BORAL RESOURCES (NSW) PTY LTD
ABN: 51 000 756 507

Rehabilitation and Landscape Management Plan

for the

Stockton Transgressive Dune Quarry

Prepared by:

R.W. CORKERY & CO. PTY. LIMITED

August 2020

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Prepared for:

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1. INTRODUCTION

This *Rehabilitation and Landscape Management Plan* (the Plan) has been prepared by R.W. Corkery & Co. Pty Limited (RWC) on behalf of Boral Resources (NSW) Pty Ltd ("Boral") for the Stockton Transgressive Dune Quarry (the Quarry). The Quarry is owned and operated by Boral and is located east of Fullerton Cove, approximately 9km northeast of Newcastle (see **Figure 1**).

Development Consent (DA) 140-6-2005 was granted on 24 January 2006 to permit extraction of sand from the active dune system within Pit 7, an area historically mined by Mineral Deposits Limited (MDL). DA 140-6-2005 has been modified twice since originally being granted (dated May 2006 and June 2011). Boral continues to take responsibility for the revegetation and maintenance of land within Lot 1 DP 1006399 historically disturbed for extractive industry purposes (Pits 1 to 6).

Condition 3(19) of DA 140-6-2005 requires Boral to prepare and implement a Rehabilitation and Landscape Management Plan that includes the following.

1. Identification of the disturbed area at the site (Section 4).
2. A description of the short, medium, and long-term measures that would be implemented to rehabilitate the site (Section 7).
3. A detailed description of the measures that would be implemented over the next 5 years to rehabilitate the site (Section 7).
4. A description of how the performance of these measures would be monitored over time (Section 8).
5. A description of the measures that would be implemented to prevent and eradicate the occurrence of pests and weeds on the site (Section 6.7).
6. Completion criteria for the rehabilitation of the site (Section 7).

Figure 1
LOCALITY PLAN

2. OBJECTIVES AND OUTCOMES

Table 1 presents the objectives and outcomes for this Plan and the Quarry.

Table 1
Objectives and Outcomes

OBJECTIVES	OUTCOMES
Rehabilitation and Landscape Management	
(a) To ensure compliance with all relevant project approval conditions, statements of commitment and reasonable community expectations.	(i) Compliance with all relevant criteria and reasonable community expectations, as determined in consultation with the relevant government agencies.
(b) To implement appropriate progressive rehabilitation and landscape management and mitigation measures during Quarry development.	(ii) All identified rehabilitation and landscape management and mitigation measures implemented.
(c) To appropriately manage site preparation works to ensure that suitable rehabilitation material remains for rehabilitation operations during all stages of the Quarry.	(iii) Sufficient, viable rehabilitation materials are available for rehabilitation operations during all stages of the Quarry.
(d) To implement appropriate weed, pest and bushfire management measures.	(iv) Weeds, pests and bushfire risks are appropriately managed in consultation with neighbouring landholders and relevant authorities.
(e) To implement appropriate corrective and preventative actions, if required.	(v) Corrective and preventative actions implemented, if required.
(f) To establish a final landform that is consistent with the surrounding remnant vegetation.	(vi) Final landform is safe, stable, non-polluting and, consistent with the final land use options.

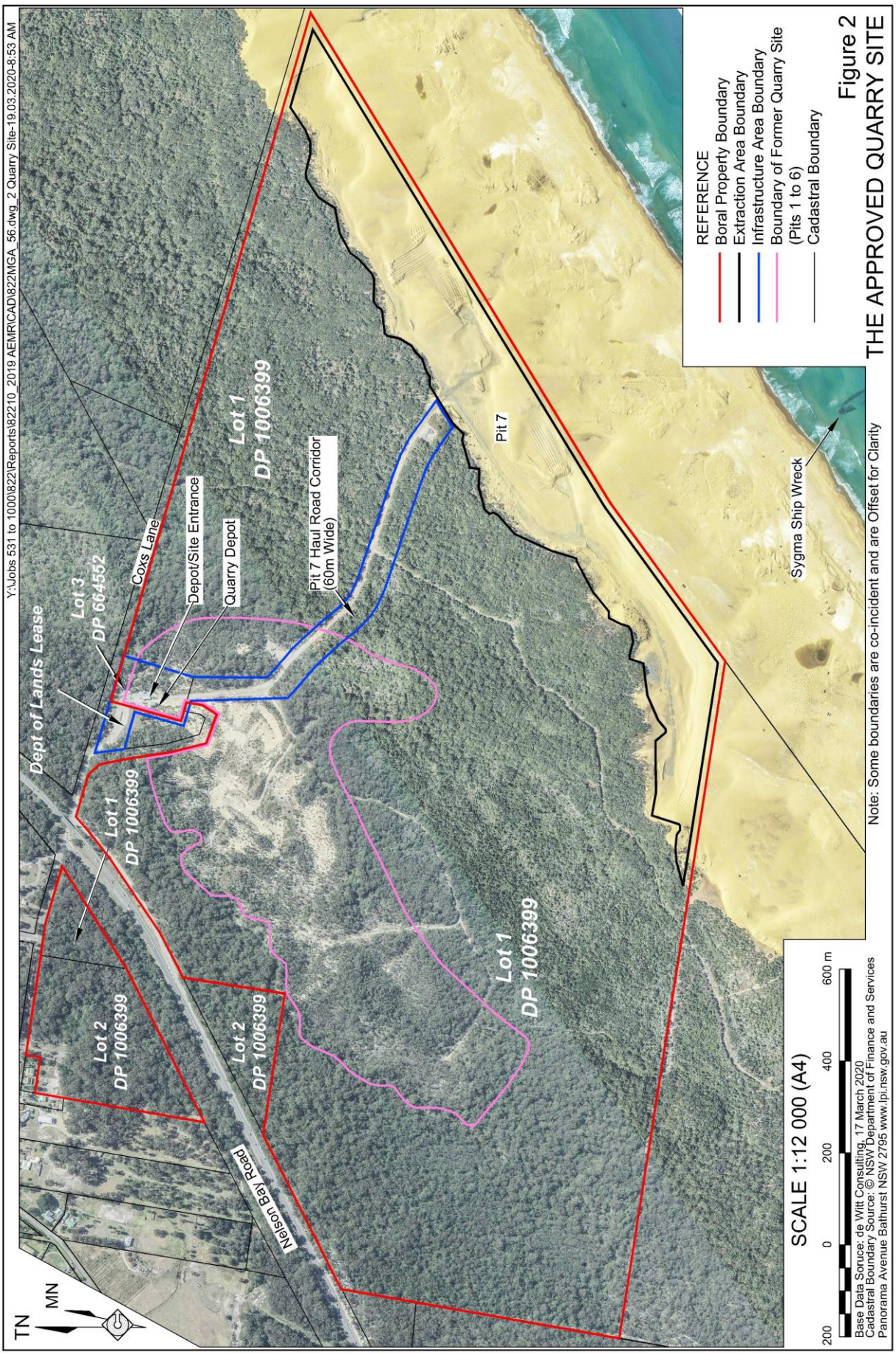
3. APPROVED DEVELOPMENT

3.1 THE APPROVED QUARRY SITE

Figure 2 displays the boundary of the approved Quarry Site (hereafter the "Quarry Site"). The Quarry Site incorporates the following component areas.

