Yalyalup Mineral Sands Project Revegetation Management Plan

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Environmental Services

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1. Introduction

In January of 2021 Cape Life Environmental was engaged by Doral Mineral Sands Pty Ltd to prepare a Revegetation Management Plan in accordance with the Department of Water and Environmental Regulation publication, *A Guide to Preparing Revegetation Plans for Clearing Permits* (DWER, 2018) to counterbalance direct impacts from clearing 2.72ha of degraded to completely degraded vegetation for the Yalyalup Mineral Sands Project. In addition, the Revegetation Management Plan forms part of Doral's overall mitigation hierarchy for potentially significant impacts to conservation significant flora, vegetation and fauna habitat as a result of indirect impacts from groundwater drawdowns.

This Revegetation Management Plan details the activities associated with the preparation, revegetation, maintenance and monitoring associated with 4.7 hectares of degraded pasture located adjacent to the McGibbon Track Threatened Ecological Community (SWAFCT10b – Shrublands of the Swan Coastal Plain Ironstones).

1.1 Objectives

The aim of this Revegetation Management Plan is to provide clear definition as to the methodology and expectations associated with the revegetation component of the Yalyalup Mineral Sands Project, in order to achieve the following key DAWE requirements:

- Planting of species suitable as habitat for *Pseudocheirus occidentalis* (Western Ringtail Possum), *Calyptorhynchus Latirostris* (Carnaby's Black Cockatoo), *Calyptorhynchus baudinii* (Baudin's Black Cockatoo) and *Calyptorhychus banksia naso* (Forest Red-tailed Black Cockatoo).
- Planting of species suitable for the establishment of woodland comprised of *Corymbia calophylla* (Marri), *Eucalyptus marginata* (Jarrah) and *Agonis flexuosa* (Peppermint tree).
- Planting of understorey species with local provenance at optimal time, with a focus on using species present in the adjacent vegetation community (SWAFCT10b);
- The capacity of the site to become sustainable with minimal management whilst working towards becoming self-sustaining once established.

1.2 Considerations

Revegetation activities incorporated with this Revegetation Management Plan require consideration of the stipulations outlined by the Department of Agriculture, Water and the Environment (the Department) in a letter addressed to Doral Mineral Sands Pty Ltd in December 2020 (EPBC Ref: 2017/8094).

Doral will consider the inclusion of Threatened and Priority Flora (located within SWAFCT10b) in the understorey and as such will require the submission of a relevant application to the Department of Biodiversity, Conservation and Attractions (DBCA) prior to approval for use of these species in the proposed revegetation area. These species may include:

- Banksia squarrosa subsp. argillacea (T)
- Verticordia plumosa var. vassensis (T)
- Calothamnus quadrifidus subsp. teretifolia (P4)
- Loxycarya magna (P3)



2. Background and Site Description

2.1 Location, Ownership, Vesting and Zoning

The Yalyalup Mineral Sands Project is situated approximately 11 km southeast of the Busselton town site with the 4.7 hectare revegetation area located adjacent to the eastern edge of the McGibbon Track (refer Figure 1.) The land proposed for revegetation is owned by Doral Mineral Sands Pty Ltd and is zoned Agriculture under the City's Local Planning Scheme (City of Busselton, 2015)





2.2 Physical and Biological Features

Ecoedge (2020a) has identified the area incorporating the revegetation site as being situated on the Swan Coastal Plain landform, specifically on the Abba plains land system (213Ab). The Abba Plain is typically represented by a level to gently undulating topography, approximately 10-40m above sea level and contains extensive areas of poor drainage (Tille and Lantzke, 1990). Soil type is identified as sandy gradational grey-brown (Busselton) soil with some red-brown sands and loams (Tille and Lantzke, 1990).

• Vegetation in the general vicinity of the revegetation area is classified as the Abba Vegetation Complex (Webb et al., 2016) and is represented on site by mature *Corymbia calophylla* (Marri) trees surrounding a *Eucalyptus rudis* (Flooded Gum) woodland (exemplified in Figure 2).

