden above the friable sandstone within the proposed extraction area. Any overburden would be used in conjunction with oversize material, in creating the substrate for vegetation on the final landform.

When the overburden is not required for immediate use, it would be stored within the topsoil and mulch stockpile area. Beyond the end of Stage 4, the Applicant would endeavour to place the overburden in an area where it would not need to be double-handled.

2.11.2.2 Oversize Management

Oversize materials generally comprise harder sandstone, ironstone or similar materials typically greater than approximately 3mm to 5mm, separated during the screening or washing process. Oversize materials would typically represent approximately 3% of the total quantity of raw feed to the brickie's sand plant and wash plant. It is proposed to use the oversize materials that are not successfully reprocessed, in combination with the overburden, to create the substrate for vegetation on the final landform.

2.11.2.3 Residual Fines Management

The management of residual fines has been described in Section 2.7.3. The residual fines would amount to approximately 11-14% of the quantity of raw feed processed through the wash plant which, based on a maximum rate of production would be approximately 140 000tpa.

2.11.3 Non-Production Wastes

2.11.3.1 Domestic Wastes and Maintenance Consumables

General domestic waste would 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. No domestic wastes would be disposed of on site.

It is estimated that approximately $100m^3$ of domestic mixed solid waste and recyclables would be produced annually with an average of one skip truck delivery/collection each fortnight. Recyclables would be collected less frequently or on an as needs basis.

2.11.3.2 Waste Oils and Filters

Waste oil and filters would be collected and removed by a licensed recycling contractor. Waste oil would be stored in a 3 000L self-bunded tank from which it would be collected and removed from site for disposal/reuse by a licenced contractor. It is expected that the waste oil tank would be collected once or twice a year. All routine maintenance consumables would be treated as general mixed solid waste. Separate collection skips would be maintained at the workshop for cardboard and metals.

Should fuel leaks or spillages occur outside these areas, the contaminated material would be either remediated on site or removed by a licenced contractor.

2.12 EMPLOYMENT, SAFETY AND SECURITY

2.12.1 Employment

During the 12 month site establishment and construction stage, the Applicant estimates a total of 20 full-time equivalent positions would be created.

During the initial period of operations, the Applicant would employ a minimum of 15 persons fulltime to undertake all on-site tasks, administration and sales. As annual sales increase, it is proposed to employ up to 22 persons fulltime on site. Between 22 and 30 truck drivers would be employed either by the Applicant or its customers to deliver sand products from the Site. The estimate of the number of truck drivers assumes each driver would typically complete an average of three return trips to and from the Site each day. **Table 2.6** lists the likely employment position/function and the employment levels for average and maximum sales of Quarry products.

Table 2.6
Indicative Employment

Position/Function	No. Employed	
	700 00tpa	**860 000tpa**
Direct Quarry Employment		
Quarry Manager	1	1
Administration	2	2
Weighbridge Officer	2	3
Sales	2	2
Wash Plant Operators	2	2
Mobile Equipment Operators	7	9
Mechanic/Fitter	2	3
Sub-total	**18**	**22**
Indirect Product Transport Contractors		
Truck Drivers	22	30
Total	**40**	**52**
Source: Sutton Forest Quarries Pty Ltd		

2.12.2 Safety

It is the Applicant's objective that each person employed on or visiting the Site is provided with a safe and healthy environment. The Applicant would prepare a comprehensive Safety Management Plan for the Quarry fully satisfying all statutory requirements of the Division of Resources and Energy and WorkCover.

The Applicant would progressively construct a series of safety bunds around the perimeter of the extraction area to prevent inadvertent access over the perimeter extraction faces. Similar safety bunds or barriers would be constructed adjacent to internal roads adjacent to any slopes >1:3 (V:H). The bunds would be retained around the southern side of the extraction area at the end of the life of the Quarry as a long-term safety feature. It is further noted that access to the final perimeter of the extraction faces would be limited by the placement of logs and growth of vegetation on the outer side of the safety bund.

The Applicant would ensure that operations within the Site would be conducted in accordance with the requirements of the following.

- *Workplace Health and Safety Act 2011.*
- *Workplace Health and Safety Regulations 2011.*
- *Work Health and Safety (Mines and Petroleum Sites) Act 2013.*
- *Work Health and Safety (Mines and Petroleum Sites) Regulations 2014.*

2.12.3 Security

Reliance would be placed upon the existing agricultural fencing around the boundary of Lot 4 DP253435. The Quarry Access Road would be enclosed with various agricultural-style fences with gates and grids to allow access for landowners of Lot 12 DP241054 and Lots 3 and 4 DP253435. A set of entrance gates would be installed immediately west of the Quarry Access Road U-turn bay (see **Figure 2.13**). These gates would prevent unauthorised access to the Site.

2.13 REHABILITATION

2.13.1 Introduction

The Applicant is committed to an integrated approach to rehabilitation of all areas to be disturbed within the Site. The progressive approach to final landform development and rehabilitation procedures used for the rehabilitation of the extraction area perimeter, benches and floor of the extraction area and the processing and stockpiling area that are described in the following subsections would ensure final land use objectives are met.

The Applicant is proposing a 30 year development consent that would permit extraction activities to Stage 5 of the extraction sequence (see Section 2.5.4 and **Figure 2.7**). It is proposed that at the cessation of the currently sought development consent, a further development consent would be sought to extend the life of the Proposal to allow the complete extraction of the friable sandstone resource. The rehabilitation strategy for the Site has been developed to incorporate the progressive development of the landform based on the longer term projected life

of the Quarry. However, it is acknowledged that the currently sought development consent would cease at the end of Stage 5 and therefore an interim final landform is presented in this subsection. A long-term final landform is also presented to account for activities to the end of Stage 7.

2.13.2 Rehabilitation and Final Land Use Objectives

The Applicant's objectives for rehabilitation are centred upon the progressive shaping and revegetation of areas of disturbance through the creation of a final landform, a suitable substrate and a vegetative cover suitable for the proposed long-term land uses. The specific objectives for the long term rehabilitation program are to:

- blend the created landforms and vegetation established on the post-extraction landform with that of the surrounding topography on the northern side of the extraction area; and
- provide a low maintenance, free draining, geotechnically stable and safe landform with minimal erosion, particularly within the extraction area and processing and stockpiling area.

The Applicant would also implement a program of interim rehabilitation of disturbed / constructed areas in order to:

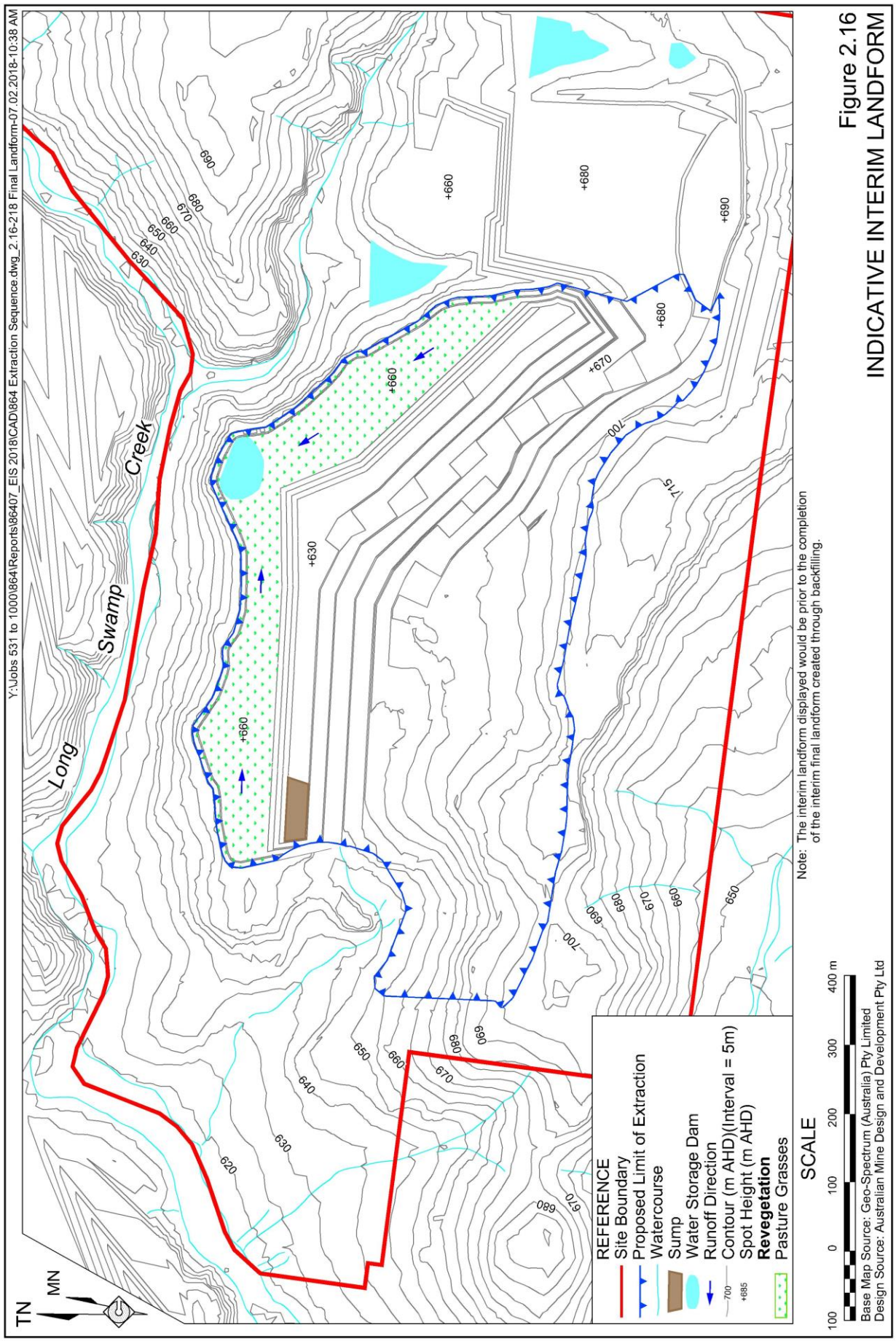
- where possible, conserve all topsoil and if not immediately used in rehabilitation, stockpile in an appropriate manner and location;
- minimise the areas of exposed surfaces that would otherwise be potential sources of sediment-laden runoff or windblown dust; and
- ensure interim slopes are stable.

2.13.3 Landform Development

2.13.3.1 Indicative Interim Landform

Figure 2.16 presents the proposed indicative interim landform at the end of extraction Stage 5, which represents the extent of extraction and rehabilitation activities undertaken up to Year 30 of the Proposal life, i.e. at the end of the current development consent being sought, assuming average rates of extraction in preceding years. The key features of the proposed indicative interim landform at the end of Stage 5 of the Proposal would be as follows.

1. The northern and eastern margins of the extraction area would be backfilled and left with a surface elevation of approximately 660m AHD and grade of approximately 1:3 (V:H) or less adjacent to these margins. The final surface would slope towards a surface water storage in the northeastern corner of the backfilled extraction area. There would be no runoff possible toward Long Swamp Creek given the final elevation of the backfilled landform would be below the existing land surface around the northern margin of the extraction area.


Y:\Jobs 531 to 1000\864\Reports\86407_EIS 2018\CAD\864 Extraction Sequence.dwg_2.16-218 Final Landform-07.02.2018-10:38 AM
Long Swamp Creek
TN
MN
REFERENCE
Site Boundary
Proposed Limit of Extraction
Watercourse
Sump
Water Storage Dam
Runoff Direction
Contour (m AHD)(Interval = 5m)
Spot Height (m AHD)
Revegetation
Pasture Grasses
SCALE
100 0 100 200 300 400 m
Base Map Source: Geo-Spectrum (Australia) Pty Limited
Design Source: Australian Mine Design and Development Pty Ltd
Note: The interim landform displayed would be prior to the completion of the interim final landform created through backfilling.
INDICATIVE INTERIM LANDFORM
Figure 2.16

2. There would be a narrow section of floor within the extraction area at a level of approximately 630m AHD. The extraction faces to the south and southeast would comprise benches up to 690m AHD.
3. The floor of the extraction area would direct the internal runoff to a sump within the western section of the floor.
4. The internal access road into the extraction area would be retained to the 630m AHD level.

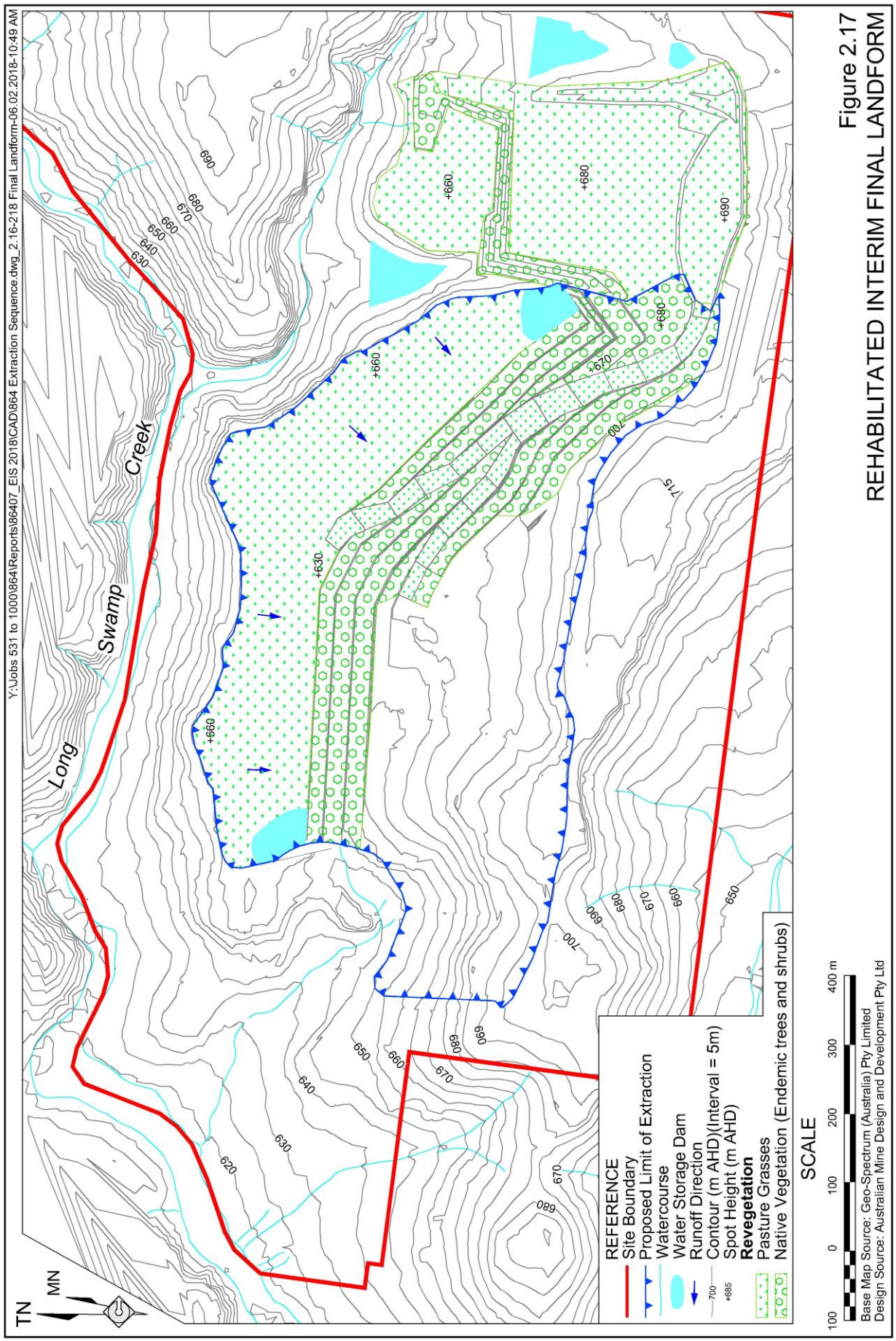
2.13.3.2 Rehabilitated Interim Final Landform

It is noted that approval would be sought prior to the conclusion of Stage 5 to extend the life of the Proposal to allow the remaining friable sandstone to be removed and the long-term final landform to be completed and vegetated. However, it is acknowledged that approval for extension of the Proposal life at the end of the initial 30 year operational period cannot be assumed. Therefore, an interim final landform and revegetation regime is presented in **Figure 2.17** that would be completed should the development not proceed beyond Stage 5. It is proposed that rehabilitation of this final landform would commence once the 30 year extraction period ceases and should an approval for ongoing extraction not be received.