- Extraction Area (Pit 7) (33.1 ha).
- Pit 7 Haul Road (60m wide Corridor and approximately 4.6 ha).
- The Depot (office, workshop, amenities, weighbridge & car park) (1.4 ha).
- The access from Coxs Lane (0.2 ha).

It is important to note that the approved Quarry Site does not include the previously approved and operated Pits 1 to 6 (see **Figure 2**). However, Boral continues to have responsibility for the rehabilitation of these areas.


Y:\Jobs 531 to 1000\822\Reports\82210_2019 AEMR\CAD\822MGA_56.dwg_2 Quarry Site-19.03.2020-8:53 AM
Dept of Lands Lease
Lot 3 DP 664552
Coxs Lane
Depot/Site Entrance
Quarry Depot
Lot 1 DP 1006399
Pit 7 Haul Road Corridor (60m Wide)
Pit 7
Sygma Ship Wreck
Lot 1 DP 1006399
Lot 2 DP 1006399
Lot 2 DP 1006399
Lot 1 DP 1006399
Nelson Bay Road
TN
MN
REFERENCE
Boral Property Boundary
Extraction Area Boundary
Infrastructure Area Boundary
Boundary of Former Quarry Site (Pits 1 to 6)
Cadastral Boundary
Figure 2
THE APPROVED QUARRY SITE
Note: Some boundaries are co-incident and are Offset for Clarity
SCALE 1:12 000 (A4)
200 0 200 400 600 m
Base Data Soruce: de Witt Consulting, 17 March 2020
Cadastral Boundary Source: © NSW Department of Finance and Services
Panorama Avenue Bathurst NSW 2795 www.lpi.nsw.gov.au

3.2 APPROVED OPERATIONS

The approved activities at the Quarry Site comprise the following.

- The extraction of no more than 500 000 tonnes of sand product from the Quarry Site annually.
- Processing of sand in Pit 7 by mobile screening equipment as required.
- Haulage of sand product from Pit 7 to the weighbridge prior to despatch via Coxs Lane.
- Progressive rehabilitation of disturbed areas.
- Extraction limits require sand extraction to remain above 2.5m AHD.

3.3 QUARRY EXIT STRATEGY

A detailed Quarry Exit Strategy will be developed three years prior to the closure of the Quarry in accordance with Condition 24 of Schedule 3 of DA 140-6-2005. The strategy will include the following at a minimum.

- Objectives and criteria for Quarry closure.
- Options for the future use of the Quarry Site.
- The measures that would be implemented to minimise or manage the ongoing environmental effects of the development.
- A description of how the performance of these measures would be monitored over time.

Indicative completion criteria are presented in Section 7 in order to provide guidance for progressive rehabilitation activities.

4. DISTURBED AREAS & REHABILITATION

4.1 HISTORIC SAND EXTRACTION OPERATIONS

Prior to the commencement of operations within Pit 7, extraction was undertaken in Pits 1 to 6 in accordance with the conditions of development consent D 2010/94 issued by Port Stephens Council in May 1996. The location of the extraction boundary for Pits 1 to 6 is displayed on **Figure 3**. Extraction from Pits 1 to 6 has now ceased, and the disturbed areas are currently undergoing rehabilitation.

4.2 EXISTING SAND EXTRACTION OPERATIONS

Extraction currently occurs entirely within Pit 7, an area in which existing dune sands are present. Pit 7 is located between the frontal beach dune system and existing vegetation and does not remove sand from vegetated areas with the foredune or interfere with beach replenishment. Under existing operations, sand is principally extracted from the northern and southern areas of Pit 7 (see **Figure 3**).