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- The revegetation site was mapped by Ecoedge (2020a) as Woodland of *Eucalyptus rudis* and (in some areas) *Melaleuca rhaphiophylla* over weeds on massive ironstone and described as "Severely degraded form of SWAFCT10b - Shrublands on southern Swan Coastal Plain Ironstones (Busselton area) recognisable only by the presence of massive ironstone and lateritic boulders at or near surface. Completely degraded with only the overstorey remaining, does not represent the TEC SWAFCT10b".
- Vegetation community SWAFCT10b, containing *Banksia squarrosa subsp. argillacea* (T), *Calothamnus quadrifidus subsp. teretifolia* (P4) and *Loxycarya magna* (P3) is situated adjacent to the western boundary of the revegetation site.



Figure 2. Eucalyptus rudis (Flooded Gum) woodland extending towards the McGibbon Track TEC

Remnant vegetation within the proposed extent of the revegetation site is considered "Completely Degraded" although it adjoins vegetation along McGibbon track considered to be in "Good" condition (Ecoedge, 2020a). Furthermore, observations of Western Ringtail and Common Brushtail Possums were recorded further north along the McGibbon Track, most recently in 2019 within vegetation community SWAFCT02, which also includes 30 potential Black Cockatoo breeding trees. Due to the previous land use of grazing, pasture weeds entirely dominate the understorey vegetation of the proposed revegetation site.

2.3 Site History

Consistent grazing by stock appears to be the most commonly undertaken activity across the revegetation site prior to acquisition by Doral Mineral Sands Pty Ltd.

2.4 Disturbances, Threats and Other Site Conditions

Weed encroachment, feral animal and pest exclusion (or control) as well as alleviating soil compaction will be the main considerations associated with the successful establishment of self-sustaining, native vegetation at the site. Mitigating these threats at the site will ensure the McGibbon Track TEC and associated DRF and Priority Flora will be resilient into the future.

Reference to the Groundwater Dependent Ecosystem (GDE) Assessment (Ecoedge, 2020b), indicates that vegetation communitySWAFCT10b is considered to be a GDE and potentially subject to shallow seasonal fresh water inundation due to the impermeable ironstone surface outcrops and heavy soils. Appropriate timing of implementation and application of a suitable methodology will help ensure the project objectives are met.



3. Revegetation Methodology

The revegetation site will be separated into two zones in order to achieve the project objectives (Figure 3). The wetland zone will incorporate suitable species that represent SWAFCT10b with a focus on those tolerating potential water inundation. The Transitional zone will be represented by suitable habitat species for threatened fauna with a focus on establishing a sustainable woodland comprised of *Corymbia calophylla* (Marri), *Agonis flexuosa* (Peppermint Tree), *Banksia attenuata* (Candlestick Banksia), *Banksia grandis* (Bull Banksia) and *Eucalyptus marginata* (Jarrah).





3.1 Provenance Native Seed Collection

Provenance native seed collection will be undertaken from stands of remnant vegetation in close proximity to the project site to be utilised for nursery propagation and direct seeding. A seeding rate of 4kg per hectare is recommended, equating to a total of 18.8kg of seed required for the direct seeding. Small batches of recalcitrant species will be targeted during the collections for nursery propagation and subsequent seedling planting where direct seeding is not practical.

With implementation projected for Winter 2022, provenance collections will be undertaken over the 2020/21 and 2021/22 South West seed collection seasons, typically running from November through to April . This will allow for targeted collections and a broad range of species being obtained, with up to 40 different species being targeted. Species selection are based on historical local flora surveys and those considered suitable habitat (feeding and/or



nesting) for threatened native fauna. Table 4 (see Appendix) details an indicative species list that will be targeted for collection. It is anticipated that other suitable species observed to be growing in similar vegetation types within the provenance zone may be added once collections are underway. All seed collected will be vacuum sealed and held in temperature-controlled storage until required for use.

Permission from the City of Busselton will be obtained to collect seed from road reserves and bushland within their jurisdiction. Initial consultation with DBCA has identified their requirements with regard to the collection of Threatened and Priority species and approval will be dependent on the submission of this revegetation plan for review. The contracting native seed collector shall be endorsed to collect in the DBCA forest blocks within proximity to the site and also utilise these areas for collections.

