

Issue: 1 Rev: 1 Date: 25/9/03	CLEARY BROS (BOMBO) PTY LTD - QUARRY DIVISION Gerroa Sand Resource Work Instruction	No: WIGSR11 Page: 1 Approved:
REHABILITATION AND LANDSCAPING		

1.0 PURPOSE AND SCOPE

This work instruction describes the final landscape plan for Gerroa sand quarry and the method for rehabilitating the site and implementing the plan.

2.0 DEFINITIONS/REFERENCES

- 2.1 2003 Development consent for Gerroa sand quarry operations.
- 2.2 Gerroa Sand Resource, Continuation of Extraction, Amended Statement of Environmental Effects (Perram & Partners 2003)
- 2.3 Gerroa Sand Resource- Quarry Environmental Management Plan.

3.0 OBJECTIVES

- 3.1 To return the land following completion of quarrying to a condition suitable for conservation and general rural management, in accordance with its zoning, with a landform requiring minimal ongoing maintenance.
- 3.2 To carry out progressive rehabilitation while sand extraction is continuing so that progress can be monitored and maintained to minimise the extent of work remaining when extraction ceases.
- 3.3 To implement the recommendations of Kevin Mills & Associates with regard to species selection, habitat creation, weed management and feral animal control in the rehabilitated areas.

4.0 LANDSCAPE DESIGN

- 4.1 The final landform for the site is shown on Figures 5.2 and 5.3 of the QEMP. Features of the design are as follows:
- 4.2 The dredge pond is to be retained as an aquatic habitat with a fully revegetated shoreline and an irregular edge with some shallow areas to create a variety of habitats;
- 4.3 The sight bund along Seven Mile Beach Road is to be retained because to remove it would create excessive disturbance to revegetated areas and it is consistent with the former sand dune parallel to the road;
- 4.4 The flood bund around the extension area is to be removed because the bund is only a recent structure in this area, there is no ongoing need for it and it is inconsistent with the flat terrain of the adjoining swamp mahogany forest;

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- 4.5 Noise bunds and the flood bund near the office are to be retained because these structures have been in place for a number of years and support mature vegetation;
- 4.6 Other than the bund structures to be retained, the land is to be contoured to an approximately flat profile consistent with the habitat of the adjoining swamp mahogany forest.
- 4.7 The access road from Berry Beach Road to the extension area will be retained because it is beneficial for future property access and maintenance;
- 4.8 Access tracks are to be retained in discrete locations around the dredge pond to enable maintenance vehicles and water cart to reach rehabilitation areas.
- 4.9 The office building will be retained as a rural storage structure with a small parking area adjacent;
- 4.10 Product bins, fuel tanks, sorters equipment and any leftover products will be removed so that there is no unwanted infrastructure remaining from sand extraction;
- 4.11 Apart from access roads, parking and existing building, all parts of the disturbed area are to be rehabilitated to wetland or bushland.

5.0 SHORELINE DESIGN

- 5.1 The design calls for a series of bays and peninsulas along the shoreline with some shallows and islands.
- 5.2 The entire shoreline is to be vegetated with wetland vegetation.
- 5.3 Wetland habitat diversity is to be created by variety of shape, depth and vegetation and by placement of protective material such as logs extending partly into the water.

6.0 ESTABLISHING WETLANDS

- 6.1 During the extraction process, natural substrata levels are to be noted allowing detailed landscape design of the artificial wetlands to be undertaken. For each area, this design is to be available prior to completing extraction works at that location. The maximum gradient within 10 metres of the average shoreline position is to be designed no greater than one in six.
- 6.2 When extraction of an area is complete, the shoreline and sub-surface profile is to be altered using surplus materials consistent with the detailed design to create peninsulas, bays, shallows and islands. Earthmoving equipment will push surplus material into the dredge pond and shape and contour the final landform prior to topsoiling and revegetation.

