SOUTH COAST CONCRETE CRUSHING AND RECYCLING PTY LTD

SCCCR QUARRIES

Rehabilitation Management Plan

1 DOCUMENT CONTROL

Rev No.	Date	Prepared By	Approved By	Comments
1	18/12/2023	Genaya Shephard	Budd Green	

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EXECUTIVE SUMMARY

In 2009 the Department of Planning (DoP) approved Application 07_0123 for the continuation and expansion of the Nowra Brickworks Quarry on Lot 464, DP1058778. As a condition of consent the DoP has requested that the proponent prepare a Landscape and Biodiversity Management Plan and Long Term Management Strategy.

1. The Rehabilitation and Biodiversity Offset Strategy Management Plan includes:
   (a) the rehabilitation objectives for the site and offset areas;
   (b) a description of the measures that would be implemented to:
      - rehabilitate and stabilise the site;
      - minimise the removal of mature trees;
      - implement the Biodiversity Offset Strategy; and
      - manage the remnant vegetation and habitat on the site and in the offset areas;
   (c) detailed performance and completion criteria for the rehabilitation and stabilisation of the site;
   (d) a detailed description of how the performance of the rehabilitation of the quarry areas would be monitored over time to achieve the stated objectives;
   (e) a detailed description of what measures would be implemented to rehabilitate and manage the landscape of the site including the procedures to be implemented for:
      - progressively rehabilitating and stabilising areas disturbed by quarrying;
      - implementing revegetation and regeneration within the disturbance areas;
      - protecting areas outside the disturbance areas, including the Biodiversity Offset Strategy areas;
      - vegetation clearing protocols, including a protocol for clearing any trees containing hollows and the relocation of hollows from felled trees;
      - managing impacts on fauna, in particular threatened species;
      - controlling weeds and pests;
      - controlling access;
      - bushfire management; and
      - reducing the visual impacts of the project;
   (f) a description of the potential risks to successful rehabilitation and a description of the contingency measures that would be implemented to mitigate these risks; and
   (g) details of who is responsible for monitoring, reviewing, and implementing the plan.

2. The Long Term Management Strategy:
   (a) includes the objectives and criteria for quarry closure and post-extraction management;
   (b) has be prepared in consultation with NOW and DII;
   (c) investigates and/or describes options for the future use of the site;
   (d) describes the measures that would be implemented to minimise or manage the ongoing environmental effects of the project; and
   (e) describes how the performance of these measures would be monitored over time.

DEFINITION OF TERMS

Within this report the following terms are defined.

- ***AEMR*** Annual Environmental Management Report
- ***Council*** Shoalhaven City Council
- ***OEH*** Office of Environment and Heritage
- ***DoP*** Department of Planning
- ***Director-General*** Director-General of Department of Planning, or delegate
- ***EEC*** Endangered Ecological Community as defined by the BC Act (2016)
- ***Exotic Species*** Species introduced from outside the area- from overseas or interstate.
- ***Local population*** Comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.
- ***Native Vegetation*** Indigenous vegetation as per the *Native Vegetation Act 2003.* This includes indigenous trees, shrubs, groundcover plants and aquatic plants.
- ***Noxious Weeds*** Any plant declared under the *Noxious Weeds Act 1993* within the local government areas of Shoalhaven City Council.
- ***Proponent*** South Coast Concrete Crushing and Recycling or any other person or persons who rely on this approval to carry out the project
- ***Regeneration*** Reproduction from self-sown seeds or by vegetative recovery (sprouting from stumps, lignotubers, rhizomes or roots), which occurs naturally after disturbance.
- ***SCCCR*** South Coast Concrete Crushing and Recycling
- ***Site*** Land to which the project application applies
- ***Stock*** All livestock (including cattle, horses, sheep, goats and alpacas).
- ***Subject area*** The Project site and any additional area, which may be affected by the proposal.
- ***Project site*** The area directly affected by the proposal.
- ***VENM*** virgin excavated natural material

2 INTRODUCTION

2.1 Background

In 2009 the Department of Planning (DoP) approved Application 07_0123 for the continuation and expansion of the Nowra Brickworks Quarry on Lot 464, DP1058778. As a condition of consent the DoP has requested that the proponent prepare a Landscape and Biodiversity Management Plan. This plan was commissioned by South Coast Concrete Crushing and Recycling Pty Ltd to satisfy the requirement of the DoP for a Rehabilitation and Landscape Management Plan for Lot 464, DP1058778.

This plan has been prepared by Mr G. Daly, Director of Gaia Research Pty Ltd. Mr Daly has a B.Sc majoring in zoology and a Graduate Diploma in Education and has undertaken ecology assessments since 1991. Mr Daly has published more than 40 scientific papers and several texts on threatened species and restoration (see Shoalhaven Landcare Associations website – publications). Mr Daly is the holder of the following licences:

- Scientific Investigation Licence No. S10470.
- Licence to conduct Animal Research. Authority Issued by the Director General of NSW Agriculture No. 05/2371 to conduct fauna surveys utilising a variety of techniques.

Mr Daly was assisted during preparation of the assessment reports by Ms R. Rudd. Ms Rudd has been employed in various roles in the areas of horticultural and ecological management since 1986. The curriculum vitae of Mr Daly and Ms Rudd are available on request.

2.2 Description of Project site

Location and Geology
The Project site occupies part of Lot 464 DP 1058778, Princes Highway, South Nowra (Nowra 1: 25,000 topographic map Lat 34º 55' 30'', Long 150º 36' GDA 281000 6132700, altitude 40 m AHD) and is situated on the south coast of NSW, six kilometres south of the Shoalhaven River. The Project site has, thin poorly drained soils that have a high content of clay, yet are derived from Nowra Sandstone (Hazelton, 1993). Exposed surface rock outcrops are absent.

Indigenous vegetation
The indigenous vegetation within the Project site may be classified as Coastal Lowlands Cycad Dry Shrub Dry Forest - *Corymbia maculata / Macrozamia communis,* Forest Ecosystem 9 according to Thomas *et al.* (2000) or Currambene-Batemans Lowlands Forest according to Tozer *et al.* (2006). The forest has been logged and much of the sub-canopy is regrowth. Based on diameter at breast height, many of the trees are in the order of forty years old. Although there is evidence of selective logging a number of older trees remain that contain hollows that provide habitat for fauna.

The forest is contiguous with that to the west, but is interrupted by the Princes Highway to the east, a saw milling plant to the south and the Nowra brickworks to the north **(Figure 1).** The connecting bushland to the west of the Project site is being developed for the South Coast Correctional Centre. The South Coast Correctional Centre site is composed of several lots and the total area is approximately 115 hectares of bushland. The gaol site is connected to

bushland to the south and west, but linkages elsewhere such as along Nowra Creek are tenuous.

2.3 Description of the Approved Works

Approved work

The Proponent's principal objectives are for the continuation and expansion of extractive operations at the Nowra Brickworks Quarry, South Nowra. This includes an existing area of approximately 2 ha and an expansion area of approximately 15 ha (**Figure 2**). The approved works include:

- the continued long-term, access to shale resources within the Project Site for the production of a range of high quality general and specialised products for construction, road maintenance and agricultural purposes.
- require the activities associated with proposed extraction, blending, processing, transportation, placement and rehabilitation operations to be conducted in a manner that avoids or minimises the impact(s) of these activities upon the environment within and surrounding the Project Site and upon residents and other land users in the vicinity of the Project Site.
- the continued recycling of construction, concrete and other similar waste materials for blending and re-use.
- a number of the quarry products produced by the Proponent.
- providing for the recycling and placement within the extraction area of virgin excavated natural material (VENM).
- the establishment a final landform that mimics the pre-extraction landform within the Project Site and will undertake progressive rehabilitation of areas disturbed by the proposed activities.