The key features of the rehabilitated interim final landform would be as follows.

1. The elevated backfilled area adjacent to the northern side extraction area would be profiled through pushing the backfilled materials to base of the 630m AHD bench to create a slope. The final surface would direct surface runoff to dams on the surface.
2. The profiled backfilled areas would be left with a grade of approximately 1:3 (V:H) or less towards the extraction benches. The dams would be retained on the final landform for watering stock and native fauna.
3. The southern extraction faces from 670m AHD and above would be retained with up to 1.5m of oversize material placed on each bench providing a substrate for native vegetation.
4. The internal access road into the final landform would be retained down to the approximately 630m AHD level.
5. The processing and stockpiling area would be retained as a single feature retaining its gentle slope towards the northeast and northwest. The margins of the processing area would be re-profiled to a final slope approaching 1:3 (V:H) with material recovered from the eastern and northeastern barriers.

The former Quarry Access Road would be retained to provide long-term access for the subsequent land uses within Lot 4 DP253545 and to properties at Lot 12 DP241054 and Lot 3 DP253435.


Y:\Jobs 531 to 1000\864\Reports\86407_EIS 2018\CAD\864 Extraction Sequence.dwg_2.16-218 Final Landform-06.02.2018-10:49 AM
Long Swamp Creek
TN
MN
REFERENCE
Site Boundary
Proposed Limit of Extraction
Watercourse
Water Storage Dam
Runoff Direction
Contour (m AHD)(Interval = 5m)
Spot Height (m AHD)
Revegetation
Pasture Grasses
Native Vegetation (Endemic trees and shrubs)
SCALE
100 0 100 200 300 400 m
Base Map Source: Geo-Spectrum (Australia) Pty Limited
Design Source: Australian Mine Design and Development Pty Ltd
REHABILITATED INTERIM FINAL LANDFORM
Figure 2.17

2.13.3.3 Rehabilitated Long-term Final Landform

As the Applicant intends to continue extraction operations and processing well beyond the initial 30 year period of development consent with its rehabilitation strategy based on the progressive backfilling of the extraction void to create a suitable final landform at the end of the Proposal's operational life.

Figure 2.18 presents the proposed long-term final landform at the end of the Proposal's operational life, i.e. after additional extraction and rehabilitation stages have occurred under a further development consent. The key features of the final landform at the end of the life of the Proposal would be as follows.

1. The overall extraction area would be backfilled with an undulating final surface typically between 660m AHD and 665m AHD which would direct surface runoff to a series of dams on the surface rather than directing surface runoff to one location.
2. The northern, eastern and western margins of the extraction area would be left with a grade of approximately 1:3 (V:H) or less towards the northwest of the extraction area. The western section of the extraction area where extraction occurs below 660m AHD would also have a grade of 1:3 (V:H) or less. The final landform in this area would be profiled to direct runoff away from this final slope and towards a dam nearby. A number of dams would be retained on the final landform for watering stock and native fauna.
3. The southern extraction faces, internal access roads, processing and stockpiling area would be rehabilitated as described for the interim final landform.

The former Quarry Access Road would be retained to provide long-term access for the subsequent land uses within Lot 4 DP253545 and to properties at Lot 12 DP241054 and Lot 3 DP253435.

2.13.4 Rehabilitation Procedures

2.13.4.1 Introduction

The Applicant recognises that the development of the Site in the manner proposed would provide limited opportunities for the progressive rehabilitation of disturbed areas during the initial development consent period. The rehabilitation procedures that would be adopted would vary depending on the nature and location of the disturbance, the status of the final landform and the future land uses.

The rehabilitation procedures provided in these subsections are conceptual. Specific timing, locations and methods of rehabilitation would be documented in the Landscape and Rehabilitation Management Plan[1], which would be updated as required during the life of the Quarry. The timing for rehabilitation implementation would be dependent on progressive development and be reported in the Annual Review for the operation.

[1] The Landscape and Rehabilitation Management Plan, a standard document required for all State significant quarries would be required to address all rehabilitation matters. It is also a standard requirement that an Annual Review be prepared each year to provide an overview of annual operation, environmental performance, rehabilitation and compliance. The Annual Review is submitted to DPE and made publicly available.

