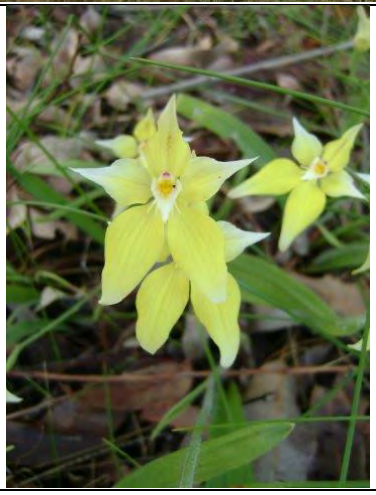
Doral Mineral Sands Pty Ltd

Dardanup Mine Closure Plan

(including the Dardanup Mine, Burekup Western Extension and the Dardanup Southern Extension*)

Mining Leases M70/643*, M70/652, M70/675, M70/720, M70/748 and M70/893*.

DMP-EMP-6.3
Version 8
25 June 2019



Nominated Contact:

Craig Bovell

OSH&E Superintendent

Phone: 08 9725 5444

Email: craig.bovell@doral.com.au

* Denotes tenements of which mining activity land is Minerals to Owner and not subject to the Mining Act 1978.

RECORD OF DISTRIBUTION

No. of copies	Report File Name	Report Status	Date	Prepared for:
1	DMP-EMP-6.3 Dardanup Mine Closure Plan V8 – March 2019	Final	25/6/2019	Department of Mines, Industry Regulation and Safety (DMIRS) (Uploaded to EARS)
1	DMP-EMP-6.3 Dardanup Mine Closure Plan V8 – March 2019	Final	25/6/2019	Department of Water and Environmental Regulation (DWER)
1	DMP-EMP-6.3 Dardanup Mine Closure Plan V8 – March 2019	Final	25/6/2019	Department of the Environment and Energy (DEE)

MINE CLOSURE PLAN CHECKLIST

Please cross reference page numbers from the Mine Closure Plan where appropriate, and provide comments or reasons for No (N) or Not Applicable (NA) answers. For Mine Closure Plan revisions please indicate where updates have been made to the previous revision and a brief summary of the change.

Q No.	MCP CHECKLIST	Y/N/NA	PAGE NO.	COMMENTS	CHANGE FROM PREVIOUS VERSION (Y/N)	PAGE NO.	SUMMARY
1	Has the checklist been endorsed by a senior representative within the tenement holder / operating company?	Y	v	Document signed by Doral Mineral Sands, General Manager	N		
Public Availability							
2	Are you aware that from 2015 all MCPs will be made publicly available?	Y		N/A			
3	Is there any information in this MCP that should not be publicly available?	Y	84, 85	Section 11.1 and 11.2			
4	If "Yes" to Q3, has confidential information been submitted in a separate document / section?	Y		Separate document			
Cover Page, Table of Contents							
5	Does the MCP cover page include: • Project title • Company name • Contact details (including telephone	Y	Cover page		Y	Cover page	Doc ID and Version updated Date updated

Q No.	MCP CHECKLIST	Y/N/NA	PAGE NO.	COMMENTS	CHANGE FROM PREVIOUS VERSION (Y/N)	PAGE NO.	SUMMARY
	numbers and email address) • Document ID and version number • Date of submission (needs to match the date of this checklist)						
Scope and Purpose							
6	State why the MCP is submitted (e.g. as part of a Mining Proposal, a reviewed MCP or to fulfil other legal requirements)	Y	1	Tenement conditions	N	1	
Project Overview							
7	Does the project summary include: • Land ownership details (include any land management agency responsible for the land / reserve and the purpose for which the land / reserve [including surrounding land] is being managed) • Location of the project • Comprehensive site plan(s)	Y Y Y	2 2	Section 2.2 Section 2.1 Figure 2-3	N N N	2 2 4	Section 2.1 Figure 2-3