The project will occur in stages (**Figure 3**), with up to 14 000t per year of weathered shale material being removed from a proposed extraction area of approximately 15ha, incorporating an existing extraction area of approximately 2ha for stockpiling or direct sale. The staged extraction of up to 350 000t per year of unweathered shale material ("extracted material") will be undertaken using drill and blast methods from the above extraction area for processing and blending to produce quarry products.

The project also involves the importation and stockpiling of up to approximately 50 000t per year of selected construction, concrete and waste bitumen material ("recycling material") for recycling by crushing and blending with extracted material to produce quarry products. The project also allows for the importation and stockpiling of up to approximately 125 000t per year of quarry products from other quarries ("blending materials") for blending with extracted and recycling materials to produce saleable products.

Project Life

The volume of the proposed extraction area is approximately 3.37 million cubic metres. At an annual average production rate of 300 000t, the proposed extraction area will provide sufficient material for approximately 30 years.

Vegetation Removal

Following identification and marking of each area to be prepared, the following procedures will be employed during vegetation removal operations. Where practicable, vegetation would be cleared during the winter to limit impacts on nesting fauna. Prior to clearing previously marked hollow-bearing trees within the area will be re-identified by a suitably qualified and experienced ecological consultant.

Where the inspection of hollows is not immediately followed by vegetation removal, a procedure would be developed to temporarily prevent re-occupation of the hollows prior to commencement of such operations. Any fauna found would be relocated to a suitable location in the vicinity of the area to be cleared.

Vegetation suitable for commercial timber or firewood and not required for rehabilitation, if present, would be harvested and removed from the site. The removal of the remaining larger vegetation would be undertaken by bulldozer or excavator. Once felled, logs and branches shall be retained for rehabilitation work. These will be cut or broken into manageable lengths or coarsely mulched and placed on areas undergoing progressive rehabilitation or stockpiled for later use.

No vegetation will be burnt or removed from the site other than that to be used for firewood or commercial timber. Smaller vegetation will be removed during soil stripping operations. No additional areas of vegetation would be disturbed or removed prior to the identification and commencement of implementation of this Rehabilitation and Landscape Management Plan and the Biodiversity Offset Strategy.

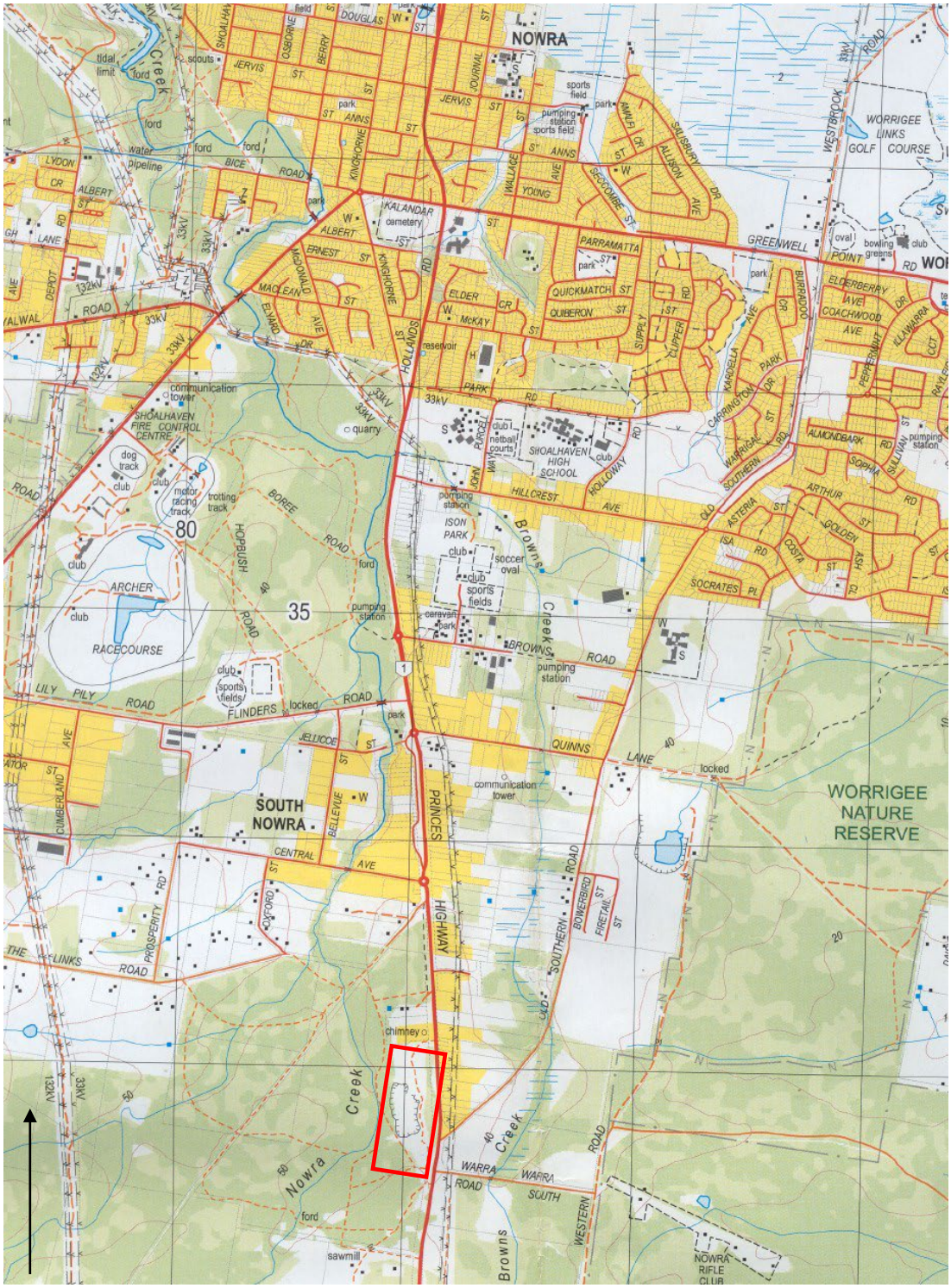

Figure 1 Approximate location of Project site (red rectangle)

Figure courtesy Department of Lands (2006)