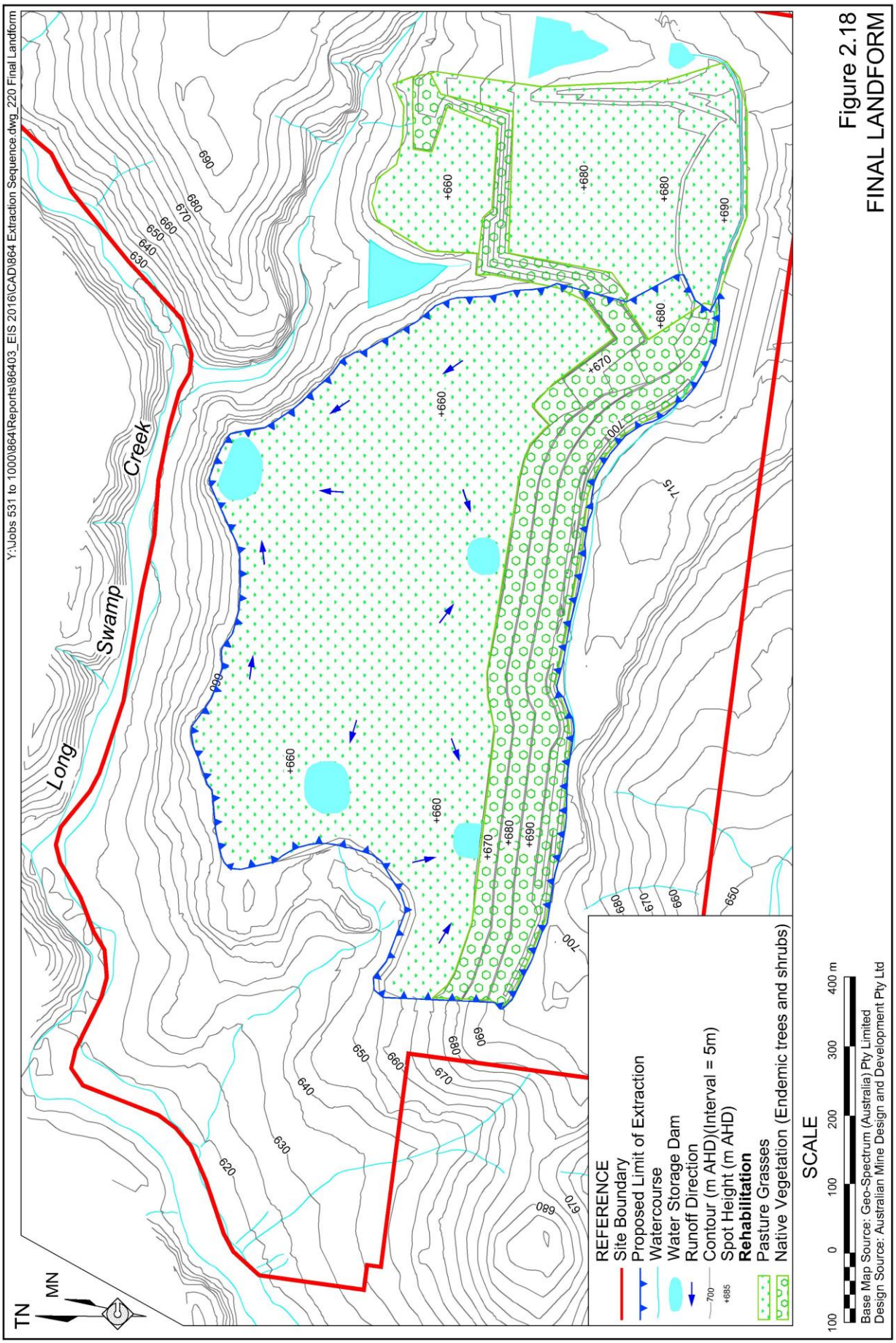


Figure 2.18
FINAL LANDFORM

2.13.4.2 Progressive Rehabilitation within the Site

It is anticipated that Fines Storage Area 1 would reach capacity after approximately 6 years of operations. This area would be progressively profiled and revegetated with suitable groundcover and native vegetation once it reaches capacity. Once revegetation is completed, the area would be incorporated within the on-site biodiversity offset area (see Section 2.14).

Once Fines Storage Area 1 and the Fines Storage Area 2 have reached capacity, the fines produced within the wash plant would be progressively placed within the completed areas of the extraction area. Once backfilling is sufficiently complete and the landform within the extraction area is at its final profile, the area would be covered with available subsoil and topsoil and revegetated consistent with the final land use.

The earthen barriers constructed to preserve visual and noise amenity would be progressively revegetated with a suitable groundcover and native vegetation. Once revegetation is completed, the southern barrier would be incorporated into on-site biodiversity offset area (see Section 2.14).

2.13.4.3 Decommissioning and Removal of Fixed Plant and Equipment

After the completion of the extraction and processing operations, all fixed plant and equipment would be removed from the Site. Any buildings or structures required by the landowner would be retained. Consent for ongoing use of these buildings and structures, where required, would be sought by the landowner. A contamination assessment of the processing and stockpiling area would be undertaken to identify any areas of contamination as a result of hydrocarbon or other material that remains in the landform. Any identified contaminated material would be remediated on site or removed to a suitable landfill facility.

2.13.4.4 Rehabilitation Procedures for the Final Landform

The procedures for the rehabilitation of the extraction area, final safety bunds, extraction benches and all other disturbed areas within the extraction area are described as follows. The Applicant plans that each of these activities is undertaken during the second development consent period, i.e. beyond 30 years. However, it is acknowledged that these procedures would be applied at the end of the development consent period, should an extension not be approved. Each of the nominated rehabilitation procedures would be implemented as each component area is completed and no longer required for any operational purpose.

Final Safety Bund

A final safety bund would be set back approximately 3m from the southern boundary of the extraction area and constructed to a height of approximately 1.5m with side slopes of 1:2 (V:H) and a flat, 1m wide crest. The bund would be constructed progressively in conjunction with the commencement of extraction near the southern boundary of the extraction area, i.e. near the beginning of Stage 7. The bund would be constructed predominantly using subsoil with up to 150mm of topsoil on the top and outer surfaces. Once each length of bund is constructed, a seed mix comprising of native shrub species would be sown over the surface of the bund. Apart from stabilising the surface of the safety bund, the vegetation growth is also intended to limit/prevent inadvertent access beyond the bund.

Subject to their availability, large logs would be placed on the upslope side of the safety bund to also provide a deterrent to any persons on trail bikes, 4WDs, etc.

Extraction Area

The extraction area would be rehabilitated principally through backfilling the extraction void with "clean fill" using imported VENM and ENM together with the unsaleable oversize materials and processing fines generated within the wash plant.

Approximately 2.7 million m^3 of backfill materials would be required to achieve the interim landform as presented in **Figure 2.16**. It is envisaged that the materials originating on site would account for 1.7 million m^3 of the backfill materials with the remaining 1 million m^3 being VENM/ENM transported to the Site as backloads principally from the Sydney Metropolitan Area.

A further 7 million m^3 of backfill materials would be required to backfill the remainder of the extraction void to achieve the final landform presented in **Figure 2.18**.

Once sufficient area is available on the floor of the extraction area (at approximately 630m AHD), the Applicant proposes to progressively relocate the fines stored within the footprint of the extraction area (Fines Storage Area 2) and place them in a manner that allows them to be compacted through the weight of the haul trucks delivering the fines, i.e. in conjunction with the imported VENM/ENM. Emphasis would be placed upon blending the imported materials with the materials generated on site.

The final landform would effectively be constructed in layers gradually rising towards the projected final contours. Care would be taken when approaching the final landform levels to ensure that the materials placed near the surface are a suitable growth medium (of sufficient depth) to support the planted vegetation growth.

Topsoil would be recovered from either the topsoil stockpile or from new extraction stages and placed upon the completed landform. Biomass (mainly small branches and shrubs) from subsequent areas to be cleared would be placed on the final landform after soil placement.

The completed areas would be revegetated with either a pasture mix (in areas designated for grazing) or a range of native species drawn from those listed in **Table 2.7** for the planned areas of nature conservation.

Extraction Benches

Extraction benches, typically approximately 25m wide, would be retained along the southern perimeter of the extraction area. The rehabilitation of the extraction benches would involve the profiling of each bench to ensure drainage flows towards the back of the bench and along to defined drop-down points to the final floor and towards the final dams. These drop-down points would, where considered necessary, be armoured with oversize material to reduce the impact of the water flow. Up to 1.5m of overburden and/or oversize materials possibly with previously cleared vegetation mulch, would be used to cover each bench and provide the ideal microclimate for hand seeding with a selection of species listed in **Table 2.7**. The placement of overburden and oversize materials would be undertaken soon after the creation of each final 10m face whilst access is still available to the area, i.e. before the adjoining face is created.

Table 2.7
Native Revegetation Species

Name	Name	Typical Height at Maturity (m)
Acacia mearnsii	Black Wattle	15
Allocasuarina littoralis	Black Sheoak	15
Banksia marginata	Silver Banksia	6
Eucalyptus agglomerata	Blue-leaved Stringybark	20
Eucalyptus dives	Broad-leaved Peppermint	15
Eucalyptus mannifera	Brittle Gum	15
Eucalyptus piperita	Sydney Peppermint	20
Eucalyptus punctata	Grey Gum	20
Eucalyptus radiata	Narrow-leaved Peppermint	20
Eucalyptus sclerophylla	Hard-leaved Scribbly Gum	15
Eucalyptus sieberi	Silvertop Ash	20
Acacia longifolia	Golden Wattle	3
Acacia terminalis	Sunshine Wattle	2
Banksia spinulosa	Hairpin Banksia	1.5
Dodonaea triquetra	Large-leaved Hop-bush	2
Hakea dactyloides	Finger Hakea	1.5
Hakea sericea	Silky Hakea	1.5
Indigofera australis	Austral Indigo	1
Kunzea ambigua	White Kunzea	2
Leptospermum polygalifolium	Yellow Teatree	2
Source: KMA (2018) – Table 13		

Seeding would typically be undertaken in autumn to maximise the survival rates, with emphasis placed upon the growth of shrubs and low trees on the benches. Natural recruitment from the surrounding vegetation is also likely, particularly for the top few benches.