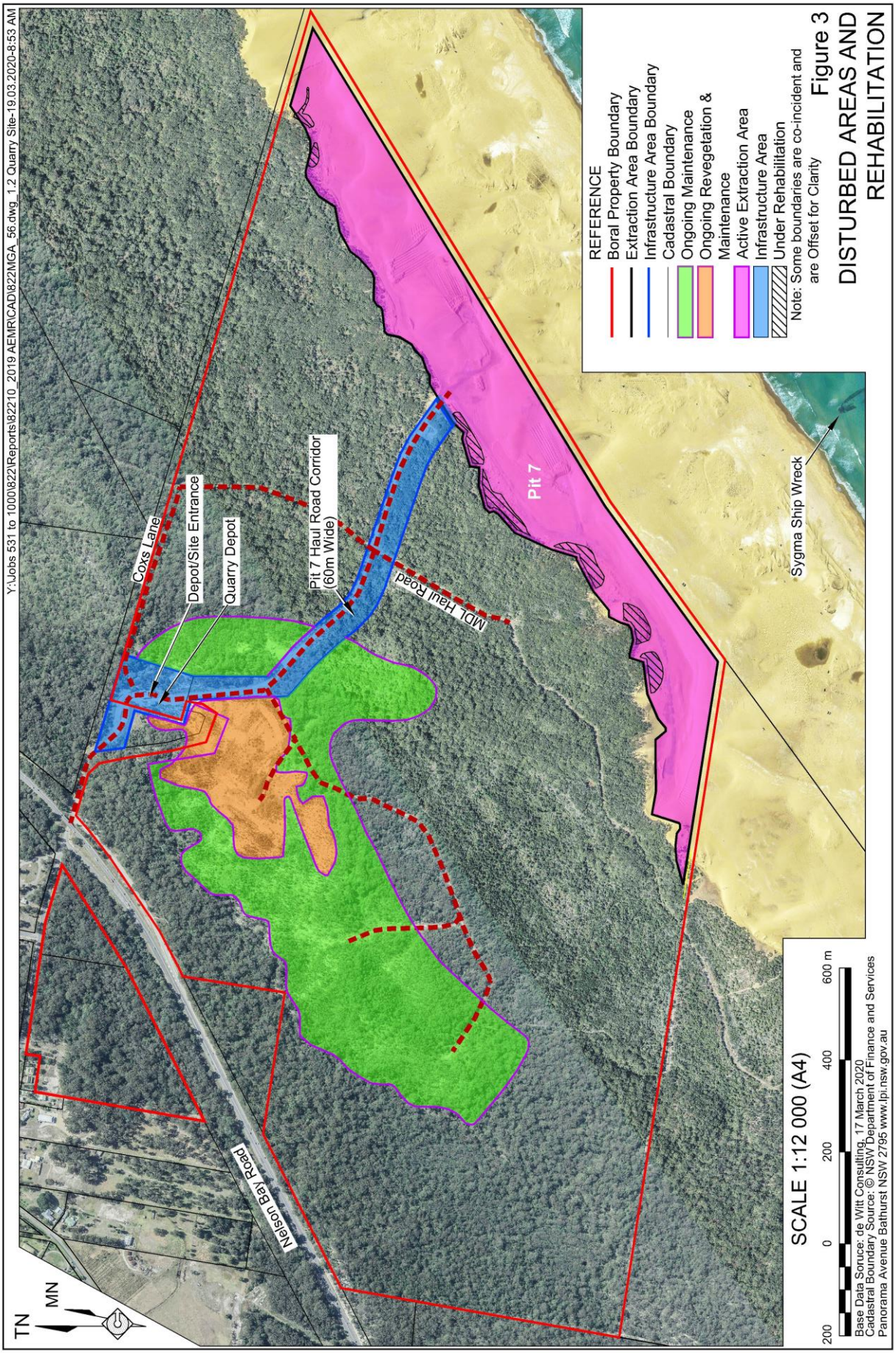

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Figure 3
DISTURBED AREAS AND REHABILITATION
REFERENCE
Boral Property Boundary
Extraction Area Boundary
Infrastructure Area Boundary
Cadastral Boundary
Ongoing Maintenance
Ongoing Revegetation & Maintenance
Active Extraction Area
Infrastructure Area
Under Rehabilitation
Note: Some boundaries are co-incident and are Offset for Clarity
Pit 7
Sygma Ship Wreck
Coxs Lane
Depot/Site Entrance
Quarry Depot
Pit 7 Haul Road Corridor (60m Wide)
MDL Haul Road
Nelson Bay Road
TN
MN
SCALE 1:12 000 (A4)
200 0 200 400 600 m
Base Data Soruce: de Witt Consulting, 17 March 2020
Cadastral Boundary Source: © NSW Department of Finance and Services
Panorama Avenue Bathurst NSW 2795 www.lpi.nsw.gov.au

Windblown sand reaching Pit 7 during extraction would be regularly cleared and processed for sale. Extraction of the windblown sand will continue up to a 15-metre-wide buffer line inside Boral's property boundaries to the north, south and along the seaward boundary. Harvesting of sand from the base of windblown dunes limits dune encroachment on areas with coast native vegetation. The boundary for harvesting from the base of windblown dunes is the existing coastal native vegetation, ensuring that no vegetation is cleared for extraction activities in this location (see **Figure 2**).

4.3 CURRENT STATUS OF REHABILITATION

Boral has consistently undertaken progressive rehabilitation of disturbed areas since DA 140-6-2005 was granted in 2006. The location of the former Pits 1, 2 and 3 have been successfully rehabilitated and currently only require periodic maintenance and weed control (see **Plate 1**). The progress of rehabilitation within Pits 1 to 3 has previously been confirmed by independent revegetation specialists who attest to high rates of regeneration within these areas. Extensive rehabilitation in Pits 4, 5 and 6 has also been undertaken by Boral, although regeneration is not as well advanced in these areas. These areas are actively managed and are subject to continued maintenance and replanting as required (see **Plate 2**).

Limited rehabilitation has been undertaken within Pit 7 due to ongoing extractive activities. However, coconut matting has been placed in designated areas in the northern and southern sections of the extraction area (see **Plate 3** and **Figure 3**). Timber has also been placed strategically along the foredune to stabilise the dunes and protect native vegetation as it regenerates. The focus of revegetation in Pit 7 has been the establishment of Pig Face (*Carpobrotus glaucescens*) and Beach Spinifex (*Spinifix sericeus*) to stabilise the dune.

Specific focus will be on the immediate rehabilitation and revegetation of the disturbed area in the southwest of the site in order to stabilise the exposed faces outside the current extraction boundary. The current onsite processes for dune stabilisation such as the use of jute fibre matting, the placing of coir logs and timber logs to provide shelter for vegetation and also the transplanting of pig face and spinifex will be employed in this area, as will the use of mulch sourced from the site.

Haul roads are regularly watered to limit dust generation and are currently monitored for potential erosion.

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Plate 1: View of revegetated area within of Pits 1-6. No further revegetation is required although weed management will continue (Ref: E822E_044)

Plate 2: View of Pits 1-6 currently subject to revegetation. Revegetation has been successful but still requires infill planting and weed management. (Ref: E822F_045)

Plate 3: View of coconut firbre matting in Pit 7 (Ref: E822F_010)

5. FINAL LANDFORM

5.1 INTRODUCTION

Figure 4 displays the final landform figure consistent with that described in the *Environmental Impact Statement* (EIS) for the existing operation (ERM, 2005) and required under DA 140-6-2005. This final landform includes the revegetation of Pits 1 to 6, however it is acknowledged that this is not a requirement under DA 140-6-2005.

5.2 INFRASTRUCTURE AREA

Rehabilitation of the infrastructure area will involve the removal of all buildings and quarry-related infrastructure. Compacted areas will then be ripped prior to the application of a growth medium (as required) for the establishment of vegetation. Revegetation and ongoing management will be carried out in a manner consistent with that described in Section 6.6.

The final landform will incorporate the haul roads and tracks established within the Quarry Site as described in the EIS (ERM, 2005) for the purpose of providing access for the eventual landowner and for firefighting.

5.3 PITS 1 TO 6

The approved Quarry Site does not include the previously approved and operated Pits 1 to 6 (see **Figure 2**), nor is rehabilitation of these areas subject to DA 140-6-2005. However, rehabilitation criteria for this area is provided to demonstrate Boral's objectives for these areas.

Rehabilitation of Pits 1 to 6 will focus on stabilising disturbed areas by re-establishing endemic vegetation cover with the objective of meeting the following criteria.