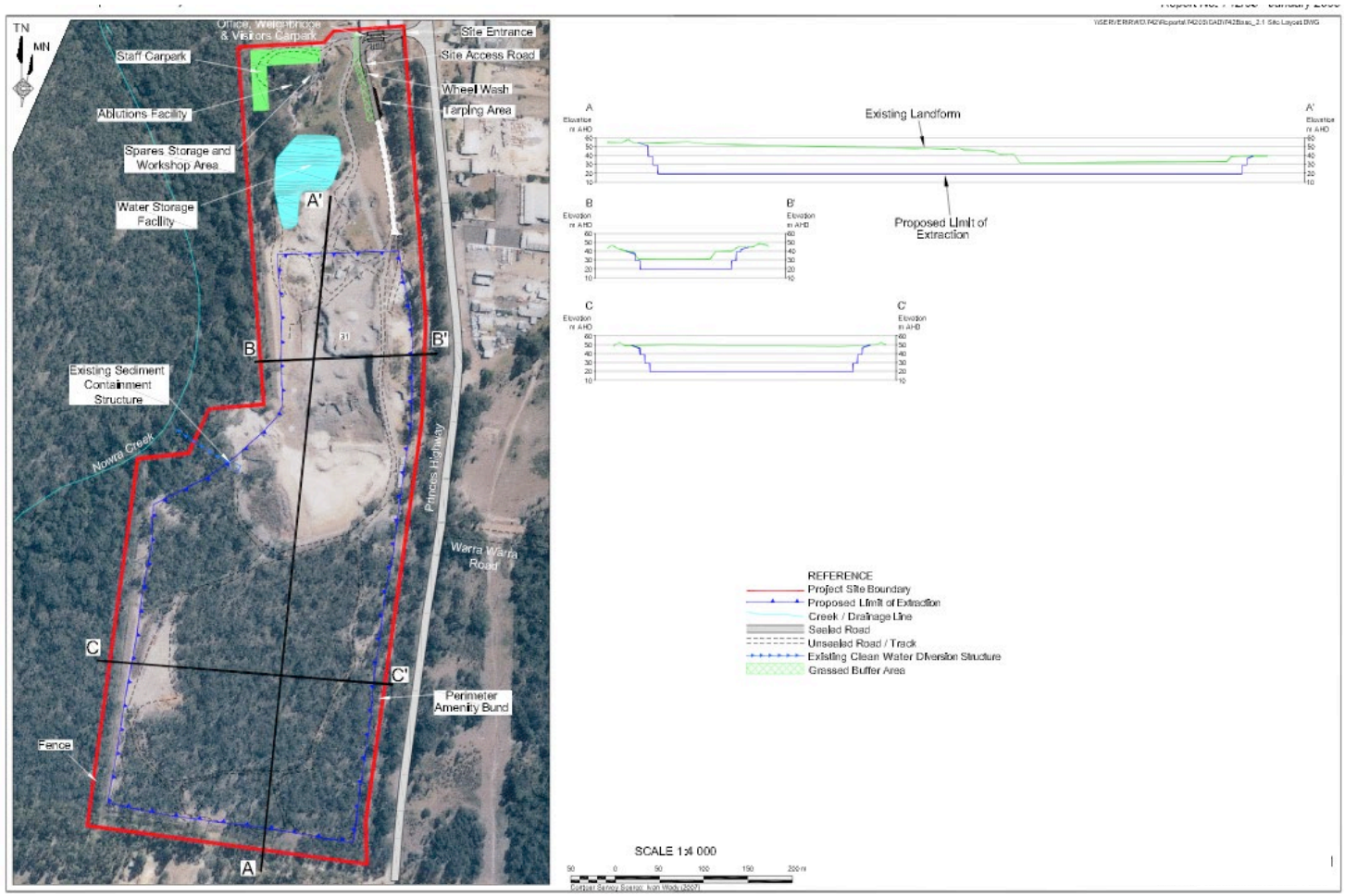

Figure 2 Detail of Quarry

Figure courtesy R.W. Corkery & Co Pty Ltd and City Plan Services (2009)

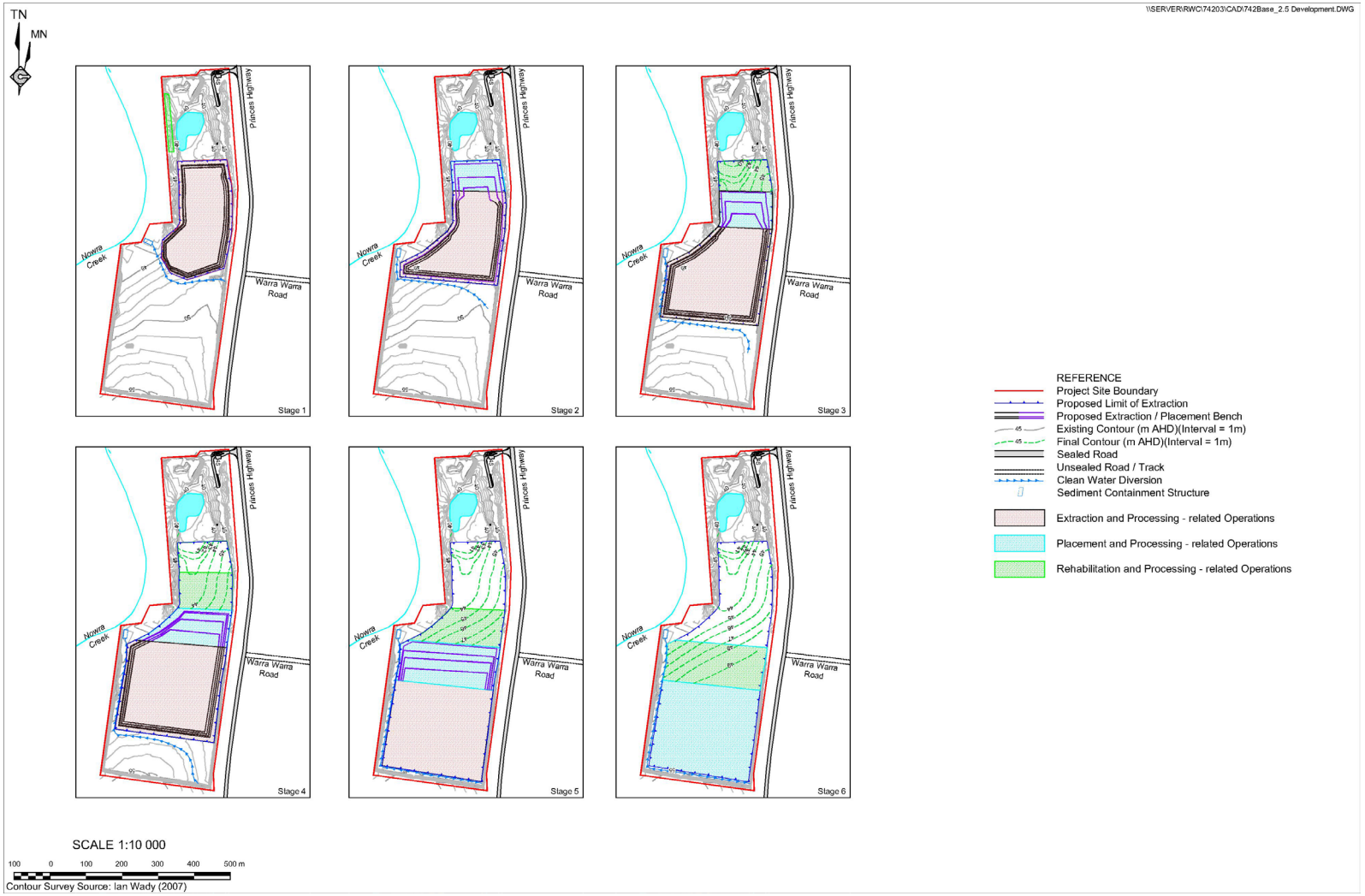

Figure 3 Staged development of the site

Figure courtesy Corkery & Co Pty Ltd and City Plan Services (2009)

Figure 4 Final Landform

Figure courtesy from R.W Corkery & Co Pty Ltd and City Plan Services (2009)

3 REHABILITATION AND BIODIVERSITY OFFSET MANAGEMENT PLAN

3.1 Rehabilitation Objectives

In the short term, the objectives are to stabilise all earthworks, drainage lines and disturbed areas no longer required for extraction-related activities in order to minimise the risk of erosion and sedimentation on the environment surrounding the Project Site.

In the longer term, the Proponent's objectives are to progressively provide a low maintenance, stable and safe landform that mimics the pre-extraction landform (**Figure 4**) and provides, through re-establishment of land capabilities comparable with the pre-extraction land capabilities, for the establishment of vegetation communities similar to those that exist in relatively undisturbed areas adjacent to the Project Site. Independent monitoring of the rehabilitation work is necessary to provide quantitative and qualitative data on compliance.

3.2 Description of Measures

3.2.1 Rehabilitation of the site

Rehabilitation shall be undertaken progressively as soon as practicable after sections of the Project Site are no longer required for extraction or placement-related activities. The following procedures shall be implemented during rehabilitation to ensure the rehabilitation objectives identified in Section 2.1 are achieved.