Processing and Stockpiling Area

Following the removal of all plant and equipment, the Applicant proposes to reshape the perimeter of the area to remove all steep slopes and rip the remaining near-flat areas within the footprint of the processing and stockpiling area prior to placement of subsoil and topsoil around the perimeter of the area. The materials within the eastern barrier would be removed and incorporated within the reshaped processing and stockpiling area. The final surface would be stabilised with a pasture seed mix and fertilised in preparation for its use for grazing and use of a stock shelter.

Acoustic Barriers

Unless required for a subsequent land use, the northeastern barrier would be removed at the end of the Quarry life and the material used to recontour sections of the processing and stockpiling area or extraction area. Similarly, the roadside acoustic barriers adjacent to the Quarry Access Road would be dismantled and removed in the event they would not serve a purpose for the subsequent land use.

Other Disturbed Areas

All internal roads not required by the landowner would be removed and the areas rehabilitated. Rehabilitation would involve either deep ripping or removal of road materials prior to the replacement of subsoil/topsoil. The former Quarry Access Road would be retained to provide long-term access for the subsequent land uses within Lot 4 DP253545 and to properties at Lot 12 DP241054 and Lot 3 DP253435.

2.13.4.5 Management of Weeds and Rehabilitation Monitoring

The Applicant intends to implement a weed management strategy involving selective weed spraying programs, predominantly during the spring months.

Specific rehabilitation monitoring procedures and schedules would be included in the Landscape and Rehabilitation Management Sub-plan for the Proposal, however, the Applicant currently plans to use the services of a rehabilitation consultant to monitor the revegetation of completed areas of the Site and the spread of any weeds.

2.13.5 Final Land Use

2.13.5.1 Potential Future Land Uses

The final landform within the extraction area (**Figure 2.18**) would be most suited to a long-term land use of both grazing and conservation areas and wildlife corridors. The extent of grazing undertaken on the final landform would be determined in consultation with the landowner prior to commencement of Stage 5. Up until that stage, there would be very little opportunity for final landform development. Notwithstanding the landowner's role in identifying preferred grazing areas, **Figure 2.18** displays an indicative revegetation regime for the final landform that provides for both grazing and nature conservation land uses.

The final landform within the processing and stockpiling area would be suitable for use as a natural shelter for grazing stock. Trees would also be planted around the water storage dams retained in the final landform for stock watering.

2.13.5.2 Compliance with Strategic Land Use Objectives

The planning, development and operation of the Proposal would be undertaken to ensure that reasonable opportunities for wildlife movement would be maintained within the rehabilitated Site to the satisfaction of OEH and in accordance with the objectives of a range of planning instruments. The Proposal would be managed to avoid any long term detrimental impact on opportunities for north-south wildlife movement throughout the area.

2.14 BIODIVERSITY OFFSETS

2.14.1 Introduction

The DGRs issued on 7 February 2014 required that the Applicant provide:

> *"a comprehensive offset strategy to ensure the development maintains or improves biodiversity values in the medium to long term."*

A Biodiversity Offset Assessment has been prepared for the Proposal by Niche Environment and Heritage Pty Ltd (hereafter referred to as Niche (2018)). The Niche (2018) assessment is presented as Part 11 of the *Specialist Consultant Studies Compendium* and is, in part, based on the field survey results reported in the *Flora and Fauna Survey and Assessment* prepared by Kevin Mills & Associates (KMA, 2018) and additional ecological assessment of the proposed Quarry Access Road corridor undertaken by Biosis (2018). The results of these assessments are summarised in Section 5.5 and provided as Part 5A and Part 5B of the *Specialist Consultant Studies Compendium*, respectively.

A preliminary biodiversity offset assessment was prepared in 2014 following field surveys undertaken to assess the site attributes as required for a biobanking offset assessment. This assessment was undertaken in accordance with the *BioBanking Assessment Methodology* (BBAM) available at the time (DECCW, 2009). Niche (2018) presents an update to the preliminary assessment following modifications to the layout of the Site. In order to provide accurate calculations of offset credit requirements, the assessment has applied the relevant BBAM and the *Bio-Banking Credit Calculator (version 4)* (OEH, 2014a).

Since the preliminary biodiversity offset assessment was prepared (and after the DGRs for the Proposal had been issued) the *Framework for Biodiversity Assessment - NSW Biodiversity Offsets Policy for Major Projects (FBA)* (OEH, 2014b) was published and the *Biodiversity Conservation Act 2016* and *Biodiversity Offset Scheme* commenced (effectively superseding the FBA). As the relevant assessment and biodiversity credit calculations were already completed, the assessment of residual impacts that require offsetting is not required to address these guidelines. However, it is acknowledged that following the commencement of the *Biodiversity Conservation Act 2016* in August 2017 and the finalisation of transitional arrangements for BioBanking Agreements, any biodiversity offset area would need to be secured under a Biodiversity Stewardship Agreement.

Niche (2018) concluded that the use of the BBAM has resulted in an assessment that is consistent with the NSW Offsetting Principles for State Significant Development (OEH, 2013[2]) and the objectives and principles of the *NSW Biodiversity Offsets Policy for Major Projects* (OEH, 2014b). The assessment and approach to establishing the offset (the preliminary Biodiversity Offset Strategy) has been undertaken in accordance with the provisions of the *NSW OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects* (OEH, 2011) and the *NSW offset principles for major projects (state significant development and infrastructure)* (OEH, 2013). Correspondence from OEH, dated 20 February 2018 confirmed that this approach to the assessment of biodiversity offsetting requirements was appropriate. Section 3.2.2 provides more detail regarding the consultation with OEH.

KMA (2018) determined that a referral to the Commonwealth Department of Environment and Energy (DoEE) is not necessary for the Proposal, as there are unlikely to be significant impacts to Matters of National Environmental Significance. In addition, the implementation of management measures would protect the local population of the *Phyllota humifusa* that is listed as a threatened species in the EPBC Act. As such, an offsetting assessment using the EPBC Act Offsets Assessment Guide is considered unnecessary.

[2] OEH (2013) NSW offset principles for major projects (state significant development and infrastructure). NSW Office of Environment and Heritage, Sydney Australia. http://www.environment.nsw.gov.au/biodivoffsets/nswoffsetprincip.htm

In addition, it should be noted that the commencement of the *Biodiversity Conservation Act 2016* triggered the repeal of the *Threatened Species Conservation Act 1995*. The DGRs for the application make specific mention of the *Threatened Species Conservation Act 1995*. Reference to the *Threatened Species Conservation Act 1995* has been retained in this document for consistency, however all listings for threatened flora and fauna are now provided in the *Biodiversity Conservation Act 2016.*

2.14.2 Preliminary Biodiversity Offset Strategy

The Applicant has investigated several options presently available in order to satisfy the offsetting requirements for the Proposal. These include securing approximately 102ha of land within the Site as an on-site biodiversity offset and additional options to satisfy offsetting credit requirements identified by Niche (2018). The Applicant has also secured an approximately 200ha property to the west of the Site for the purpose of establishing a further land-based offset area. This land is referred to as the off-site biodiversity offset area and is yet to be comprehensively assessed to establish the credits that would be generated by securing this land as an offset area. A preliminary assessment of the land is provided in Section 2.14.5. Niche (2018) also reviewed the additional methods available to the Applicant to satisfy offsetting requirements including purchase and retirement of credits directly for landowners and various forms of financial contribution possible under the Biodiversity Offset Scheme.

The location of the proposed on-site biodiversity offset area and off-site biodiversity offset area is presented in **Figure 2.19**. Vegetation within the proposed on-site biodiversity offset area has been mapped and ecosystem and species credits that would be generated within this area have been calculated. Vegetation communities and native flora and fauna within the proposed off-site biodiversity offset area have not yet been surveyed. Niche (2018) has undertaken a preliminary assessment of the proposed off-site biodiversity offset area based a review of available aerial photography.

As the Proposal requires disturbance to a species listed under the *NSW Threatened Species Conservation Act 1995* (i.e. the Dwarf Phyllota (*Phyllota humifusa)),* the calculation of biodiversity offset requirements and management measures includes consideration of species credits in accordance with the BBAM (OEH, 2014a).