1. Native shrub and tree coverage generally consistent with remnant vegetation (assume 70% coverage).
2. 75% of species consistent with flora species in listed in **Appendix 1** which were identified during flora surveys during the preparation of the EIS (ERM, 2005).
3. Weed coverage of less than 5% foliage cover.

No infrastructure remains in this area. Revegetation activities will focus principally on areas where vegetation density has not satisfied completion criteria (see **Figure 3**). Completion criteria for rehabilitation in Pits 1 to 6 are discussed in more detail in Section 7. It is noted that large sections of the former quarrying area are naturally regenerating and satisfy the above criteria and that described in Section 7.

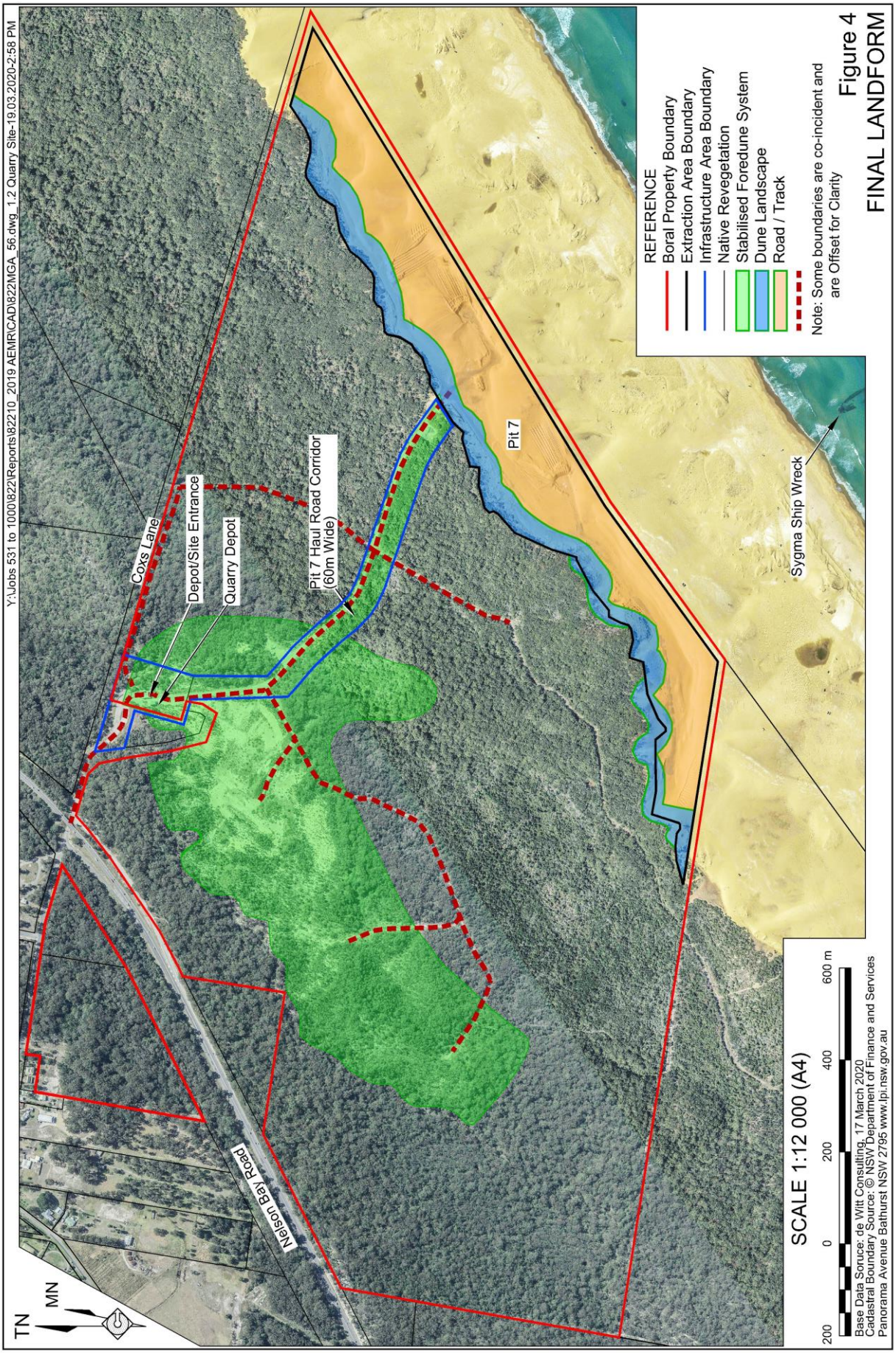
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Figure 4
FINAL LANDFORM
REFERENCE
Boral Property Boundary
Extraction Area Boundary
Infrastructure Area Boundary
Native Revegetation
Stabilised Foredune System
Dune Landscape
Road / Track
Note: Some boundaries are co-incident and are Offset for Clarity
Coxs Lane
Depot/Site Entrance
Quarry Depot
Pit 7 Haul Road Corridor (60m Wide)
Pit 7
Sygma Ship Wreck
Nelson Bay Road
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MN
SCALE 1:12 000 (A4)
200 0 200 400 600 m
Base Data Soruce: de Witt Consulting, 17 March 2020
Cadastral Boundary Source: © NSW Department of Finance and Services
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5.4 PIT 7

Final landform rehabilitation objectives within Pit 7 include the following.

1. Creation of a gently sloping dune landscape with an minimum floor height of 2.5m AHD and an average angle of repose for the foredune of approximately 34 degrees (ERM, 2005).
2. Stabilisation and revegetation the foredune and land within 15m of the foredune on the inland side.
3. Given the often-sparse nature of dune vegetation a foliage cover of 15 percent will be considered successful for stabilising the dune.

Completion criteria for rehabilitation in Pit 7 are discussed in Section 7. Boral has progressively stabilised the foredune area with timber screened from sand product and coconut fibre matting (see **Plate 3**). The success of these activities over time has provided a good indication of the likely success of these measures during ongoing progressive rehabilitation and at closure of the Quarry.

Future focus will be on the immediate rehabilitation and revegetation of the disturbed area in the southwest of the site in order to stabilise the exposed faces outside the current extraction boundary. The above final landform objectives will be the immediate priority for this area.

6. LANDSCAPE MANAGEMENT

6.1 INTRODUCTION

The following subsections describe the general landscape management and progressive rehabilitation activities currently implemented at the Quarry. These measures would continue to be implemented over the next five years of operations.