- Following completion of placement activities, subsoil and topsoil shall be placed on the constructed landform.
- The surface of the placed topsoil shall be left even but 'roughened' to assist with infiltration of water and seed retention.
- Where required, surface water management structures (silt fences) will be constructed to minimise the potential for erosion and to contain any potentially sediment-laden surface water within the Project Site.
- Coarsely mulched or broken vegetation shall be spread over the topsoil to limit the potential for erosion of the newly placed soil material.
- A temporary, non-regenerating cover crop may be used to stabilise the area to be rehabilitated in the short-term to allow diversion of surface waters away from the extraction area.
- Species used during final revegetation shall be a mixture of indigenous lower, mid and upper storey species.
- Seed for use during final revegetation operations shall continue to be collected in the vicinity of the Project Site, generally during Summer and Autumn.
- Collected seed shall be broadcast over each area to be revegetated, generally during Autumn.
- Direct seeding shall be supplemented by placement of whole or coarsely mulched vegetation sourced from clearing operations on the areas to be rehabilitated.
- Tube stock shall be planted to supplement direct seeding and natural revegetation.
- The area to be rehabilitated will have restricted access.
- Rehabilitation shall be monitored annually as described in Section 2.4.

3.2.2 Mature Trees

The proposed extraction area has been designed to avoid a stand of mature vegetation in the north-western section of ML6322 adjacent to Nowra Creek. The earthen bunds surrounding the Project Site will be modified so that earth is not piled against the trunks of several mature trees. Other safeguards include the clear marking of boundaries of areas of native vegetation to be cleared. No clearing would occur outside these boundaries.

3.2.3 Implementation of the biodiversity offset strategy

In order to compensate for the removal of approximately 7.4ha of Spotted Gum Forest within the Project Site, the Proponent will protect and maintain the ecological qualities of the following areas of Spotted Gum Forest within and surrounding the Project Site (**Figure 5**):

- Approximately 3ha within the Northern Biodiversity Offset Area that supports existing indigenous vegetation
- Approximately 14 ha of rehabilitated area.
- Approximately 17ha within the Southern Biodiversity Offset Area.

The aim of the proposed biodiversity offset strategy would be to maintain or improve the cumulative biodiversity values of the land within and surrounding the Project Site for the life of the anticipated impacts. The Proponent will manage the Southern Biodiversity Offset Area for at least the term of the lease of the land for the purposes of nature conservation and enhancement of the biodiversity values of the land. The Proponent has secured the Southern Biodiversity Offset Areas through a term on the lease that has as part of that agreement restricted the use of the Southern Biodiversity Offset Area to those purposes identified in the project approval.

Northern Biodiversity Offset Area

The Northern Biodiversity Offset Area incorporates part of Lot 1, DP1126288 (**Figure 5**). The State of New South Wales is the registered owner of this land, with the Department of Lands administering the land for the Crown. The Proponent holds Mining Leases 5087 and 6322 over this land and retains access to that land through those leases. As the Proponent's rights in relation to the land are dependent on the existing mining leases remaining in force, it would not be appropriate to secure the Northern Biodiversity Offset Area through a covenant on the title or similar arrangement. However, the Proponent or its successors in title would manage the Northern Biodiversity Offset Area in accordance with the management measures described below while ever the mining leases remain in force. In the event that the leases are relinquished or cancelled, the Proponent would provide sufficient resources for the on-going management of the Northern Biodiversity Offset Areas for the life of the offset strategy. The Proponent envisages that an amount to secure the appropriate management of the Northern Biodiversity Offset Area would be included in the security required under the Mining Act 1992 in relation to the mining leases.

Southern Biodiversity Offset Area

The Southern Biodiversity Offset Area comprises part of Lot 228 DP 755952 and is adjacent to and to the southwest of the Project Site (**Figure 5**). The Proponent has acquired a lease over the land for the term of the offset strategy. The lease includes terms that prevent the lease from being terminated by the lessor or subsequent owners of the land.

3.2.4 Management of the remnant vegetation

The following biodiversity management measures would be implemented throughout the life of the biodiversity offset strategy:

- Appropriate fences (not barb-wire) have been erected to restrict wildlife from entering areas of active extraction and rehabilitation-related operations. Currently Mining Leases 5087 and 6322 are fenced with 1.8 - 2.4 m high ring-lock wire. One common boundary with Lot 228 has been also fenced with similar wire by the Department of Correctional Services.
- Ongoing implementation, in conjunction with neighbouring landowners, of pest control programs, including for rabbit, Red Fox and feral cats.
- Ongoing implementation, in conjunction with neighbouring landowners, of weed control programs, including for noxious weeds such as Bitou Bush, Blackberry, Crofton Weed, Fireweed, Honey Suckle, Madeira Vine, Moth Vine and Turkey Rhubarb. These weed control programs would be generally in accordance with the procedures described on the Shoalhaven Landcare Association website – Rehabilitating Shoalhaven Landscapes – Bringing Back the Bush (Daly 2017).
- Annual monitoring of the biodiversity offset areas for fauna species utilising the areas, weeds and feral pests.

Should the Proponent relinquish Mining Leases 5087 and 6322, an appropriate arrangement for the ongoing management of the Northern Biodiversity Offset Area would be negotiated with the appropriate government agency prior to the leases being relinquished.