3.2 Cutting Material Collection

Species identified as being difficult to secure viable seed from, or that hold significant importance with regard to project objectives, will have cutting material taken from them for propagation at a suitably experienced nursery. This activity will be best undertaken in Spring 2021 to allow appropriate time for seedlings to establish.

3.3 Site Exclusion Fencing and Rabbit Control

Perimeter exclusion fencing is essential in mitigating the risks of predation by kangaroos and other grazing animals. Fencing would need to be of a height and strength adequate in preventing access by pest fauna. Timely rabbit baiting and burrow fumigation will provide a cost effective rabbit control in addition to a rabbit 'skirt' along the bottom of the perimeter fence line. Initial control would be scheduled for April-May 2022 with follow up treatments as required. Signage educating the general public, mine employees and contractors of the revegetation activities will be installed at access points to the site.

3.4 Pre-vegetation Establishment Weed Control

The success of any revegetation project is dependent on timely and thorough weed control. Applications of broad acre weed control throughout the revegetation site in autumn 2021 will be undertaken to reduce the weed burden and deplete the weed seed bank prior to implementation. Follow up pre-planting weed control will then occur each spring and autumn until implementation in winter 2022. Summer weed control will also be implemented in case weeds encouraged by soil disturbance need to be managed.

3.5 Site Preparation

To alleviate soil compaction, promote root development and to provide protection for broadcasted seed, ripping and furrowing of the site will be undertaken prior to implementation. Intermittent access tracks throughout the site will be established to enable more efficient post-implementation weed control and monitoring.

Hygiene protocols will be implemented where any machinery, equipment and personnel are accessing the revegetation site to eliminate the introduction of diseases and weed species. This will include the inspection and cleaning of all light vehicles and earth-moving equipment to remove any residual soil and/or vegetation prior to entering and leaving the area. A dieback Clean on Entry point will be installed once fencing is in place.

3.6 Seed Pre-treatment and Batching

Seed pre-treatments and batching will be carried out in the days leading up to direct seeding, anticipated in late July/early August of 2022.

Seed pre-treatments are required to break dormancy of certain species allowing for a higher germination rate across the site utilising a combination of smoke, hot water, heat and acid.



Seed batching will aid in ensuring species and quantities are evenly distributed across the site. An initial site visit identified the requirement for a seeding mix incorporating suitable wetland species and a fringing intermediate species mix including *Corymbia calophylla* (Marri), *Agonis flexuosa* (Peppermint Tree) and *Eucalyptus marginata* (Jarrah). The site will be divided into these two distinct zones with a different species mix attributed to each zone.

3.7 Tubestock Planting and Direct Seed Broadcasting

Once the site is prepared and a final broad acre weed control event has been undertaken, seedling planting and hand seeding will occur. Due to potential water inundation across the revegetation area (which will be observed and monitored during winter 2021), the revegetation activities will likely occur in late winter of 2022 once water levels have reached capacity and drainage issues can be alleviated if required.

Seedlings used in the project will be propagated, where practicable, from provenance seed collected and forwarded to a trusted, accredited nursery.

Seedling planting will act to enhance the seeding zone and will help with biodiversity and native vegetation cover in areas where direct seeding is not practical. In both the wetland and transitional zone understorey seedlings will be installed at a density of 1/5m2. Tree species will be installed at a rate of 1/20m2 in the transitional zone and a lower rate of 1/40m2 in the wetland zone, as there is mature *Eucalyptus rudis* already present within the area. Seedlings will be planted with Pottiputkis where surface preparation is possible and with hand augers to break surface compaction in areas where surface preparation is not practical (e.g. areas with remnant *Eucalyptus rudis* in the wetland zone).

For the direct seeding, approximately 8 bags per hectare will be batched up and hand broadcast across both the wetland and transitional zones. Each bag will be mixed with sterile yellow sand to help with hand distribution. A mycorrhizal inoculant will be used to assist with seed germination and development by mixing it with the seed at a rate of 1kg per hectare. The site will be seeded at a rate of 4kg per hectare requiring a total of 18.8kg for the estimated 4.7 hectares of seeding area. All seed will be sourced from provenance, targeted collections described above.

3.8 Schedule of Works

The Schedule of works will guide activities at the site and will provide a quick reference as works are implemented at the site. The Schedule of Works is provided in Table 1 (see Appendix).