6.2 VEGETATION REMOVAL AND STOCKPILING

No vegetation clearing is required along the foredune for ongoing extraction activities. Timber debris that is screened from sand will continue to be stockpiled for use in dune stabilisation and revegetation activities.

6.3 EROSION AND SEDIMENT CONTROL

The following erosion and sediment control measures continue to be implemented at the Quarry during operational activities.

- Ongoing monitoring of potential erosion along the Pit 7 haul road.
- Maintenance of an existing drain along the haul road the captures runoff and diverts it to the former extraction area.
- Stabilisation of the foredune and revegetation.

6.4 RE-ESTABLISMENT OF DUNE TOPOGRAPHY

The Stockton Beach dune system, and associated native vegetation, comprise a dynamic bio-physical environment subject to a range of climatic and physical interactions. These factors invariably lead to significant distinctions in the slope, size and shape of the dune system. As such, rehabilitation activities undertaken to re-establish dune topography aim to stabilise and subtly contour exposed foredune faces. Due to the highly mobile nature of the dune system, the primary objective of contouring is to eliminate significant irregularities, such as hummocks or uncharacteristic steep slopes. Boral currently utilises the same heavy earth moving equipment which is used for sand extraction to contour the foredunes in Pit 7 upon completion of extraction activities in those areas.

6.5 STABILISATION OF DUNES

The varied climatic and physical conditions experienced within coastal dune systems can constrain the diversity and abundance of endemic vegetation. Vegetation will also differ significantly depending on its location within the dune system. Three main locations, or zones, are typically encountered in coastal dune systems.

- Incipient Foredune Zone – this zone is typically unstable and vegetated by herbs and grasses.
- Foredune Zone – this zone is semi-stable and features shrubs and associated ground plants.
- Hind Dune Zone – this zone is dominated by trees with an understorey of shrubs and ground plants.

A general indication of the locations of each zone is displayed on **Figure 5**.

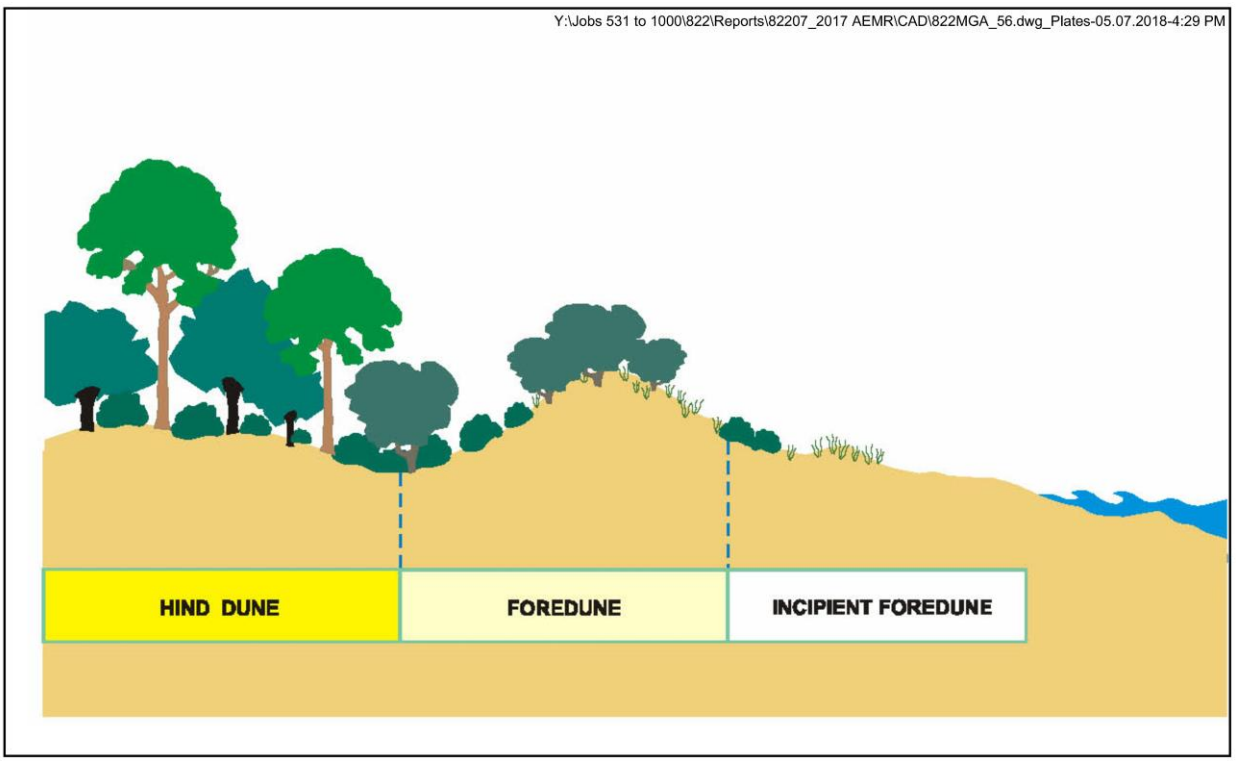

Figure 5 **Typical Dune Structure (Source Coastal Dune Management – Department of land and Water Conservation 2001 – Figure 6.3)**

Stabilisation of the foredunes in Pit 7 will continue to be undertaken by installing coconut fibre matting in critical locations, emplacing timber and logs to provide shelter for vegetation, and planting Pig Face and Beach Spinifex. **Plate 4** displays successfully planted Pig Face within Pit 7. The re-establishment of native dune vegetation in completed areas is an important component in the stabilisation of the dune system.

Plate 4 Pig Face (*Carpobrotus glaucescens*) planted within Pit 7 (Ref: E822F_015)

6.6 PROGRESSIVE REVEGETATION

Rehabilitation and revegetation of disturbed areas within the Quarry Site must be undertaken with consideration of the location within the dune system, the type of vegetation disturbed, and species encountered in nearby undisturbed areas. Extensive planting of endemic species has been undertaken by Boral within Pits 1 to 6 with significant success. Shrub and tree species endemic to the region (consistent with the species in **Appendix 1**) will be seeded or planted as tubestock. Species that have been planted with success to date include the following which will continue to be used in the rehabilitation of disturbed areas

- Coastal Wattle (*Acacia sophorae*).
- Coastal Teatree (*Leptospermum laevigatum*).
- Broad leaved Paperback (*Melaleuca quinquenervia*).
- Coastal Banksia (*Banksia integrifolia* & *Banksia serrata*).
- Swamp Mahogany (*Eucalyptus robusta*).
- Pig Face (*Carpobrotus glaucescens*).
- Beach Spinifex (*Spinifix sericeus*).