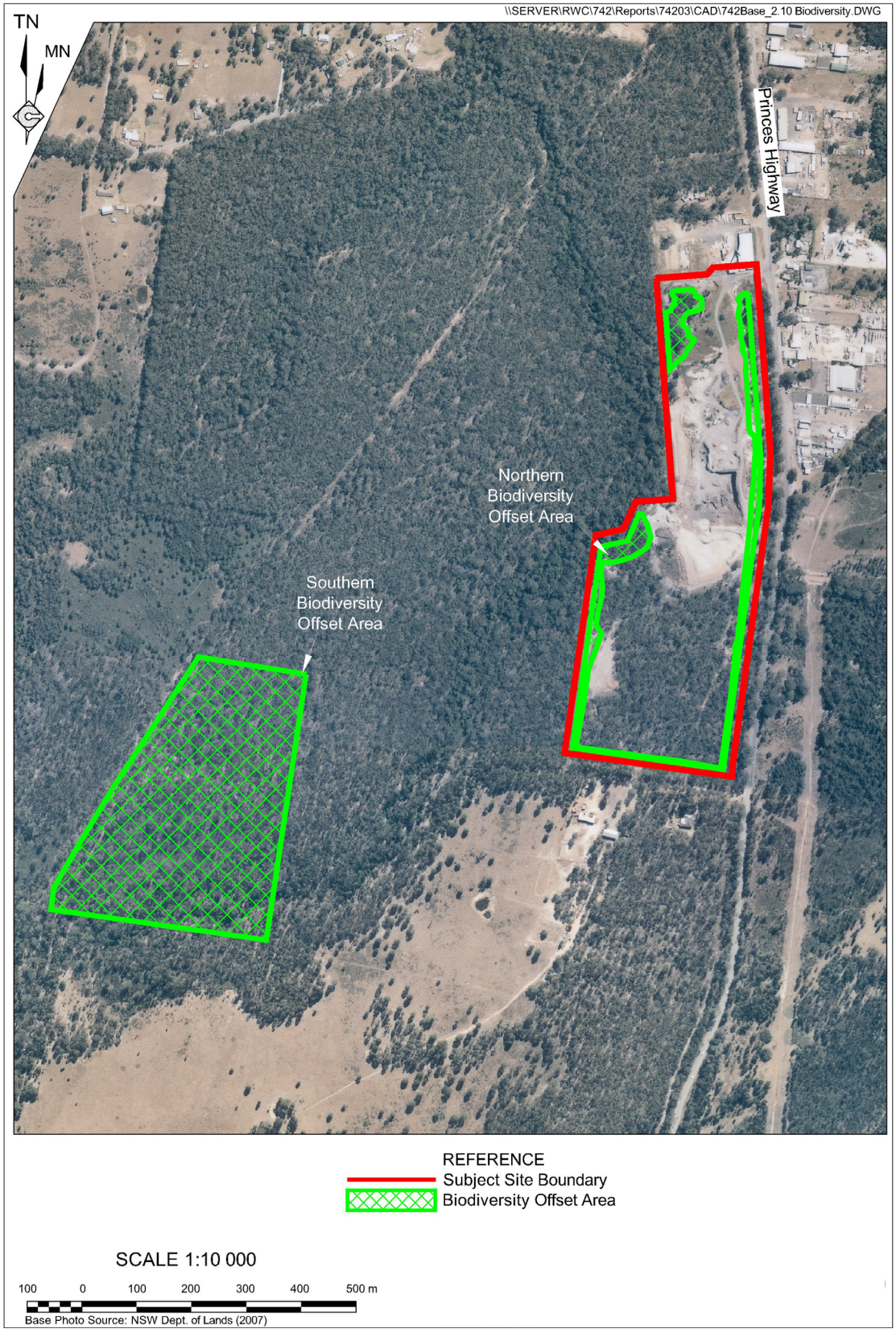

Figure 5 Biodiversity offsets

Figure courtesy R.W. Corkery & Co Pty Ltd and City Plan Services (2009)

3.3 Performance Criteria and Completion Criteria

The following performance criteria and proposed completion criteria are presented in **Table 1.**

Table 1
Performance criteria and completion criteria

Performance criteria	Completion criteria
Noxious weeds are not allowed to establish on site.	Annual weed inspection and control program ensures that no noxious weeds establish on site.
Reduce the impact of existing weed problems.	Implement an ongoing weed control program within 12 months.
Prevent weeds from invading any natural areas retained onsite.	No weeds found in the natural areas or along fence-lines during annual inspections. Treat all weeds found during inspection visits.
Restoration and revegetation of areas that have been disturbed.	Regular collection and redistribution of seed on the site. Annual planting of local native tube stock in autumn. Immediate control of any weeds detected.
Weed control operators comply with all legislative requirements.	No breaches of the relevant acts are recorded by the authorities.
All weed control operations consider waterways.	All weed control operators are able to competently work in creek-lines and water bodies. All weed operators are provided with recommended practices for weed control over waterways.
Quantify data on chemicals used, seeds collected and date of collections and time of dispersal, number of each species of used for revegetation via tubestock.	Within 12 months
Feral animal - fox control program.	Undertake feral animal baiting course run by Local Lands Service – use ejectors
Monitoring rehabilitation.	Annually
Establish and commence photo-points.	Annually
Impact on removal of hollows. Quantify and report on number of vertebrates detected during clearing of hollow-bearing trees	During phase 4 and 5 clearing of native vegetation.
Assessment on southern biodiversity offset area improvement in habitat quality.	Criteria established within six months and reports provided annually

3.4 Monitoring

The following monitoring program would be implemented within the Project Site, the results of which would be used to refine the Proponent's management procedures. The results of the monitoring program would be reported in each Annual Environmental Management Report (AEMR) prepared for the Project.

- Biodiversity offset areas will be monitored on an annual basis. The Southern Biodiversity Offset area will be monitored by the operators of the Nowra Correction Facility. Any negative impacts on these sites together with photos taken at permanent photo points will be included in the AERM
- Areas undergoing rehabilitation will be monitored annually to determine the success or otherwise of the management, mitigation and ameliorative measures and the rehabilitation programs.
- A set of photographic reference points will be established and photographs taken at six monthly intervals to document activities within the Project Site, including rehabilitation progress (see cover image of this report).
- A weed inspection commenced in 2008 and was undertaken within the Project Site and the biodiversity offset areas to enable weed control activities to be planned and implemented.

Routinely records will be maintained for following activities:

- Species of weeds treated and the method and timing of control;
- Chemical and quantity used;
- Species of seed collected and timing of collection and
- Species, quantities, methods and location of revegetation programs.

The above will be included in the annual AEMR.

3.5 Description of Measures and Procedures

3.5.1 The progressive rehabilitation of disturbed areas

Bunds

Weeds have been treated in sections of the bund areas with herbicide and by mechanical methods. The areas have then been planted with tubestock of wattles, Mattrush and creepers. Seed collected from the site has also been broadcast over the area. **Table 2** lists indigenous species that may be used for direct planting and seeding.

Table 2
Species used or recommended for direct planting

Family	Species	Common Name
MAGNOLIOPSIDA -	DICOTYLEDONS	
Fabaceae: Faboideae	*Hardenbergia violacea*	False sarsaparilla
	Kennedia rubicunda	
	Pultenaea villosa	
Fabaceae: Mimosoideae	*Acacia elongata*	
	Acacia longifolia	
	Acacia falcata	
	Acacia ulicifolia	Prickly Moses
Goodeniaceae	*Goodenia heterophylla* subsp *heterophylla*	Violet-leaved Goodenia
	Goodenia ovata	
Myrtaceae	*Kunzea ambigua*	Tick Bush
Proteaceae	*Hakea sericea*	Bushy Needlebush
MAGNOLIOPSIDA -	MONOCOTYLEDONS	
Lomandraceae	*Lomandra longifolia*	
Phormiaceae	*Dianella revoluta* var *revoluta*	Mauve Flax Lily
Poaceae	*Aristida vagans*	Three-awn Speargrass
	Austrodanthonia sp.	Wallaby Grass
	Entolasia stricta	
	Themeda australis	Kangaroo Grass

Existing Storage Piles

These areas largely consist of the perimeter bund with material abutting the existing operation. These piles need to be stabilised using fast growing native ground covers and small shrubs. This can be achieved by the distribution of seed collected from the site opportunistically and an annual planting of local native tube stock. A list of species suitable for revegetation is included in **Table 2.** The focus for revegetation operations should be on fast growing species such as *Hardenbergia violaceae, Kennedia rubicunda, Acacia spp.* and local grasses such as *Themeda australis*. An important component of the restoration and revegetation program is to suppress the potential for dust creation.

Future Storage Piles

As material from the site is retained in piles for storage and in the longer term restoration, a native vegetation cover that will diminish the dust problem and retain some of the genetic integrity of the existing vegetation will be established. Piles will be seeded and planted out in the autumn. Mulch resulting from the clearing of native vegetation will be used on these piles.

Final Site Restoration

As landform reconstruction operations are completed in sections of the quarry area, a program of permanent restoration will commence. This will be undertaken progressively, with soil material removed during land preparation activities placed immediately on areas undergoing permanent restoration (**Figure 3**). The process would require material to be deposited within the section to mimic the original contour of the land. Any native vegetation cleared from the section being developed would be used to provide cover and habitat in the restoration area. Once the major earthworks are completed a program to re-establishing the native cover shall commence. A combination of direct seeding and planting of local native species is required.

Within the areas undergoing permanent restoration, a cover of lower, mid and upper storey species would be established. This will require planting of indigenous tree species grown from seed of local provenance. To achieve this, seed should be collected opportunistically from the site, dried and stored in labelled plastic clip lock bags. When the non-hollow bearing trees are cleared they will be placed within the area to be rehabilitated to provide a source of seed and habitat for fauna. The hollow-bearing trees will be felled and placed into the riparian protection area near Nowra Creek to provide habitat for fauna. There shall be an ongoing program of seed collection, propagation and planting. The restoration program will last for the life of the project and beyond until the site has adequate cover to restrict erosion.