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- 6.3 Water depths around the margins will be maintained consistent with the detailed design so that they promote the development of certain plant species as intended.
- 6.4 Any available logs or tree trunks are to be selectively placed close to and just within the waters edge to create fauna habitats.
- 6.5 Wetland planting will be delayed until sediment movement in the completed area has reduced. This will normally require a separation of more than 100 metres from ongoing extraction works.
- 6.6 As a guide, the following species occurring naturally on the site have responded favourably to transplanting elsewhere on the site:

Philydrum lanuginosum
Villarsia exalata
Bacopa monieri
Juncus planifolius

- 6.7 The following species have been transplanted from nearby sites in a trial plot:

Tetragonai tetragonoides
Artiplex australsica
Sarcicornia quinqueflora
Suaeda australis
Triglochin striata
Selliera radicans
Portulaca oleracea

- 6.8 The two existing islands are to be planted with dryland species.
- 6.9 When extraction is complete on the entire site, flood bund walls are to be pushed into selected areas of the dredge pond where the foreshore has not been revegetated to create shoals and islands. The disturbed foreshore is then to be planted as above.

7.0 DRYLAND REHABILITATION

- 7.1 As sand extraction progresses, land surrounding the dredge pond is to be contoured in accordance with the rehabilitation plan, Figures 5.2 and 5.3 in the QEMP
- 7.2 In any dryland area, rehabilitation is to commence not later than one month after earthworks are completed.

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- 7.3 Topsoil (or organic-rich sand) previously collected from the site and stockpiled is to be recovered and spread over the profiled surface.
- 7.4 Prior to planting, place any available logs or other native vegetation debris over the topsoiled surface.
- 7.5 Plants should be placed at 2-metre centres or closer and be in place within two months of the completion of earthworks, unless planting needs to be deferred for climatic reasons.
- 7.6 The species list is made up of species recommended by Kevin Mills & Associates and are either endemic to the site or the Gerroa area and have shown themselves to be effective in previous revegetation:

Bangalay	<i>Eucalyptus botryoides</i>
Black Wattle	<i>Acacia mearnsii</i>
Cheese tree	<i>Glochidion ferdinandii</i>
Coast Banksia	<i>Banksia integrifolia</i>
Corkwood	<i>Duboisia myoporoides</i>
Golden Wattle	<i>Acacia longifolia</i>
Illawarra Zieria	<i>Zieria granulata</i>
Narrow-leaved Paperbark	<i>Melaleuca linariifolia</i>
Swamp Mahogany	<i>Eucalyptus robusta</i>
Swamp Oak	<i>Casuarina glauca</i>
Tree Broom-heath	<i>Monotoca elliptica</i>
	<i>Acacia ulicifolia</i>
	<i>Melaleuca ericifolia</i>
	<i>Leptospermum laevigatum</i>
	<i>Leptospermum juniperinum</i>

- 7.7 The following species have been recommended for future consideration if the nominated species are found to require supplementing. It is anticipated that many of these species will regenerate naturally from topsoil that has been stockpiled correctly (low-level piles and no compaction).

Gymnostachys anceps
Helichrysum elatum
Helichrysum diosmifolium
Indigofera australis
Perlargonium australe
Goodenia ovata
Myoporum acuminatum
Persoonia linearis
Zieria smithii

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8.0 MAINTENANCE AND MONITORING

- 8.1 Kevin Mills & Associates will visit the site annually in October to monitor progress of revegetation and recommend any improvements in species selection of methods. It is the responsibility of the Environmental Manager to arrange these inspections. A report of the inspection, prepared by Mills will form part of the annual report.
- 8.2 All plants will be watered and fertilised at the time of planting, to ensure rapid early growth and establishment.
- 8.3 A second watering will take place from one to six weeks later, depending on weather conditions. Follow-up watering will be based on weather conditions. A water cart is available as required facilitate watering large numbers of plants.
- 8.4 Maintenance includes weeding around the base of new plants to ensure they grow faster than the competition, staking fallen plants and removing strangling or obstructing vegetation to enable trees to gain height without excessive distortion.