Campaigns of revegetation have been supported by the trial of fertiliser use in areas subject to planting and the use of coconut fibre matting and retained timber to provide additional stabilisation. These activities have had some success and will be continued where appropriate in ongoing rehabilitation activities.

The regeneration of dune vegetation at the Quarry Site will continue to be facilitated through the implementation of a stringent planting, monitoring and maintenance schedule. These activities include the following actions.

- Regeneration of disturbed areas through the collection and planting of seeds and runner propagation.
- Direct planting of tube stock in dune buffer areas.
- Regular weed inspections and control.

Replanting of collected runners or cuttings will be done as soon as possible after removal. Some species within the Quarry Site for which seed may be collected only release their seed after a fire or if a plant dies, suffers stress from drought or loses a branch. In some instances, it may simply require that seed is removed from the parent plant.

The following key species are considered critical to progress assisted and unassisted native vegetation regeneration at the Quarry Site.

Beach Spinifex

Beach Spinifex (*Spinifex sericea*) is a common and established species within the Quarry Site and immediate surrounds. Through its natural growth habit of sending out runners, Beach Spinifex has the ability to survive burial. Dense hairs and in-rolled leaf blades reduce transpiration and the effects of salt and abrasion. The principal benefit of this species is its deep roots that stabilise the sand, and when combined with the vegetative growth, make this plant very important in the dune forming and stabilisation process. It is usually the dominant species growing in the foredunes.

Beach Spinifex runners are obtained from within the Quarry Site with care not to destabilise collection areas or damage the roots and nodes of the runners themselves. Beach Spinifex runners are cut to approximately 0.5m in length ensuring a number of nodes remain attached to the runner tip. Runners are then planted in grid style colonies in moist sand to a depth of approximately 300mm. Whilst a number of Beach Spinifex runners have been successfully established in revegetated areas, locations prone to heavy winds have proven more difficult to establish. Additional measures, such as the emplacement of timber or logs, is required in exposed locations to provide additional shelter for the plants.

Pigface

The Pigface (*Carpobrotus glaucescens*) is a secondary dune stabilising species that grows as a series of prostrate creeping stems. These stems root at the nodes where there is contact with the sand and vegetative growth from these nodes results in a dense, matted plant that binds the sand and helps prevent wind erosion. The Pigface is salt-tolerant with thick, fleshy leaves store water, making it very tolerant of dry conditions and its matted growth habit reduces evaporation from the sand. Pigface will survive being covered by sand, growing upwards when this happens to form a new mat of growth over the previous one. The old, buried plant then provides a nutrient source for the new one. The plant sometimes forms hummocks of trapped wind-blown sand.

Pigface species are planted through the collection of seed or runners which are translocated. When planting, shallow trenches should be dug so that the top 5cm of the plant is exposed when laid in the trench.

Coastal Wattle

Coastal Wattle (*Acacia sophorae*) is a prevalent species within the Quarry Site. It survives partial burial by sand and stems that are buried will layer at the nodes to form new plants. It has nitrogen fixing capabilities, is salt and wind tolerant, and assists in the capture and deposition of windblown sand. Coastal Wattle provides for protection of other species once established and produces masses of seed for regeneration.

Seed pods from the Coastal Wattle may be collected during spring and summer and extracted for use in replanting. The extracted seeds have a germination inhibitor which is removed either by abrasion or by applying heat. This facilitates field germination and the seeds are planted immediately upon removal of the inhibitor. Tube stock plantings of Coastal Wattle have also been used for revegetation at the Quarry Site.

6.7 WEED AND FERAL ANIMAL MANAGEMENT

6.7.1 Bitou Bush

Bitou Bush is one of the most prevalent coastal weed species in NSW and is listed as a "Weed of National Significance". Methods implemented to control Bitou Bush depend on the magnitude of the infestation and the total area of infestation. Small infestations can be successfully controlled by manually extracting the root system of the weed, whereas, larger infestations typically require the application of chemical spraying using selected herbicides. Both weed spraying and manual extraction of Bitou Bush are undertaken within the Quarry Site.

Weed management occurs on a regular basis with more activities directed to spring and summer months when weeds are more prevalent.

6.7.2 Other Weeds

A number of other weeds have been identified within the Quarry Site. The following notifiable (identified in red text) and other general weeds have been observed during weed monitoring and are subject to both manual extraction and weed spraying.

- Chinese Violet
- Mother of Millions
- Ambrosia
- Berry Bush
- Burr
- Canary Island Date Palm
- Castor Oil Plant
- Cobblers Pegs
- Dandelion
- Fire Weed
- Fleabane
- Guinea Grass
- Lantana
- Milk Thistle
- Natal Grass
- Primrose
- Purple Top
- Rocket
- Salt Bush
- Scotch Thistle
- Sticky Weed
- Stinking Roger
- Summer Grass
- Torpedo Grass
- Vetch

A weed action plan prepared by Hunter Land Management and currently implemented at the Quarry is reproduced in **Appendix 2**.

An annual weed management report will be prepared and included in the AEMR summarising weed management activities over the previous 12 months and recommendations for the next 12 months of management.

6.7.3 Feral Animal Control

Feral animals do not present a significant threat to rehabilitation activities within the Quarry Site despite historic observations of several feral dogs and pigs. Baiting programs will continue to be implemented, as required and in conjunction with the relevant authority, to control the presence of feral animals.

6.8 SITE ACCESS AND SECURITY

Given that the Quarry Site includes a road that provides direct access to Nelsons Bay Road, the Quarry has in the past been used by recreational users of Stockton Beach for access. Boral has and will continue to manage access through the use of high visibility line with reflective tags and warning signs and fencing and gates at the site entrance. The current fencing involves the installation of bunting flags and warning signs surrounding operations areas (see **Plate 5**). Posts for signage and high visibility line are made of flexible shatterproof plastic to prevent injury to the public during possible collision.

Plate 5 Signs and flagging on the dune system (Ref: E822E_023)

6.9 BUSH FIRE MANAGEMENT

Section 63(2) of the Rural Fires Act 1997 specifies that it is the duty of the owner or occupier of land to take notified steps and any other practical steps to prevent the occurrence of bush fires on land and minimise the danger of the spread of bushfires from land.

The document Coastal Dune Management – A Manual of Coast Dune Management and Rehabilitation Techniques (WLWC, 2001) notes that naturally occurring fires are not considered to be a regular feature of the coastal dune environment. This is due to relatively low fuel loads, humid conditions and the lack of ignition sources.