Following receipt of development consent, the Applicant would assess the biodiversity offset credits that would be generated in the proposed off-site biodiversity offset area and re-assess the biodiversity offset credits that would be generated in the proposed on-site biodiversity offset area in accordance with the methodology provided under the *Biodiversity Conservation Act 2016.* A *Biodiversity Offset Strategy* would be developed in consultation with OEH and include preparation of a Biodiversity Offset Management Plan that would provide further details on the implementation of the *Biodiversity Offset Strategy* as well as ongoing management of biodiversity within the final offset areas. It is proposed that the *Biodiversity Offset Strategy* would be submitted prior to the commencement of vegetation clearing and the Biodiversity Offset Management Plan prepared within 12 months of the commencement of operations.

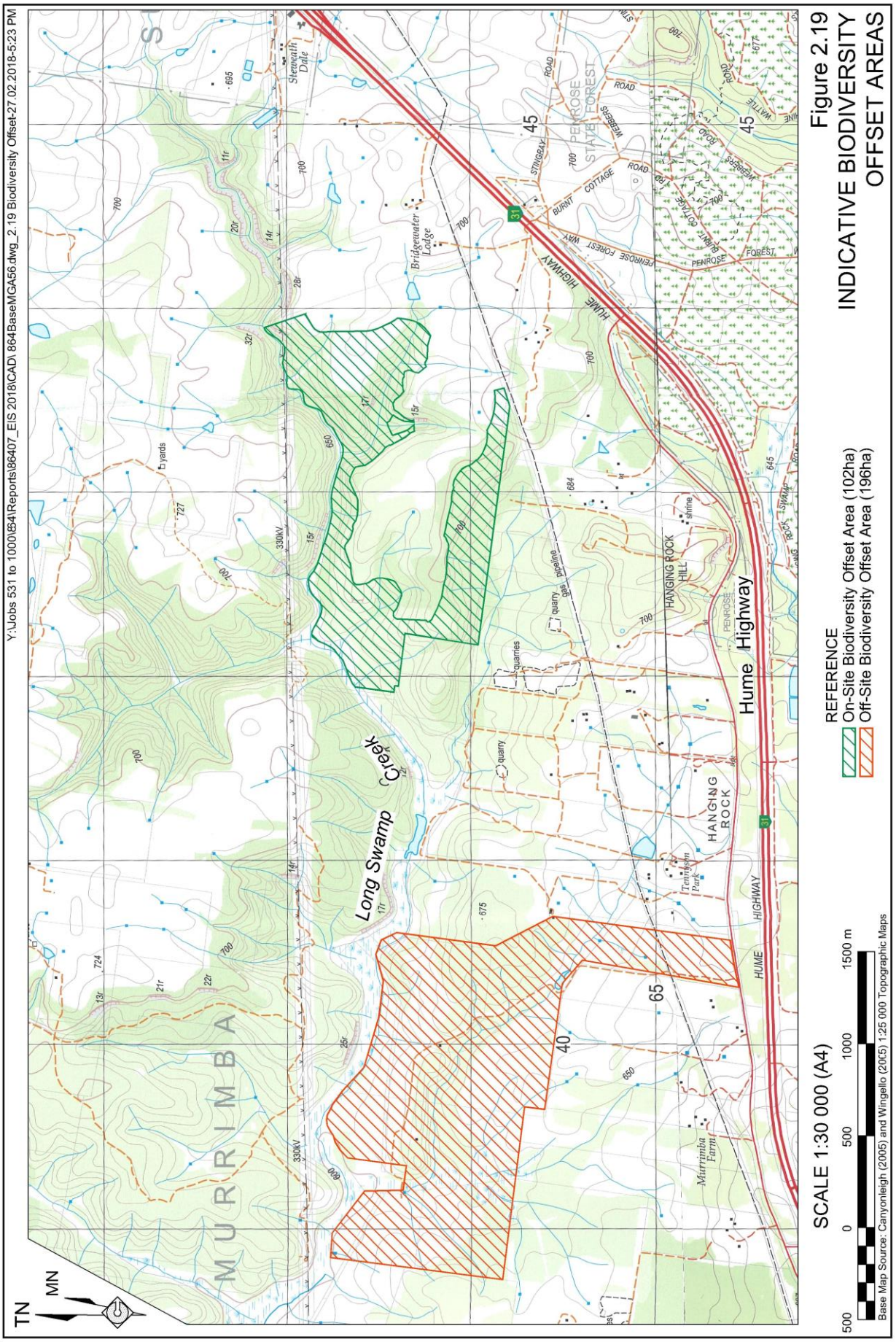


Figure 2.19
INDICATIVE BIODIVERSITY OFFSET AREAS
REFERENCE
On-Site Biodiversity Offset Area (102ha)
Off-Site Biodiversity Offset Area (196ha)
SCALE 1:30 000 (A4)
500 0 500 1000 1500 m
Base Map Source: Canyonleigh (2005) and Wingello (20C5) 1:25 000 Topographic Maps
TN MN
Y:\Jobs 531 to 1000\864\Reports\86407_EIS 2018\CAD\ 864BaseMGA56.dwg_2.19 Biodiversity Offset-27.02.2018-5:23 PM
MURRIMBA
Long Swamp Creek
Hume Highway
HANGING ROCK HILL
HANGING ROCK
PENROSE STATE FOREST
Bridgewater Lodge
Stewarts Dale
Murrimba Farm
Tenterden Park
quarries
quarry
gas pipeline
330kV
HUME HIGHWAY
PENROSE FOREST WAY
BURNT COTTAGE ROAD
WEEDENS ROAD
STINGRAY ROAD
WATTLE MINE ROAD

The following subsections provide a summary of:

- residual impacts on native vegetation as a result of the Proposal and the credits required to offset the impact;
- the proposed on-site biodiversity offset area and indicative ecosystem and species credits available within that area;
- the location of the proposed off-site biodiversity offset area; and
- the proposed management strategies.

2.14.3 Overview of Impacts Requiring Offsetting

2.14.3.1 Landscape and Connectivity

Niche (2018) assessed the native vegetation cover class and connectivity of the existing landscape to determine any impacts following the vegetation clearing associated with the Proposal. Assessment of vegetation based on percentage cover over a 1 000ha circle estimated that vegetation cover would decrease from 51% to 55% before clearing to 46% to 50% after clearing, while within a 100ha circle centred on the Site, vegetation cover would decrease from 91% to 95% before clearing to 41% to 45% after clearing.

The Proposal would not impact primary connecting links and the connectivity width would remain greater than 500m. The average condition of vegetation in the over-storey, mid-storey and groundcover would remain at benchmark.

2.14.3.2 Ecosystems

Following the implementation of all practical measures to avoid or mitigate impacts to native vegetation, it is estimated that the Proposal would result in the removal of approximately 63.2ha of native vegetation, which is considered a residual impact of the Proposal. The impacted area has been further refined as ‘direct’, i.e. areas within the nominated impact footprint of the Quarry Operations Area, and ‘indirect’, i.e. those within a 5m buffer zone from the directly impacted areas which could be subject to minor levels of disturbance such as access tracks or indirect impacts such as edge effects. The total impact area for the purpose of the biodiversity offsetting assessment is 67.2ha. Six native vegetation communities have been mapped within the Site (see Section 5.5.2.4 for more detail) of which four would be directly impacted by the Proposal. **Table 2.8** identifies these communities, the area of disturbance and number of ecosystem credits required to be offset following the application of BBAM assessment undertaken by Niche (2018).

HN565 Red Bloodwood - Hard-leaved Scribbly Gum - Silvertop Ash heathy open forest is separated into two separate management zones based on the Biosis (2018) surveys identifying vegetation in poor condition within the corridor of the proposed Quarry Access Road.