Q No.	MCP CHECKLIST	Y/N/NA	PAGE NO.	COMMENTS	CHANGE FROM PREVIOUS VERSION (Y/N)	PAGE NO.	SUMMARY
	• Background information on the status of the project	Y	2	Section 2.1 to 2.3	N	2	Section 2.1 to 2.3
Legal Obligations and Commitments							
8	Does the MCP include a consolidated summary or register of closure obligations and commitments?	Y	8	Section 3	N	8	Section 3
Stakeholder Engagement							
9	Have all stakeholders involved in closure been identified?	Y	20	Section 3	N	59	Section 5
10	Does the MCP include a summary or register of historic stakeholder engagement with details on who has been consulted and the outcomes?	Y	22	Table 4-1	Y	61	Table 5-1
11	Does the MCP include a stakeholder consultation strategy to be implemented in the future?	Y	21	Section 4	N	60	Section 5
Post-Mining Land Use(s) and Closure Objectives							
12	Does the MCP include agreed post-mining land use(s), closure objectives and	Y	28	Section 5	N	67	Section 6

Q No.	MCP CHECKLIST	Y/N/NA	PAGE NO.	COMMENTS	CHANGE FROM PREVIOUS VERSION (Y/N)	PAGE NO.	SUMMARY
	conceptual landform design diagram?						
13	Does the MCP identify all potential (or pre-existing) environmental legacies, which may restrict the post mining land use (including contaminated sites)?	NA		No pre-existing environmental legacies	N		No pre-existing environmental legacies
14	Has any soil or groundwater contamination that occurred, or is suspected to have occurred, during the operation of the mine, been reported to DER as required under the *Contaminated Sites Act 2003*?	Y	67, 70	Lot 3551 on Plan 202219 and Lot 105 on Plan 32063 were classified under the CS Act 2003 on 6/7/17 as *"Possibly contaminated – investigation required."* Sections 8.2.9 and 8.2.15	Y	75	
Development of Completion Criteria							
15	Does the MCP include an appropriate set of specific completion criteria and closure performance indicators?	Y	30	Section 6	N	80	Section 8
Collection and Analysis of Closure Data							
16	Does the MCP include baseline data (including pre-mining studies and	Y	33	Section 7	Y	57	Section 4.15 Closure Data Gaps

Q No.	MCP CHECKLIST	Y/N/NA	PAGE NO.	COMMENTS	CHANGE FROM PREVIOUS VERSION (Y/N)	PAGE NO.	SUMMARY
	environmental data)?						
17	Has materials characterisation been carried out consistent with applicable standards and guidelines (e.g. GARD Guide)?	Y	33	Section 7.3	N	20	Section 4.3
18	Does the MCP identify applicable closure learnings from benchmarking against other comparable mine sites?	N		All rehabilitation completed. Submission of document to relinquish all tenements is scheduled for Q2/Q3 in 2019	N		
19	Does the MCP identify all key issues impacting mine closure objectives and outcomes (including potential contamination impacts)?	Y	62	Section 8	N	70	Section 7
20	Does the MCP include information relevant to mine closure for each domain or feature?	Y	73	Section 9	N	85	Section 10
Identification and Management of Closure							
21	Does the MCP include a gap / risk assessment to determine if further information is required in relation	Y	62	Section 8	N	70	Section 7

Q No.	MCP CHECKLIST	Y/N/NA	PAGE NO.	COMMENTS	CHANGE FROM PREVIOUS VERSION (Y/N)	PAGE NO.	SUMMARY
	to closure of each domain or feature?						
22	Does the MCP include the process, methodology and has rationale been provided to justify identification and management of the issues?	Y	62	Section 8	N	70	Section 7
Closure Implementation							
23	Does the MCP include a summary of closure implementation strategies and activities for the proposed operations or for the whole site?	Y	73	Section 9.1	N		Section 10.1
24	Does the MCP include a closure work program for each domain or feature?	Y	73	Section 9			
25	Does the MCP contain site layout plans to clearly show each type of disturbance as defined in Schedule 1 of the MRF Regulations?	Y		Figure 2-4	Y	Figure 2-4	
26	Does the MCP contain a schedule of research and trial activities?	N		All rehabilitation completed. Submission of document to relinquish all tenements is	N		No trials were conducted or planned in previous version of MCP.