Regardless, Boral will continue to manage bushfire risks within the Quarry Site through the establishment of suitable fire breaks between operational areas and vegetated areas and will continue to consult with the local Rural Fire Service and National Parks and Wildlife Service regarding fire-fighting access and the need for controlled burns.

7. PERFORMANCE AND COMPLETION CRITERIA

7.1 INTRODUCTION

Performance and targets or completion criteria are presented for ongoing landscape management and final landform rehabilitation. These criteria encompass all activities that will be implemented prior to closure of the Quarry with performance recorded and reported in the *Annual Review* document.

7.2 LANDSCAPE MANAGEMENT

Condition 19(b) of Schedule 3 of DA 140-6-2005 requires that the short, medium and long term measures required to rehabilitate the site are described within this Plan. Condition 19(c) of Schedule 3 further requires that specific rehabilitation measures are identified for the following 5 years.

Condition 5 of Schedule 2 of DA 140-6-2005 allows for extraction at the Quarry to continue for a period of 20 years from the commencement of operations. Based on this condition, the management time frame is defined as follows.

- Short to Medium Term: Present – 2023.
- Long term: 2024 – Project Completion.

Ongoing activities generally relate to landscape management measures that would maintain or enhance the condition of remnant vegetation, previously rehabilitated areas and habitat within the Quarry. In the short to medium term, rehabilitation activities will be directed to those areas that are completed. This will include planting within Pits 1 to 6, within areas of Pit 7 where extraction activities have been completed as well as continued maintenance of all revegetated areas. In the long term, rehabilitation will focus on the revegetation and stabilisation of the foredunes in Pit 7, maintenance and completion of revegetation in Pits 1 to 6.

Table 2 provides a summary of landscape management activities that will be implemented at the Quarry Site. All measures are separated into ongoing, short to medium term and long-term time frames. Performance criteria are also provided to evaluate the implementation of landscape management activities.

7.3 REHABILITATION AND CLOSURE

The preliminary completion criteria for final landform rehabilitation are presented in **Table 3**. It is noted that these closure criteria will be finalised in a Quarry Exit Strategy (see Section 3.3) and subject to the results and experience from ongoing rehabilitation activities.

Table 2
Landscape Management Performance Criteria

Management Measure	Frequency	Performance Indicators	Response and Corrective Actions	Targets
Ongoing Management				
Compliance with approved extraction boundaries to prevent encroachment into existing vegetation.	Ongoing	Weekly visual inspections of boundary markers Review of extraction activities for each year in the Annual Environmental Management Report (AEMR)	Any land disturbed outside of extraction boundaries to be rehabilitated immediately once identified.	No disturbance beyond the extraction boundary.
Use of site haul roads to contain disturbance to approved areas.	Ongoing	Daily visual inspections of haul road.	Any land inadvertently disturbed to be rehabilitated immediately once identified.	No disturbance beyond the extraction boundary.
Erosion and sediment controls are maintained and functional.	Ongoing	Daily visual inspection for evidence of erosion or uncontrolled discharge. Additional inspections following prolonged or heavy periods of rain.	Remediate controls to return function.	Water management structures are functioning effectively to minimise erosion.
Toolbox talks to educate Quarry personnel of risks to flora and fauna due to vegetation clearing.	Ongoing	Quarry personnel educated / informed of native flora and fauna likely to be encountered.	Environmental training held annually and any concerns raised and discussed in daily toolbox meetings.	Reduce risk to native flora and fauna that may be encountered at the Quarry.
Weed management programs by a person suitably experienced in weed identification and involving spraying and manual weed removal.	Quarterly (or more frequent if needed)	Maintenance weeding occurs quarterly and recorded in daily work sheets.	If weed infestations are identified, commission an additional weed removal program by a suitably qualified landscape manager.	Weed infestations are contained and weed cover is no greater than surrounding remnant vegetation.
Visual monitoring programs of site security by Quarry personnel.	Ongoing	Daily visual inspection for evidence of trespassers.	Risks to safety identified through access by vehicles, trespassers or feral animals. Risks to be immediately remediated.	The site is secured.
Visual monitoring programs of feral animal presence by Quarry personnel.	Ongoing	Daily visual inspection for evidence of feral animals.	Feral animals identified in numbers that present a risk to native fauna and/or require control measures such as a dedicated baiting program.	Feral animal presence is used to guide ongoing management.
Feral animal control programs involving trapping and/or baiting	As needed	Baiting program undertaken by suitably qualified person.	Quarry to initiate feral animal baiting programs in consultation with OEH, where appropriate.	The Quarry does not become a harbor for feral animals.
Visual monitoring programs of progressive revegetation activities.	Following planting campaigns and then monthly.	Revegetation success and signs of dieback monitored at least monthly. Native vegetation coverage and percentage foliage cover recorded in the Annual Environmental Management Report.	The need for additional management such as mulching, watering or fertilising to be identified and implemented. If unexpected dieback of native vegetation occurs, review site conditions to determine cause of dieback and rectify core issue where possible. Rehabilitate affected area.	Revegetation campaigns have an 85% success rate. Revegetation failures are replaced.