Table 2.8
Summary Table – Existing Vegetation Ecosystem Credits

Vegetation Community	Biometric Vegetation Type		Area of Impact (ha)		Ecosystem Credits Required
	Code	Description	Direct	Indirect	
Sydney Peppermint Forest	HN568	Red Bloodwood - Sydney Peppermint - Blue-leaved Stringybark heathy forest	7.7	0.6	417
Stringybark Forest	HN568	Red Bloodwood - Sydney Peppermint - Blue-leaved Stringybark heathy forest	2.6	0.3	155
Scribbly Gum Woodland	HN565	Red Bloodwood - Hard-leaved Scribbly Gum - Silvertop Ash heathy open forest	24.1	2.2	1 680
Scribbly Gum Woodland (poor condition)	HN565	Red Bloodwood - Hard-leaved Scribbly Gum - Silvertop Ash heathy open forest	0.1	0.1	4
Regrowth Peppermint Forest	HN568	Red Bloodwood - Sydney Peppermint - Blue-leaved Stringybark heathy forest	28.6	0.8	1 645
Total			**63.2**	**4.0**	**3 901**
Source: Niche (2018) – Modified after Tables 4 and 6					

2.14.3.3 Threatened Flora and Fauna Species

No threatened fauna as listed within the *Threatened Species Conservation Act 1995* (now listed under the *Biodiversity Conservation Act 2016*), that require the retirement of species credits, were detected by KMA (2018) during the field surveys. Three individuals of the threatened plant Dwarf Phyllota (*Phyllota humifusa)* are located within the proposed extraction area and species credits are required in order to offset impacts to this species.

2.14.4 On-site Biodiversity Offset Area

2.14.4.1 Ecosystem Credits

During the development of the Proposal, the likely requirement for a biodiversity offset area was identified and vegetation surveys were therefore extended to include potential areas within Lot 4 DP253545 for this purpose. Following establishment of a defined impact footprint, and initial calculations of BBAM ecosystem credit requirements, a proposed on-site biodiversity offset area was defined.

Figure 2.19 illustrates the proposed on-site biodiversity offset area which is focussed on the conservation of the remnant vegetation within the Site. The proposed on-site biodiversity offset area covers approximately 102ha and comprises the vegetation communities set out in **Table 2.9**. Once the field survey was completed and the impact footprint finalised, the BBAM was applied to the communities within the proposed on-site biodiversity offset area to objectively quantify the ecosystem credits generated by securing the on-site biodiversity offset area (see **Table 2.9**) in accordance with the BBAM and the *Bio-Banking Credit Calculator (version 4)* (OEH, 2014a).

Table 2.9
On-site Biodiversity Offset Area Ecosystem Credits

Vegetation Community	Biometric Vegetation Type Code	Area (ha)	Ecosystem Credits Generated	Ecosystem Credit Surplus / Deficit
Sydney Peppermint Forest	HN568	33.6	363	-1 701
Stringybark Forest	HN568	6.3	66	
Regrowth Peppermint Forest	HN568	3.7	45	
Southern Barrier and Fines Storage 1 (to be revegetated)	HN568	3.6	42	
Scribbly Gum Woodland	HN565	41.3	433	-1 193
Cleared Land (to be revegetated)	HN565	4.7	58	
Peppermint Tall Forest	HN584	3.3	40	40
Freshwater Wetlands (Swamp)	HN602	5.8	70	70
Total		**101.5**		

Source: Modified after Niche (2016) – Table 9

Based on the offset requirements described in **Table 2.8** and the credits generated within the proposed on-site biodiversity offset area (**Table 2.9**), Niche (2018) concluded that ecosystem credit surplus or deficits remain for the following Biometric Vegetation Types.

- HN568 – 1 701 credit deficit
- HN565 – 1 193 credit deficit
- HN584 – 40 credit surplus
- HN602 – 70 credit surplus

The retirement of the 40 HN584 ecosystem credits against the deficit for HN565 is considered a like for like outcome as these communities are within the same Keith class. The 70 HN602 credits would remain in surplus and cannot be retired against the credits required as a result of the Proposal. The final credit deficit is therefore 2 854 ecosystem credits assuming that only the surplus of 40 ecosystem credits associated with HN602 are able to be retired against the deficit for HN565.

2.14.4.2 Species Credits

The biobanking credit calculator predicted that all of the threatened fauna identified by KMA (2018) and Biosis (2018) within the Site would occur in the vegetation communities within the on-site biodiversity offset area by (i.e. ecosystem credit species) and therefore these species would not generate species credits.

KMA (2018) observed several hundred of the threatened plant Broad-leafed Sallee (*Eucalyptus aquatica*) and a population of approximately 105 plants of Dwarf Phyllota (*Phyllota humifusa*) within the on-site biodiversity offset area. The observed individuals are wholly within the on-site biodiversity offset area and are therefore not likely to be impacted by the proposed development. See Section 5.5 for a detailed description of the threatened fauna and flora identified by KMA (2018) within the Site boundary.

Niche (2018) calculated that 746 species credits are created for the *Phyllota humifusa* and 1 775 credits are created for the *Eucalyptus aquatica* located within the on-site biodiversity offset area. Based on the proposed removal of three *Phyllota humifusa* plants, 54 species credits would be retired of the 746 generated to offset impacts to this species.

2.14.5 Alternative Methods to Meet Offset Requirements

Following consideration of the offsetting credit requirements for the Proposal, it was identified that a total of 3 901 ecosystem credits and 54 species credits would be required to offset residual impacts to biodiversity values as a result of the Proposal, in accordance with the BBAM and credit calculator (OEH, 2014a). A deficit of 2 854 ecosystem credits would remain after the proposed on-site biodiversity offset area was secured and all species credits would be satisfied with a surplus of species credits remaining.

Niche (2018) investigated alternative methods available to the Applicant to secure the deficit of ecosystem credits (see Section 3.3 of Niche (2018) in accordance with options provided under the Biodiversity Offset Scheme and described in the *Biodiversity Conservation Regulation 2017*. These methods are summarised as follows.

- The retirement of the required number and class of like-for-like biodiversity credits.
- The retirement of the required biodiversity credits in accordance with the variation rules.
- The funding of a biodiversity conservation action that would benefit the relevant threatened species or ecological community, and that is equivalent to the cost of acquiring the required like-for-like biodiversity credits as determined by the offsets payment calculator.
- The payment of an amount into the Biodiversity Conservation Fund determined in accordance with the offsets payment calculator instead of retiring biodiversity credits.

The Applicant has considered the following options to satisfy the indicated ecosystem deficit.

- The purchase of land for the purpose of establishing an offset area. The Applicant has secured a property for the purpose of establishing an off-site biodiversity offset area. Field surveys of the off-site biodiversity offset area are yet to be completed, however Niche (2018) reviewed available aerial photography of the subject property and concluded that vegetation present on the off-site biodiversity offset area is likely to like-for-like offset for areas being impacted by the Proposal and the vegetation appears to be in relatively good condition.
- The purchase and retirement of ecosystem credits. Investigations of the BioBanking Credits Register determined very few credits are currently available of the ecosystem credits required for the Proposal. However, if the variation rules are applied (in consultation with OEH and assuming other options for like-for-like offsets have been exhausted) the acquisition and retirement of the required number of ecosystem credits would be partially satisfied for between $2,000 and $10,000 per credit.

- Payment into Biodiversity Conservation Fund established by OEH or contribution to a biodiversity conservation action would be possible with the total obligation calculated in accordance with the Offsets Payment Calculator. These options would be considered once all remaining options are exhausted given that the contribution is equivalent to credit purchase with administrative and other risk-based fees applied.

2.14.6 Suitability of the Proposed Biodiversity Offset Areas

2.14.6.1 Introduction

The following subsection considers the suitability of the proposed Biodiversity Offset Strategy incorporating the proposed on-site biodiversity offset area and the off-site biodiversity offset area in accordance with *NSW OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects* (OEH, 2011a) and the *NSW offset principles for major projects (state significant development and infrastructure)* (the NSW offset principles) (OEH, 2013).