3.5.2 Implementing revegetation and rehabilitation within disturbed areas

The revegetation and rehabilitation of disturbed areas will be conducted in a staged manner. The bunds have been revegetated, seeded and weeds controlled. These actions have to continue on an annually. Indigenous species colonised one of the existing storage piles from seed and propagules taken from material stripped from the site but was subsequently removed for the progressive expansion of the quarry.

The next area to be revegetated will be a section of land to the north of the water storage facility. This area is shown on the cover of this report. This includes a platform area and a bund. The area to the west of the water storage facility will then be rehabilitated. Thereafter rehabilitation work will progress sequentially south of the water storage facility as shown in **Figure 3**.

Table 3
Works Program for Revegetation

Action	Timing	Comment
Seed collection	Generally summer and autumn	Seed collected opportunistically when ripe. Site visit every 3 months will be sufficient to determine the availability of seed. Seed can also be collected when vegetation is being cleared or there are wind falls.
Direct seeding	Autumn	Seed should be broadcast when there is a high likelihood of rain. Autumn is the most reliable time for rain in this region. Any weeds in areas to be direct seeded need to be treated prior to the broadcasting of seed.
Storage of cleared native vegetation	When native vegetation is being cleared	Native vegetation that is removed in the quarrying operation must be used to stabilise areas that are being restored.
Tube stock planting	Autumn	Tubes must be ordered in advance to ensure that stock is available for autumn planting.
Bund areas	2009 - ongoing	Weeds spot sprayed. Natural revegetation augmented by planting tubestock. Seeds collected from site grown and used for revegetation.
North and West of water storage facility	2010 - ongoing	Final landform shaped with VENM, area ripped, covered with mulch, timber pieces and seeded with indigenous species of plant from seed collected on site.
South of water storage facility	ongoing	As above

3.5.3 Vegetation clearing protocols

The sequential actions for clearing are highly associated with minimising impacts on fauna. They include:

- relocating and clearly identifying (with spray) hollow-bearing trees;
- surveys to establish if birds are using hollows for nesting;
- clearing of the shrublayer;
- clearing of non-hollow trees;
- removal and stacking of non-hollow trees;
- hollow-bearing trees removed as outlined in Section 2.5.4;
- Hollow-bearing trees placed within the northern Biodiversity Offset area;
- Debris and some non-hollow trees placed onto rehabilitation areas and
- Topsoil stripped from area and used for rehabilitation or stored in piles to be used for rehabilitation.

3.5.4 Management impacts on fauna

Any clearing of hollow-bearing trees will be conducted during a time that is outside the breeding season for birds and microbats. Most birds and vespertilionid bats breed in spring and summer and clearing will be conducted outside these seasons. A suitably qualified biologist will be on site during the clearing in order to rescue or euthanase injured or displaced animals.

Hollow-bearing trees will be tapped by an excavator prior to removal in an attempt to make resident fauna vacate hollows, trees will then be lowered to the ground and any wildlife found will be rescued and either placed in dark linen bags. Injured animals will be assessed and either euthanased or taken to a veterinarian for treatment. Animals requiring care will be lodged with persons with appropriate experience and qualifications.

3.5.5 The control of weeds and pests

The following weed management objectives detailed in **Table 4** have been and will continue to be adopted to minimise or ameliorate any adverse impacts on flora and fauna within or in the vicinity of the Project Site. The list of weeds that require control are detailed in **Table 5** and the Works Program for Weed Control detailed in **Table 6.**

Table 4
Objectives and performance indicators for weed control

Objective	Performance indicator
No noxious weeds are allowed to establish on site.	Annual weed inspection and control program ensures that no noxious weeds establish on site.
Reduce the impact of existing weed problems.	Implement an ongoing weed control program within 12 months of consent.
Prevent weeds from invading any natural areas retained onsite.	No weeds found in the natural areas or along fence-lines during annual inspections. Treat all weeds found during inspection visits.
Balance the management of kikuyu as a dust suppressor and revegetation.	Gradually reduce the area covered by kikuyu and replace it with native shrubs and ground covers.
Restoration and revegetation of disturbed areas	Regular collection and redistribution of seed on the site. Annual planting of local native tube stock in autumn. Immediate control of any weeds detected.
Reduce levels of annual weeds	Implement annual control programs before seed set.
Weed control operators comply with all legislative requirements.	No breaches of the relevant acts are recorded by the authorities.
All weed control operators consider waterways.	All weed control operators are able to competently work in creek-lines and water bodies and provided with recommended practices for weed control over waterways.

Table 5
Weeds located on the Project site

Common name	Scientific name	Category
Bitou Bush	*Chrysanthemoides monilifera ssp.*	WONS[3], W4[1]
Blackberry	*Rubus fruticosus species aggregate*	WONS[3], W4
Black Thistle	*Cirsium vulgare*	
Capeweed	*Arctotheca calendula*	
Castor oil plant	*Ricinus communis*	
Cleavers	*Galium aparine*	
Cobblers Pegs	*Bidens pilosa*	
Couch	*Cynodon dactylon*	
Crofton Weed	*Ageratina adenophora*	W4[1]
Dock	*Rumex sp*	
Fireweed	*Senecio madagascariensis*	W4[1]
Fleabane	*Conyza sp*	
Honey Suckle	*Lonicera japonica*	Key threatening process[2]
Inkweed	*Phytolacca octandra*	
Kikuyu	*Pennisetum clandestinum*	
Madeira Vine	*Anredera cordifolia*	Key threatening process[2]
Mistflower	*Ageratina riparia*	W4[1]
Mother of Millions	*Bryophyllum delagoense*	
Moth Vine	*Araujia sericifera*	Key threatening process[2]
Mustard	*Sisymbrium orientale*	
Paddy's Lucerne	*Sida rhombifolia*	
Paspalum	*Paspalum dilatatum*	
Purple Top	*Verbena bonariensis*	
Rhodes Grass	*Chloris gayana*	
Ribgrass	*Plantago lanceolatus*	
Scarlet pimpernel	*Anagallis arvensis*	
Senna	*Senna pendula*	
Smoke Weed	*Fumaria muralis*	
Soursob	*Oxalis pes-caprae*	
Turkey Rhubarb	*Acetosa sagittata*	Key threatening process[2]

Note 1: **W1**: State Prohibited Weeds , **W2**: Regionally Prohibited Weeds , **W3**: Regionally Controlled Weeds, **W4**: Locally Controlled Weeds, **W5**: Restricted Plants.
W4 – the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. These weed management plans are available on the web site http://www.shoalhaven.nsw.gov.au/Environment/weeds. Key threatening process is listing under the *Threatened Species Conservation Act, (1995)*.
Note 2: Under the *Threatened Species Conservation Act 1995*.
Note 3: Weed of National Significance.

Table 6
Works program for weed control

Action	Timing	Comment
Control of Declared Noxious weeds.	As per weed prescriptions. On going all year and as required (**Appendix 2**)	High priority task requiring immediate action. Use of herbicides is generally best when the weed is actively growing. Hand removal can be opportunistic and best before the weed has a chance to set seed. There is a legislative requirement to do this work.
Control of all other weeds.	As per weed prescriptions. On going all year and as required (**Appendix 2**)	Regular control measures need to be taken to meet the objectives in **Table 1**.
Seed collection	Generally summer and autumn	Seed collected opportunistically when ripe. Site visit every 3 months will be sufficient to determine the availability of seed for collection. Seed can also be collected when vegetation is being cleared or there are wind falls. This applies to the collection of *Eucalyptus* seed.
Direct seeding	Autumn	Seed should be broadcast when there is a high likelihood of rain. Autumn is the most reliable time in this region. Any weeds in areas to be direct seeded need to be treated prior to the broadcasting of seed.
Storage of cleared native vegetation	When native vegetation is being cleared	Native vegetation that is removed in the quarrying operation must be used to stabilise areas that are being restored.
Tube stock planting	Autumn	Tubes must be ordered well in advance to ensure that stock is available for autumn planting.
Monitoring	Every 3 months	Spring and Autumn are when it is most likely to detect weed incursions and control works can be undertaken. However the site needs to closely monitored for the availability of seed and any potential problems and quarterly site inspections will facilitate early detection.
Photo points	Every 3 months	Set photo monitoring sites and take the same photo every 6 months. Also opportunistically when activities are being undertaken every 3 months.
Reporting	Reporting of weed management would be incorporated into the Annual Environmental Management Report to the Department of Primary Industries – Mineral Resources.	See Section 7 for details of what is required in the report.