4. Revegetation Monitoring

4.1 McGibbon Track Reference Site

In the interest of providing relevant comparison data from which to gauge the success of the revegetation site, species richness and density of the understorey will be recorded within SWAFCT10b.

4.2 Monitoring Methodology

4.2.1 Quadrat

Six 5mx5m quadrats will be established throughout the revegetation area in accordance with the specifications stipulated in *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016). Revegetation monitoring events will be undertaken annually in Spring and continue until the Completion Criteria objectives have been met.



4.2.2 Traverse

A traverse style search will be undertaken to collect opportunistic data at the same time as annual quadrat monitoring. The primary focus of the traverse will be to search for Threatened and Priority Flora as well as to assess general plant health, species representation outside of quadrats as well as weed presence and distribution.

4.3 Completion Criteria

With the primary objectives of the revegetation to enhance habitat for threatened native fauna as well as to incorporate species present within the adjacent vegetation community, the completion criteria will reference the framework in Table 1 below.

CLOSURE OUTCOME	COMPLETION CRITERIA	MEASUREMENT TOOL	CORRECTIVE ACTIONS	TIMING
Exclusion of grazing stock and feral animals to secure revegetation success	Erection of suitable perimeter fence to be installed and provide an effective barrier to prevent or reduce impacts to revegetation area	Observed installation and maintenance of perimeter fence	Maintain fence	Q2 2022
Overstorey vegetation is self- sustaining and suitable for future use by three species of Black Cockatoos and Western Ringtail Possums.	Within 5 years a total surviving tree count of 250 overstorey woodland species (comprising at least 100 Marri, 100 Jarrah and 50 Peppermint trees).	Visual inspection (Tree count)	Additional planting of overstorey woodland species using tube stock following yearly review of number of surviving overstorey species	Q1 2026
Understorey composition is similar to the adjacent vegetation community (SWAFCT10b)	Within 5 years: Species richness is at least 50% of adjacent SWAFCT10b richness. Species density is at least 1,000 stems/ha.	Quadrats	Additional planting of tubestock and application of direct seeding to be undertaken following yearly review of species richness and diversity.	Q1 2026
Plants used in rehabilitation to be of local provenance.	The mix of species is comprised of species recruited from direct seeding and species introduced as tube stock grown from seed, cuttings or whole plants salvaged from within 20km of the revegetation site.	Audit of rehabilitation records for sources of plant materials used in rehabilitation.	Purchase or collection of additional local provenance seed of target species	

Table 1. Completion Criteria



Reduced weed cover in comparison to the adjacent vegetation community (SWAFCT10b)	Within 5 years: Weed cover is no greater than 60% of the current weed cover within adjacent SWAFCT10b (currently 80-100%). No Declared weeds are present within the revegetation area.	Quadrats	Weed control methods such as chemical application will be modified as required to achieve the best practice solution. The use of targeted spray applications and adaptive techniques such as weed wipers or rope wick technology will be implemented where required to selectively treat weeds	Q1 2026
Dieback	No dieback is present within the revegetation area at 5 years post establishment.	Dieback survey	Exclusion and signage. Possible phosphite treatment	Q1 2026

5. Maintenance Commitments and Contingency

5.1 Weed Control

5.1.1 Revegetation Site

Fundamental to the success of establishment throughout the revegetation site, seasonal weed control is scheduled for two years post initial implementation. In both zones, careful spot spraying using a combination of glyphosate and selective herbicides at different rates will be utilised. Maintenance weed control will be undertaken seasonally (at a minimum) and more intensely in the early stages after seeding and planting. Once plants have established (after 24 months) they will be able to out compete emerging weed species. From this time only problematic and declared weeds should need control.

5.1.2 McGibbon Track

In the interest of maintaining the occurrence of SWAFCT10b in the adjacent McGibbon Track and potentially enhancing its biodiversity value, bi-annual weed control will be undertaken along the track (as stipulated by DAWE and in consultation with DBCA and the City of Busselton) within the vegetation community designated as "Good" condition. The intention will be to mitigate further weed encroachment while providing the opportunity for remnant vegetation to recover naturally by reducing the weed ground cover.