Niche (2018) reviewed the principles of the *NSW Biodiversity Offsets Policy for Major Projects* (OEH, 2014) and concluded that in satisfying the NSW offset principles (OEH, 2013) the assessment was consistent with the principles that underpin this policy.

2.14.6.2 Offsetting State Significant Development

The comprehensive survey and assessments undertaken by KMA (2018) and Biosis (2018) have informed the Biodiversity Offsetting Assessment undertaken by Niche (2018). Options to satisfy residual impacts to biodiversity under the Biodiversity Offset Scheme of the *Biodiversity Conservation Act 2016* include the following.

- Retiring credits based on the like-for-like rules or through the application of variation rules if like-for like options are exhausted.
- Funding a biodiversity conservation action that benefits the threatened entity impacted by the development.
- Making a payment to the Biodiversity Conservation Fund calculated using the offset payments calculator.

Niche (2018) has undertaken an assessment of the potential for the Proposal to achieve a like-for-like offsets to satisfy the calculated biodiversity offset requirements. In summary, Niche (2018) concluded that the establishment of the on-site biodiversity offset area would partially satisfy a like-for-like outcome with remaining credits to be satisfied through a proposed off-site offset area, direct purchase and retirement of credits or through contribution to biodiversity conservation actions or the Biodiversity Conservation Fund. Niche (2018) confirmed that these mechanisms are readily available to the Applicant.

2.14.6.3 NSW Offsetting Principles for State Significant Development

In 2013, the NSW Government released the seven principles for the assessment of impacts to biodiversity and determination of acceptable offsets for State Significant Development and State significant infrastructure projects (OEH, 2013). The following presents these principles and describes how the Proposal would satisfy each principle under the preliminary Biodiversity Offset Strategy.

1. **Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts.**

   The Proposal has been designed to limit the vegetation that would be disturbed as much as practically possible by locating components within operational areas such as the proposed temporary topsoil and mulch stockpile area and the Fines Storage Area 2. Where impacts cannot be avoided, areas would be stabilised and revegetated as soon as they are no longer required for operational use. The southern barrier and Fines Storage Area 1 would both be included in the on-site biodiversity offset area once these components have been developed to a final profile.

2. **Offset requirements should be based on a reliable and transparent assessment of losses and gains.**

   Niche (2018) has assessed the offset requirements using the BBAM and the Bio-banking Credit Calculator (version 4). For the purposes of the offsetting assessment, the field surveys are described in KMA (2018) and meet the draft survey guidelines as required by OEH (DEC, 2004). All data required to operate the Bio-banking Credit Calculator and the necessary electronic files necessary for OEH to complete its assessment would be provided. As such, the biodiversity offsets assessment is transparent and reliable.

3. **Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities.**

   Niche (2018) has determined that the proposed on-site biodiversity offset area would partially satisfy a like-for-like outcome with remaining credits to be satisfied through a proposed off-site offset area, direct purchase and retirement of credits or through contribution to biodiversity conservation actions or the Biodiversity Conservation Fund. Therefore, the final offsetting strategy would be targeted to the biodiversity values being lost, or to higher conservation priorities.

4. **Offsets must be additional to other legal requirements on the site proposed.**

   Any proposed biodiversity offset area would be secured under Biodiversity Stewardship Agreement or similar approved mechanism and is independent of any existing legal requirements to manage the site for conservation.

5. **Offsets must be enduring, enforceable and auditable.**

   Any proposed biodiversity offset would be subject to good governance arrangements to ensure it is managed and secured as an in-perpetuity offset. Appropriate plans of management would be developed, including monitoring, and legal security would be guaranteed through a suitable planning mechanism.

6. **Supplementary measures can be used in lieu of offsets.**

   Section 3.3 of Niche (2018) describes the available and suitable supplementary mechanisms that may be used in lieu of a biodiversity offset area. The Applicant is confident that a suitable land-based offset agreement would be reached based on securing the on-site and off-site biodiversity offset areas in perpetuity through a Biodiversity Stewardship Agreement.

7. **Offsets can be discounted where significant social and economic benefits accrue to NSW as a consequence of the proposal.**

   The social and economic benefits of the Proposal are described in Section 5.14. The Applicant notes that discounting of offset requirements due to significant social and economic benefits is possible under OEH (2013), which applied at the time the DGRs for the Proposal were issued. If the consent authority believes that the social and economic benefits are significant, it may be reasonable to reduce or modify the offset requirement.

2.14.7 Conclusion

The biodiversity offset assessment prepared by Niche (2018) has identified and quantified the residual impacts to native vegetation as a result of the Proposal, in accordance with the BBAM (OEH, 2014a). A preliminary *Biodiversity Offset Strategy* has been developed through comprehensive assessment and quantification of ecosystem and species credits that would be generated by securing a proposed on-site biodiversity offset in perpetuity for the purposes of biodiversity conservation. Discounting the assessed ecosystem and species credit generated by the proposed on-site offset area, a credit deficit of 2 894 ecosystem credits has been identified by Niche (2018). This deficit would be addressed through further assessment of a proposed off-site biodiversity offset area. Should this not succeed in addressing the ecosystem credit deficit, the assessment by Niche (2018) has identified the mechanisms readily available to the Applicant to seek additional ecosystem credits. Based on this strategy, it is concluded that the Proposal, incorporating an approved *Biodiversity Offset Strategy*, would maintain or improve biodiversity values in the medium to long term.

2.15 ALTERNATIVES CONSIDERED

2.15.1 Introduction

The Director-General's Requirements for the Proposal (see **Appendix 1**) contains a general requirement that the EIS describes the alternatives considered for the Proposal.

Throughout the planning stages of the Proposal, the Applicant considered alternatives with respect to site access from the Hume Highway, transportation of the sand products and surface water management structures. All other components were decided upon/designed following the assembly and consideration of all relevant information and data. The following subsections outline the alternatives considered and the reasons for pursuing the preferred alternative described earlier in this section.

2.15.2 Method of Extraction

Given the nature and location of the sand resource at or near the land surface, open cut methods were determined to be the only feasible means of extracting the identified resource. Reliance solely on ripping to extract the harder friable sandstone was assessed as inappropriate given the greater efficiency achieved through blasting.

2.15.3 Limit of Extraction

The Applicant originally considered a larger extraction area, particularly to the east of the area proposed. The eastern area was retained for use as a product stockpiling area.

2.15.4 Depth of Extraction

The maximum depth of extraction has been selected to remain above the Long Swamp Creek channel bed to minimise the reduction in baseflow from the extraction area towards the creek.

2.15.5 Transport Options

Access to the Site via the existing Sallys Corner Interchange was originally considered by the Applicant. This option involved the construction of a 2.4km long road which would have traversed four properties (Lots 1, 2, 3 and 4 DP253435) as well as requiring additional vegetation disturbance between the Site and the existing Sallys Corner Interchange. All vehicles entering and exiting the Site during the operational phase of the Proposal would have been required to utilise the infrastructure at the Sallys Corner Interchange. Furthermore, constraints with the existing infrastructure at the Sallys Corner Interchange were identified and would have required remedial works to support the proposed quarry product transport vehicle configurations.

Therefore, given the current infrastructure and use of the Sallys Corner Interchange, the Applicant considered the construction of a new project-specific interchange with the Hume Highway to be the more feasible option as it would require less disturbance, principally from the perspective of safety and amenity for all road users.

2.15.6 Extraction Area

The Applicant inspected a range of potential sand quarry sites in the Wingello-Penrose area, as documented by Mason (1995) which identified large resources of friable sandstone in the area. Whilst sites on the southeastern side of the Hume Highway were considered suitable, the Applicant made a commercial decision to proceed with the current proposal given the size and quality of the identified resource on Lot 4 DP253435.