Strip, stockpile and spread topsoil and subsoil in accordance with Section 2.5.1. Progressively rehabilitate all areas of disturbance no longer required for extraction or placement-activities in accordance with Section 2.5.1.

3.5.6 The control of access

The Project Site will continue to be serviced by a site entrance and sealed site access road in the north-eastern section of the Project Site. This is the only open entrance to the site. The operational area is secured by a ringlock fence.

3.5.7 Bushfire management

The Project Site is identified as bushfire prone land on the Bushfire Prone Lands Map published by the NSW Rural Fire Service. A bushfire assessment was undertaken by R.W. Corkery & Co. Pty Limited in accordance with Clause 46 of Rural Fires Regulation 2002 and the document Planning for Bushfire Protection published by the NSW Rural Fire Service (Rural Fire Service, 2006). The bushfire mitigation measures and management controls implemented by the Proponent throughout the life of the Project include:

- Locating all fixed infrastructure (weighbridge and office) more than 70 m from the boundary of mature vegetation.
- Maintaining an independent water supply.
- No wood piles are to be located within 100m of infrastructure.
- Vegetation storage piles to be kept manageable i.e. accessible and not too large.
- Preparation of an Evacuation Plan.

3.5.8 Reducing visual impacts

An important component of the existing operation of the Nowra Brickworks Quarry has been focused on limiting the impact of the Proponent's activities on the visual amenity of residents and other land users in the vicinity of the Project Site, including motorists using the Princes Highway. The Proponent would continue to operate the proposed continued and expanded Nowra Brickworks Quarry with the aim of limiting impacts to the visual amenity of surrounding residents, land users and motorists. The Proponent will implement the following mitigation measures and management procedures throughout the life of the Project.

- The existing perimeter bund along the eastern, southern and western boundaries of the Project Site shall be retained and enhanced by revegetation. The existing vegetated buffer within the Nowra Creek riparian zone shall be retained and enhanced to limit views of the Project Site from the South Coast Correctional Facility.

- The existing line of mature trees adjacent to the eastern Project Site boundary will be retained, where appropriate. Additional planting of tubestock may be undertaken to augment natural revegetation. Soil from bunding shall not be placed against the trunks of trees.

- The Proponent will adopt a high standard of housekeeping to achieve a visually attractive site. As part of this approach, the visual character of the various activities on the site would also be considered through the following.

    - The weighbridge will be relocated 65 m from the existing gateway to limit views from the highway.
    - The Project Site would be kept clean, tidy and rubbish free at all times.

3.6 Details of Persons Responsible for Monitoring, Review and Implementation of the Plan

The mine Manager shall be responsible for monitoring, review and implementation of the plan.

3.7 Description of Potential Risks and Contingency Plans

This project has several potential risks and these have been considered. Contingency plans outlined in **Table 7** shall be implemented.

Table 7
Potential risks and contingency plans

Risk	Action
Proponent sells lease	Southern Biodiversity Offset covered by lease agreement
Proponent sells lease	The new owner required to fulfil the Rehabilitation and Landscape Management as per this plan
Proponent sells or relinquishes lease	Southern Biodiversity Offset managed by the South Coast Correctional Facility
Proponent relinquishes lease	DoP to seek adequate funds for completion of Rehabilitation and Landscape Management of mining leases.
Adverse weather conditions	Re assess Rehabilitation Plan
Uncontrolled bushfire	Re assess Rehabilitation Plan

4 LONG-TERM MANAGEMENT STRATEGY

The future use of the quarry site will dictate the long-term management strategy. The quarry managers have indicted that after the cessation of the lease the crown land will be incorporated into and managed by Nowra Correctional Facility. Given this arrangement the objectives of the closure of the quarry are:

- to bring the surface landscape (including pit floor) back to a landform that replicates that of the original by backfilling the quarry using “Virgin Excavated Natural Materials” as defined in the Protection of the Environment Operations Act 1997 (see **Figure 4**). This is to be undertaken to the satisfaction of the Director-General. All buildings and infrastructure will be removed from the hardstand (unless stakeholders have entered into formal written agreements for their retention). These areas will be reshaped and ripped where necessary for topsoiling and revegetation;
- Revegetate the land with species endemic to the original forest, that includes tree, shrub and ground cover species;
- Provide habitat (logs and stumps) to the site to provide refuge habitat for native animals
- Provide habitat (ephemeral pond see **Figure 4**) that caters for the species of amphibian that occupied the site and
- Implement a monitoring program that has measures to quantify the ongoing environmental restoration of the project.

4.1 Description of actions for quarry decommission

Rehabilitation
The quarry will be rehabilitated progressively, that is measures shall be taken to repair disturbed or degraded land and return it to a stable and nonpolluting state and a visual buffer for the Nowra Correctional Facility. Rehabilitation shall be progressive, that is worked out areas shall be rehabilitated while extraction continues. The final landform of the site is shown in **Figure 4** and this has been agreed upon with NOW DRE and Shoalhaven City Council.

In areas progressively developed the stockpiled overburden and topsoil shall be placed directly onto worked out areas for rehabilitation. This will avoid double handling of materials, prevent compacting of the topsoil, minimise visual impacts, weed invasion and also retain a seed bank from the site.

Apart from the boundary bunds the final landform should mimic the original slope. The bunds can be reduced in height particularly along the southern and western boundaries so that their gradients do not exceed 1:3. All other gradients shall be slight in the order of 1:20 or less. The overall drainage shall flow into Nowra Creek (west of the site, as shown in **Figure 3**) and the sediment barrier fencing shall be maintained to reduce impacts on water quality.

Prior to the quarry expansion a portion of the drainage flowed to the east of the site. This is no longer possible as the eastern bund and modifications of landform associated with the Princes Highway upgrade have blocked this drainage line. To cater for species that used this periodically inundated area it is recommended that the replicate landform mimic that which existed prior to the quarrys development. Having an area subject to periodic flooding will also cater for the Bleating Tree Frog *Litoria dentata* and Bibron's Toadlet *Pseudophryne bibronii*, species that were recorded on the site prior to development and are surrogates to measure success of rehabilitation. Logs and tree stumps shall be placed at various intervals around the rehabilitated landform to provide habitat for fauna.

Fencing has been erected and maintained to exclude and prohibit the movement of persons and vehicles into the area. After the cessation of the lease the maintenance of fencing shall be the responsibility of the Nowra Correctional Facility.

Species to be used for revegetation shall be endemic (**Table 8**). Where possible seed shall be sourced from the immediate area or collected during the clearing associated with the progressive development. Some plants such as the Burrawang *Macrozamia communis* it is best to collect seed and disperse these by hand to facilitate natural regeneration. The Elk Horn *Platycerium bifurcatum* subsp *bifurcatum,* Hare's Foot Fern *Davallia pyxidata* and Birds Nest Fern *Asplenium australasicum* were epiphytes on the larger Burrawang and it will take 20 years or more for the cycads to attain a caudex large enough to support these ferns.