Table 2 (Cont'd)
Landscape Management Performance Criteria

Management Measure	Frequency	Performance Indicators	Response and Corrective Actions	Targets
Ongoing Management (Cont'd)				
Visual inspection of active coconut fibre matting areas within the transgressive dune system located on the border to existing vegetated areas.	Weekly	Condition of coconut fibre and potential damage due to strong winds or trespassers.	Rectify or replace matting as required. Inhibit trespassers by placing logs or timber in selected locations.	Dunes are stable and vegetation is regenerating naturally.
Short to Medium Term (0-5 years)				
Rehabilitation and revegetation of the disturbed area in the southwest of the site to stabilise the exposed faces outside the current extraction area	Immediate campaign, ongoing as needed based in monitoring	Revegetated plants are surviving.	Replace species that have died back. Place suitable timber or coir logs on dunes to stabilise dunes and provide shelter for native vegetation.	Foredune has an average angle of repose of approximately 34 degrees. Dunes are stable and vegetation cover is approaching 15%.
Application of timber and logs in Pit 7 to stabilise dunes.	As needed based on monitoring	Dunes becoming stable and natural vegetation regeneration is occurring.	Place suitable timber or logs on dunes to stabilise dunes and provide shelter for native vegetation.	Dunes are stable and vegetation is regenerating naturally. Foredune has an average angle of repose of approximately 34 degrees.
Revegetation of dunes in Pit 7 with stabilising species.	Annual campaigns	Revegetated plants are surviving.	Replace species that have died back.	Dunes are stable and vegetation cover is approaching 15%.
Maintenance of Pits 1 to 6, including replanting (if required)	As needed based on results of monitoring	Vegetation is starting to naturally regenerate.	Undertake revegetation activities using tube stock, seeds and runners, as appropriate.	Vegetation cover of 70% 75% of species consistent with flora species in **Appendix 1**. Weed coverage less than 5%.
Long Term (5+ years)				
Maintenance or replacement of shrub or tree planting in Pits 1 to 6 as required.	As needed based on monitoring	Vegetation is naturally regenerating.	Undertake revegetation activities using tube stock plants or other suitable specimens.	Vegetation cover of 70% 75% of species consistent with flora species in **Appendix 1**. Weed coverage less than 5%.
Application of timber and logs in Pit 7 to stabilise dunes.	As needed based on monitoring	Dunes becoming stable and natural vegetation regeneration is occurring.	Place suitable timber or logs on dunes to stabilise dunes and provide shelter for native vegetation.	Dunes are stable and vegetation is regenerating naturally. Foredune has an average angle of repose of approximately 34 degrees
Progressive rehabilitation of disturbed areas no longer required for operations in Pit 7.	As completed and practicable	Review of species against species list in **Appendix 1**	Replace species that have died back.	Dunes are stable and vegetation is regenerating naturally. Vegetation cover of 15%.

Table 3
Quarry Closure Criteria

Quarry Area	Final Land Use	Rehabilitation Activity	Objective / Action	Completion Criteria
Infrastructure Area (including haul road)	Native Vegetation	Decommissioning	All Quarry-related infrastructure and equipment removed. Concrete pads broken up and removed for recycling or landfill	All mobile equipment and other infrastructure removed
		Landform Establishment	Compacted surfaces are capable of supporting vegetation.	The only compacted surfaces are roads that are to be retained in the final landform.
		Growth Medium Development	Where necessary, place topsoil and/or mulch on areas to be revegetated.	Area capable of supporting vegetation.
		Ecosystem Establishment	Revegetation of the area with native endemic species consistent with those in **Appendix 1**.	Vegetation cover of 70%. 75% of species consistent with flora species in **Appendix 1.** Weed coverage less than 5%.
Former Extraction Area (Pits 1-6)	Native Vegetation	Ecosystem Establishment	Revegetation of the area with native endemic species consistent with those in **Appendix 1**.	Vegetation cover of 70%. 75% of species consistent with flora species in **Appendix 1.** Weed coverage less than 5%.
Pit 7	Coast Dune Ecosystem	Decommissioning	All Quarry-related infrastructure removed.	All infrastructure removed.
		Landform Establishment	The access road is removed, contoured and stabilised consistent with the surrounding dunes.	Final landform at a minimum elevation of 2.5m AHD. Foredune has an average angle of repose of approximately 34 degrees
		Ecosystem Establishment	Stabilisation and revegetation of the foredune area and buffer area 15m from the foredune.	Vegetation cover is 15% on foredune. 75% of species consistent with flora species in **Appendix 1.** Weed coverage less than 5%.

8. MONITORING AND REPORTING

The Rehabilitation and Landscape Management Plan is required to describe how the performance of management measures will be monitored over time.

The performance criteria for final landform rehabilitation has been provided in Section 7 of this Plan with a detailed description of landscape management and progressive rehabilitation actions established in **Table 2.** This table also identifies the nature and frequency of monitoring to be undertaken during Quarry operations until Quarry closure. During normal operations, landscape management measures would be managed through regular visual inspection by the Quarry Manager.

Visual inspections of revegetated areas would be undertaken at least monthly to identify any signs of vegetation dieback or identify the need for remediation or landscape management. An annual summary of revegetation and maintenance activities, monitoring of revegetated areas and a summary of the locations and focus of weed management will be prepared by the contracted land managers. This report will be included in the *Annual Environmental Management Report*.

The *Annual Environmental Management Report* for the Quarry will, at a minimum, provide a summary of:

- progressive rehabilitation activities undertaken during the reporting period;
- the success of past activities and status of revegetated areas;
- the activities proposed for the following 12 months; and
- Progressive rehabilitation and revegetation of the disturbed area in the southwest of the site outside the current extraction area.

Appendices

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Appendix 1 Native Flora Species Identified at Quarry Site (4 pages)

Appendix 2 Weed Action Plan – March 2012 Prepared by Hunter Land Management (22 pages)

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Appendix 1

Native Flora Species Identified at Quarry Site

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Table A1.1
Native Flora Species Identified at Quarry Site

Scientific Name	Common Name
Carpobrotus glaucescens	pig face
Platysace ericoides	
Platysace lanceolate	
Pandorea pandorana	wonga wonga vine
Pteridium esculentum	bracken
Hibbertia linearis	
Hibbertia obtusifolia	
Brachyloma daphnoides	
Monotoca elliptica	tree broom-heath
Breynia oblongifolia	coffee bush
Ricinocarpos pinifolius	wedding bush
Aotus ericoides	aotus
Bossiaea ensata	
Bossiaea heterophylla	
Bossiaea rhombifolia	
Dillwynia retorta	heathy parrot pea
Glycine clandestina	love creeper
Hardenbergia violacea	false sarsaparilla
Indigofera australis	
Jacksonia scoparia	dogwood
Kennedia rubicunda	red kennedy pea
Acacia longifolia	coastal wattle
Acacia suaveolens	sweet wattle
Acacia ulicifolia	prickly moses
Scaevola calendulacea	scented fan flower
Gonocarpus teucrioides	
Lomandra longifolia	spiny-headed matrush
Angophora costata	smooth-barked apple
Eucalyptus pilularis	blackbutt
Leptospermum laevigatum	coast teatree
Leptospermum polygalifolium	
Leptospermum trinervium	
Melaleuca quinquenervia	paperbark
Dianella caerulea var. producta	
Banksia integrifolia	coast banksia
Banksia serrata	
Conospermum taxifolium	coneseeds
Persoonia levis	broad-leaf geebung
Chloris sp.	
Cynodon dactylon	couch
Imperata cylindrica var. major	blady grass
Spinifex sericeus	hairy spinifex
Themeda australis	kangaroo grass
Conospermum ellipticum	
Pomax umbellata	pomax

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Appendix 2

Weed Action Plan March 2012

Prepared by Hunter Land Management

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