5.2 Remediation Planting

Infill planting has been incorporated into the works schedule at 20% of the original seedling amount for Winter 2023 and 10% of the original seedling amount for Winter 2024 (see Appendix, Table 1). These events are designed to enhance stem density whilst increasing species richness and will be dependent on monitoring observations.

5.3 Other Maintenance Actions

Further management actions that will require consideration include the identification and remediation associated with damage caused by pests (e.g. grasshoppers, weevils, rabbits, etc.) and the inspection and maintenance of the revegetation perimeter fencing.



6. References

City of Busselton (2015). Local Planning Scheme 21, Map Sheet No. 4 Yoganup. City of Busselton, Western Australia

Ecoedge (2020a). Appendix 4A Level 1 Flora and Revegetation Survey. Report to Doral Mineral Sands

Ecoedge (2020b). Appendix 4D Groundwater Dependent Ecosystems Assessment. Report to Doral Mineral Sands

Environmental Protection Authority of WA (2016). Technical guidance Flora and Vegetation Surveys for Environmental Impact. EPA. Perth, Western Australia

Tille, P. J. and Lantzke, N. C. (1990). Busselton Margaret River Augusta Land Capability Study. Land Resources Series No. 5. Department of Agriculture. Perth, Western Australia

Department of Water and Environmental Regulation (2018). A Guide to Preparing Revegetation Plans for Clearing Permits. DWER. Perth, Western Australia



7. Appendix

Table 2. Indicative Target Species List



Doral Yalyalup McGibbon Track TEC Extension Indicative Species List

Species	Direct seed or plant	Propagation method	Suggested nursery
Acacia applanata	Plant	seed	Nuts about Natives
Acacia extensa	Seed	seed/broadcast	Geographe or Boyanup
Acacia pulchella	Seed	seed/broadcast	Geographe or Boyanup
Acacia saligna	Seed	seed/broadcast	Geographe or Boyanup
Adenanthos meisneri	Plant	cuttings	Nuts about Natives
Agonis flexuosa	Seed/Plant	seed/broadcast	Geographe or Boyanup
Agrostocrinum scabrum	Plant	Seed	Nuts about Natives
Astartea scoparia	Seed	broadcast	n/a
Banksia attentuata	Seed/Plant	seed	Geographe or Boyanup
Banksia grandis	Seed/Plant	seed	Geographe or Boyanup
Banksia littoralis	Plant	seed	Geographe or Boyanup
Banksia squarrosa subsp. argillacea (DRF)	Plant	seed	Nuts about Natives
Callistachys lanceolata	Plant	seed	Geographe or Boyanup
Calothamnus quadrifidus subsp. teretifolia (P4)	Seed	broadcast	
Corymbia calophylla	Seed/Plant	seed	Geographe or Boyanup
Daviesii preissii	Plant	seed	Nuts about Natives
Eucalyptus marginata	Seed/Plant	seed/broadcast	Geographe or Boyanup
Eucalyptus rudis	Seed/Plant	seed/broadcast	Geographe or Boyanup
Haemodorum spicatum	Plant	seed	Nuts about Natives
Hakea ceratophylla	Plant	seed	Nuts about Natives
Hakea lissocarpa	Plant	seed	Nuts about Natives
Hakea prostrata	Plant	seed	Nuts about Natives
Hakea varia	Plant	seed	Nuts about Natives
Hypocalymma angustifolium	Seed/Plant	seed/broadcast	Nuts about Natives
Hypocalym ma robustum	Plant	seed	Nuts about Natives
Jacksonia furcellata	Plant	seed	Geographe or Boyanup
Juncus pallidus	Seed	broadcast	n/a
Kennedia cocciniea	Seed	seed	Geographe or Boyanup
Kunzea micrantha	Plant	seed	Nuts about Natives
Loxycarya magna (P3)	Plant	seed	Nuts about Natives
Melaleuca incana	Seed	broadcast	n/a
Melaleuca osullivanii	Seed	broadcast	n/a
Melaleuca preisiana	Seed/Plant	seed/broadcast	Geographe or Boyanup
Melaleuca raphiopylla	Seed/Plant	seed/broadcast	Geographe or Boyanup
Melaleuca viminea	Seed	broadcast	n/a
Nuytsia floribunda	Plant	seed	Nuts about Natives
Patersonia occidentalis	Seed	broadcast	n/a
Patersonia umbrosa	Plant	seed	Nuts about Natives
Persoonia elliptica	Plant	seed	Nuts about Natives
Pericalymma ellipticum	Plant	seed	Nuts about Natives
Regelia ciliata	Seed/Plant	seed/broadcast	Geographe or Boyanup
Verticordia plumosa var. vassensis (DRF)	Plant	seed	Nuts about Natives
Viminaria juncea	Seed	broadcast	n/a
Xanthorrhoea preissii	Plant	seed	Nuts about Natives
Xylomelum occidentalis	Plant	seed	Geographe or Boyanup