9.0 WEED CONTROL

- 9.1 The following exotic tree and shrub species have been recorded as having naturalised in the Gerroa area or have been observed on site.

Scheduled plants (Noxious Weeds Act)

Bitou bush	<i>Chrysanthemoides monilifera</i>
African boxthorn	<i>Lycium ferocissimum</i>
Blackberry	<i>Rubus fruticosus</i>
Weeping willow	<i>Salix babylonica</i>
Broadleaf privet	<i>Ligustrum lucidum</i>

Non-Scheduled Plants

	<i>Cassia coluteoides</i>
	<i>Erythrina x sykesii</i>
Lantana	<i>Lantana camara</i>
	<i>Psoralea pinnata</i>
	<i>Solanum pseudocapsic</i>
Cobblers peg	<i>Bidens pilosa</i>
Wandering jew	<i>Tradescantia albiflora</i>
	<i>Dipogon lignosus</i>
	<i>Asparagus densiflorus</i>
	<i>Passiflora edulis</i>
	<i>Phytolacca octandra</i>
	<i>Solanum nigrum</i>
	<i>Verbena bonariensis</i>

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- 9.2 This instruction primarily applies to weed control within the land to which development consent applies, being land affected or disturbed by sand extraction. Weed control may also be undertaken on adjoining parts of the property in accordance with rural management practices implemented for that land.
- 9.3 The quarry production manager is to arrange for Kevin Mills & Associates to inspect the site each October to record the extent of weed infestation and advise on weed control requirements.
- 9.4 Weeds are to be controlled as recommended by Mills in his written annual advice.
- 9.5 It is the responsibility of the quarry production manager to continue to monitor and control all exotic species throughout the extraction and rehabilitation period.
- 9.6 The following targeted management practices shall be employed, as previously recommended by Mills:
- a) Bitou bush will be continually monitored and removed or sprayed with Roundup.
 - b) As regeneration of native species improves to provide shrub habitat, lantana is to be progressively removed or sprayed with Roundup
- 9.6 General weed control in existing bushland and regenerating areas will be carried out by the following methods:
- a) Areas of least weed infestation will be treated first. Such areas should have a reasonable population of native species, capable of providing a supply of seeds to aid natural regeneration.
 - b) Weeds will be removed with minimal disturbance. In the sandy soils of the extraction site, even large woody plants can be removed without the surrounding topsoil being excessively disturbed. Older, well-established plants will be cut off at ground level, then immediately painted with herbicide. Because of the proximity of the site to water and the national park, only Roundup will be used, as this herbicide is recognised to be biodegradable.
 - c) The rate of weed removal will be determined by the rate of native regeneration: In some areas natural regeneration will be supplemented by the planting wattle seedlings, and by "brushing" (placing of cut, seed-laden branches over the weeded sites).

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10.0 FERAL ANIMALS

- 10.1 In the past Kevin Mills & Associates has considered the potential for the site to harbour feral animals but found little evidence of rabbits or hares within the area.
- 10.2 Quarry staff are to report any observation of feral animals to the quarry production manager. During annual inspections, Kevin Mills & Associates will investigate regenerating areas for evidence of grazing by feral animals.
- 10.3 Should the site be found to harbour feral animals, in consultation with Kevin Mills & Associates regarding methods, a pest exterminator is to be engaged to deal with the problem.
- 10.4 Should planted seedlings suffer from grazing by feral animals, rabbit-proof fencing, or individual tree guards will be considered.

11.0 SUSTAINABLE WATER MANAGEMENT

- 11.1 Any water required for maintenance of regenerating areas can be obtained from the dredge pond.
- 11.3 The existing pond overflow arrangements will be retained to enable surplus waters to discharge via the drainage system.
- 11.4 Following completion of sand extraction and removal of sections of the flood bund, the flood storage capacity of the property will be restored.

12.0 APPENDICES

- 12.1 Nil