Q No.	MCP CHECKLIST	Y/N/NA	PAGE NO.	COMMENTS	CHANGE FROM PREVIOUS VERSION (Y/N)	PAGE NO.	SUMMARY
				scheduled for Q2/Q3 in 2019.			
27	Does the MCP contain a schedule of progressive rehabilitation activities?	N		All rehabilitation completed. Submission of document to relinquish all tenements is scheduled for Q2/Q3 in 2019.	Y	95	Section 10.7
28	Does the MCP include details of how unexpected closure and care and maintenance will be handled?	Y	79	Mining ceased on 23 December 2015. All rehabilitation has been completed. Submission of document to relinquish all tenements is scheduled for Q3 in 2019.	N	97	Section 10.8
29	Does the MCP contain a schedule of decommissioning activities?	Y	App F	All infrastructure has been decommissioned and removed from site. Appendix F contains the Dardanup Mine Decommissioning Plan.	N	App G	
30	Does the MCP contain a schedule of closure performance monitoring and maintenance activities?	Y	80	Section 10	N	98	Section 11
Closure Monitoring and Maintenance							

Q No.	MCP CHECKLIST	Y/N/NA	PAGE NO.	COMMENTS	CHANGE FROM PREVIOUS VERSION (Y/N)	PAGE NO.	SUMMARY
31	Does the MCP contain a framework, including methodology, quality control and remedial strategy for closure performance monitoring including post-closure monitoring and maintenance?	Y	80	Section 10	N	98	Section 11
Financial Provisioning for Closure							
32	Does the MCP include costing methodology, assumptions and financial provision to resource closure implementation and monitoring?	Y	84	Section 11	N	83	Section 9
33	Does the MCP include a process for regular review of the financial provision?	Y	84	Section 11	N	83	Section 9
Management of Information and Data							
34	Does the MCP contain a description of management strategies including systems and processes for the retention of mine records?	Y	87	Section 12	N	101	Section 12

Corporate Endorsement:

"I hereby certify that to the best of my knowledge, the information within this Mine Closure Plan and checklist is true and correct and addresses all the requirements of the Guidelines for Preparing Mine Closure Plans approved by the Director General of Mines.

Name: A Tomlinson Signed:

Position: General Manager Date: 28/6/19

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TABLES

PLATES

FIGURES

ABBREVIATIONS

ASS	Acid Sulfate Soil
ASSMP	Acid Sulfate Soil Management Plan
bcm	Bank cubic metre
Bq/g	Becquerel per gram
CCW	Conservation Category Wetland
CER	Consultative Environmental Review
DWER	Department of Water and Environmental Regulation (formerly DER, DoW and OEPA)
DoEE	Department of the Environment and Energy (formerly SEWPaC, DoE)
DMIRS	Department of Mines, Industry Regulation and Safety (formerly DMP)
DMS	Doral Mineral Sands
EMP	Environmental Management Plan
EC	Electrical Conductivity
EPS	Environmental Protection Statement
GDE	Groundwater Dependant Ecosystem
mAHD	(Meters) Australian Height Datum
mBGL	Meters Below Ground Level
Mya	Million Years Ago
PASS	Potential Acid Sulfate Soil
REW	Resource Enhancement Wetland
SEP	Solar Evaporation Pond
SMU	Soil Management Unit
TDS	Total Dissolved Solids
TEC	Threatened Ecological Community
tpa	Tonnes per annum
µGy/h	One microgray per hour

1. SCOPE AND PURPOSE

This Mine Closure Plan (MCP) describes Doral Mineral Sands Pty Ltd (Doral's) retrospective plans for closing the Dardanup Mine operation, decommissioning mining infrastructure, rehabilitating the land and releasing the area for future use.

It is expected that this will be the final version of this Mine Closure Plan and is pending the relinquishment of the Site and the Mining Tenements.

1.1. PURPOSE OF THIS DOCUMENT

This document, the Dardanup Mine Closure Plan (MCP), has been prepared to meet Conditions 38, 25, 36 and 25 of Mining Leases 70/652, 70/675, 70/720 and 70/784 respectively and to partially meet the requirements of Condition 8 of EPBC Act Referral 2011/6087 approval decision. It has been structured and prepared to meet the requirements of the Environmental Protection Authority (EPA) and Department of Mines and Petroleum's (now DMIRS) *Guidelines for Preparing Mine Closure Plans, May 2015* (the Guidelines).

1.2. SCOPE OF THIS DOCUMENT

The Dardanup Mine, as referred to within this document, includes the Burekup Western Extension and the Dardanup Southern Extension. The scope of activities which are addressed by this Plan have been subject to approval under the requirements of the *Environmental Protection Act 1986* and are covered by Ministerial Statements 484 and 789.