Table 3. Proposed Schedule of Works

	Item	Timimg	Responsibility	Comments
1.0	Completion Criteria			
1.1	Reference site quadrat establishment	Spring 2021	Revegetation Consultant	
1.2	Confirmation of completion criteria	Spring 2021	Revegetation Consultant	
2.0	Native seed collection			
2.1	Field collections	Summer 20/21/22	Revegetation Consultant	
2.2	Seed cleaning	Summer 20/21/22	Revegetation Consultant	
2.3	Cutting material collections	Spring 2021	Revegetation Consultant	
3.0	Site Preparation			
3.1	Fencing	2021	Doral	
3.2	Weed control - Autumn	Autumn 2021	Revegetation Consultant	
3.3	Weed control - Spring	Spring 2021	Revegetation Consultant	
3.4	Weed control - Summer	Summer 2021/22	Revegetation Consultant	If required
3.2	Weed control - Autumn	Autumn 2022	Revegetation Consultant	Potentially 2 events pre and post ripping
3.3	Site ripping/furrowing	Autumn 2022	Doral/Reveg Contractors	
3.4	Rabbit baiting/burrow fumigation	Autumn 2022	Pest Mgt Contractors	
4.0	Vegetation Establishment			
4.1	Seed preparation for nursery propagation	Spring/Summer 2021/22	Revegetation Consultant	Withdraw and deliver seed to nursery
4.2	Tubestock orders to nursery (if applicable)	Spring/Summer 2021/22	Revegetation Consultant	
4.1	Seed preparation for direct seeding	Autumn 2022	Revegetation Consultant	Pre-treatments and batching
4.2	Plant tubestock and direct seed broadcasting	late Winter 2022	Revegetation Consultant	
5.0	Revegetation Monitoring			
5.1	Site quadrat establishment	late Spring 2022	Revegetation Consultant	
5.2	Monitoring Spring 2022	late Spring 2022	Revegetation Consultant	
5.3	Monitoring Report Spring 2022	late Spring 2022	Revegetation Consultant	
5.4	Monitoring Autumn 2023	Autumn 2023	Revegetation Consultant	
5.5	Monitoring Report Autumn 2023	Autumn 2023	Revegetation Consultant	
5.6	Monitoring Spring 2023	Spring 2023	Revegetation Consultant	
5.7	Monitoring Report Spring 2023	Spring 2023	Revegetation Consultant	
5.8	Monitoring Autumn 2024	Autumn 2024	Revegetation Consultant	
5.9	Monitoring Report Autumn 2024	Autumn 2024	Revegetation Consultant	
5.10	Monitoring Spring 2024	Spring 2024	Revegetation Consultant	
5.11	Monitoring Report Spring 2024	Spring 2024	Revegetation Consultant	
6.0	Maintenance and Contingency			
6.1	Maintenance weed control	Spring 2022	Revegetation Consultant	
6.2	Maintenance weed control	Summer 2022/23	Revegetation Consultant	If required as the revegetation is establishing
6.3	Maintenance weed control	Autumn 2023	Revegetation Consultant	
6.4	Remedial infill planting	late Winter 2023	Revegetation Consultant	20 % of original seedling amount
6.5	Maintenance weed control	Spring 2023	Revegetation Consultant	
6.6	Maintenance weed control	Autumn 2024	Revegetation Consultant	
6.4	Remedial infill planting	late Winter 2024	Revegetation Consultant	10 % of original seedling amount
6.7	Maintenance weed control	Spring 2024	Revegetation Consultant	