For other species a mixture of ripping then direct sowing of seed in conjunction with planting tubestock is recommended. **Table 8** provides the method for each species recorded on the site. For some plants, such as terrestrial orchids, it is impossible to access stock and these species will hopefully colonise the site naturally. Monitoring will provide evidence of natural colonisation. Seeds can be collected from the site or purchased from specialists suppliers (Diversity Native Seeds) and tubestock for various locations including specialist native

nurseries and Landcare Nurseries at Milton and Berry. The seeding rate should be a minimum of 0.3 kg/ha but 0.8 kg/ha for Spotted Gum *C. maculata.*

Rehabilitation Monitoring

Regular monitoring of the revegetated areas will be required to demonstrate that the objectives of the rehabilitation strategy are being achieved and that a, stable landform has been provided. Monitoring will be conducted annually by independent, suitably skilled and qualified persons at locations, which will be representative of the range of conditions on the rehabilitating areas. Annual reviews will be conducted of monitoring data to assess trends and effectiveness. The outcome of these will be included in each Annual Environmental Management Report (AEMR).

The standard methods to measure change is the establishment of 20 x 20 m quadrats over various locations (minimum of five) in the quarry plus two 100m transects. The transects should run in a north/south direction and where possible cross two of the quadrats. All stems on the transects shall be measured for diameter and height. Photos shall be taken at either end of the transects looking back along the line. These photos can be used for comparisons in future surveys.

The quadrats shall measure species present, cover scores ranging from 1-5 (1: rare <5%, 2: occasional <5%, 3: common but <5%, 4: very common but <5%, 5: 5-25%, 6: 26-50%, 7: 51-75%, 8: 76-100%). These methods shall allow the performance of the revegetation/rehabilitation to quantified over time, while the photo-points will give a qualitative account.

Table 8
Species to be used for revegetation of the site

Note: s = seed and t = tubestock, unnecess – unnecessary as these species may colonise the site unaided, none = not practical or unable to access stock/see.

Family	Species	Common Name	Method
FILICOPSIDA			
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair Fern	none
Aspleniaceae	*Asplenium australasicum*	Birds Nest Fern	none
	Asplenium flabellifolium	Necklace Fern	none
Davalliaceae	*Davallia pyxidata*	Hare's Foot Fern	none
Lindsaeaceae	*Lindsaea microphylla*	Lacy wedge Fern	
Polypodiaceae	*Platycerium bifurcatum* subsp *bifurcatum*	Elk Horn	none
CYCADOPSIDA			
Zamiaceae	*Macrozamia communis*	Burrawang	s
MAGNOLIOPSIDA	**DICOTYLEDONS**		
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower	s
Amaranthaceae	*Parsonsia straminea*	Common Silkpod	unnecess
Asclepiadaceae	*Tylophora barbata*		s
Asteraceae	*Cassinia aculeata*	Common Cassinia	t/s
	Cassinia longifolia	Long-leaved Cassinia	t/s
	Lagenifera stipitata		s
	Olearia microphylla	Bridal Daisy Bush	t/s
	Ozothamnus diosmifolium	Paper daisy	t/s
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak	t

Family	Species	Common Name	Method
Campanulaceae	*Wahlenbergia sp*	Bluebells	s
Chenopodiaceae	*Einadia hastata*		s
Epacridaceae	*Leucopogon juniperinus*	Bearded Heath	t
	Lissanthe strigosa	Native Cranberry	s
Fabaceae: Faboideae	*Daviesia ulicifolia*		s
	Glycine clandestina	Love Creeper	unnecess
	Hardenbergia violacea	False sarsaparilla	t
	Kennedia rubicunda		t
	Pultenaea polifolia		t
	Pultenaea villosa		t
Fabaceae: Mimosoideae	*Acacia elongata*		t/s
	Acacia falcata		t/s
	Acacia longifolia	Sydney Golden Wattle	t/s
	Acacia myrtifolia	Myrtle Wattle	t/s
	Acacia ulicifolia	Prickly Moses	t/s
Goodeniaceae	*Goodenia heterophylla subsp heterophylla*	Violet-leaved Goodenia	t
	Goodenia ovata	Hop Goodenia	t/s
Lobeliaceae	*Pratia purpurascens*	White Root	s
Myrtaceae	*Corymbia maculata*	Spotted Gum	t/s
	Eucalyptus globoidea	White Stringy Bark	t/s
	Eucalyptus gummifera	Red Bloodwood	t/s
	Eucalyptus longifolia	Woollybutt	t/s
	Eucalyptus paniculata	Grey Iron Bark	t/s
	Kunzea ambigua	Tick Bush	t/s
	Melaleuca styphelioides	Prickly-leaved Paperbark	t/s
	Syncarpia glomulifera	Turpentine	t/s
Pittosporaceae	*Bursaria spinosa*	Blackthorn	t
	Rhytidosporum procumbens		s
Polygalaceae	*Comesperma ericinum*	Matchheads	s
Proteaceae	*Hakea sericea*	Bushy Needlebush	t
Ranunculaceae	*Clematis aristata*	Old Man's Beard	unnecess
MAGNOLIOPSIDA	**DICOTYLEDONS**		
Rubiaceae	*Galium binifolium*	Bedstraws	s
	Pomax umbellata		s
Rutaceae	*Boronia sp*		unnecess
	Zieria smithii	Sandfly Zieria	t
Santalaceae	*Exocarpus cupressiformis*	Cherry Ballart	none
Solonaceae	*Solunum prinophyllum*	Forest Nightshade	s
Stylidiaceae	*Stylidium graminifolium*	Trigger Plant	none
Thymeliaceae	*Pimelia linifolia spp. linifolia*	Rice Flower	t
MAGNOLIOPSIDA -	**MONOCOTYLEDONS**		
Cyperaceae	*Baumea articulata*	Jointed twig Rush	t
	Eleocharis sp		
	Lepidosperma laterale		t
	Lepidosperma urophorum		t
	Ptilothrix deusta		t
Iridaceae	*Patersonia sericea*	Silky Purple Flag	t
Juncaceae	*Juncus bufonius*		t
	Juncus continuus		t
Liliaceae	*Hypoxis hygrometrica*	Yellow Stars	x
Lomandraceae	*Lomandra gracilis*		t

Family	Species	Common Name	Method
	Lomandra longifolia	Mat Rush	t
	Lomandra multiflora		t
Orchidaceae	*Acianthus fornicatus*		none
	Calochilus robertsonii		none
	Corybas sp.		none
	Cyanicula caerulea		none
	Cymbidium suave	Snake Flower	none
	Eriochilus cucullatus		none
	Glossodia major		none
	Myrmechila sp.		none
	Prasophyllum brevilabre		none
	Pterostylis acuminata	Sharp Greenhood	none
	Pterostylis curta		none
	Pterostylis nutans	Nodding greenhood	none
	Thelymitra spp.		none
	Tropilis aemula	Ironbark Orchid	none
Phormiaceae	*Dianella revoluta var revoluta*	Mauve Flax Lily	t
Poaceae	*Aristida vagans*	Three-awn Speargrass	s
	Entolasia stricta		s
	Panicum simile	Two Colour Panicum	s
	Phragmites australis	Native Reed	unnec
	Themeda australis	Kangaroo Grass	t
Xanthorrhoeaceae	*Xanthorrhoea sp.*	Grass Tree	t

REFERENCE

Daly, G. 2017. *Rehabilitating Shoalhaven Landscapes. Bringing Back the Bush.* Shoalhaven Landcare Association Inc. ISBN: 978-0-9874519-1-0

Acknowledgements

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