The Dardanup Mine operates on the following mining tenements which provide tenure to the operations under the Mining Act 1978:

- M70/652.
- M70/675;
- M70/748;
- M70/720.

The Dardanup Mine also operates on the following mining tenements, however the land on which the mine operates has been formally confirmed by DMIRS as being pre-Torrens and therefore classified as Minerals to Owner and not legislated under the *Mining Act 1978*. Therefore, the land for which the mine operates under the following tenements operate under an Extractive Licence as granted by the Shire of Dardanup.

- M70/643;
- M70/893.

For the purposes of this MCP, all tenements have been incorporated to maintain a consistent and transparent approach to the closure of the operations.

A description of the activities undertaken on these mining tenements and within the scope of the environmental approval for the Project is contained within Section 2.

This MCP does not include closure of the Picton Dry Separation Plant.

2. PROJECT OVERVIEW

2.1. PROJECT LOCATION AND OWNERSHIP

The Dardanup Mine (the Mine) comprises:

i) Dardanup Mine, located on mining tenements M70/675 and M70/748;

ii) Burekup Western Extension to the Dardanup Mine, located on mining tenements M70/652 and M70/720;

iii) Dardanup Southern Extension, minerals to owner lots located on mining tenements M70/643 and M70/893.

The Mine is situated approximately 20km east of the coastal city of Bunbury in the South West Region of Western Australia, as shown on Figure 2-1.

The mine is owned and operated by Doral Mineral Sands Pty Ltd (Doral). Doral is a wholly owned subsidiary of Perth-based Doral Pty Ltd, which itself is an unlisted public company owned by Iwatani International Corporation of Japan.

Mining operations commenced in mid-2002 based on continuous (24 hours a day) open cut mining. The first zircon shipment to customers in India and China left through the Port of Fremantle in August 2002. The first ilmenite shipment left from Bunbury Port the following month. Doral produces (and exports) about 150,000 tonnes per annum (tpa) of ilmenite, 3,000tpa leucoxene and 12,000tpa zircon.

2.2. LAND OWNERSHIP

The majority of the land utilised for the Dardanup Mine is owned by either Doral Pty Ltd or Iluka Resources (Figure 2-2). In the situations where Doral requires access to private land an individual land access agreement is negotiated with the land owner. In some situations, Doral has acquired the land and the previous owner has first option to purchase the land once mining and rehabilitation is completed.

2.3. MINE HISTORY

Mining of the Dardanup Mineral Sands Deposit commenced in June 2002 on M70/675 and M70/748. The Mine has been subject to a number of extensions to both the footprint required for solar evaporation ponds and for mining areas as more deposits became available for Doral to mine. Doral ceased mining operations in December 2015 and have rehabilitated the Site in accordance with this MCP. Doral's intent is to commence relinquishing mining tenements in 2019.

A detailed history of the approvals and development of the Mine is provided within Table 2-1.

Table 2-1: Project Approvals History

Date	Approvals History
Jun 1991	The proposed mining project was referred to the EPA by ISK Minerals Pty Ltd via the 'The Dardanup Mineral Sands Project - Consultative Environmental Review' (CER). This document was also submitted to the DOIR and is known as Notice of Intent 761.
Apr 1992	The CER was approved by the Minister for the Environment subject to the Conditions of Ministerial Statement No.239.
Aug 1998	The Minister for the Environment extended the project commencement date to August 2000, and then August 2003, subject to Ministerial Statement No.484. The delay in project commencement was due to a

Date	Approvals History
	recession in world titanium mineral markets. Recommendations of the Section 46 Report to extend the project commencement date to August 2000 were published in EPA Bulletin 898 (June 1998). Approval to extend the project commencement date to August 2003 was provided by the Minister for the Environment in a letter dated 31 October 2000.
Jun 2001	The EPA was informed of the agreement between ISK and Doral Mineral Sands Pty Ltd. Doral was formerly nominated as the proponent under Section 38(7) of the *Environmental Protection Act (1986)*.
Sep 2001	The PEASD (GHD, 2001) was submitted to the regulatory authorities to: • Meet the requirements of Ministerial Statement No.484; • Obtain clearance under Part V of the *Environmental Protection Act (1986)* through submission of a Works Approval (No.3521); and • Gain approval from the State Mining Engineer under the *Mining Act (1978)* on the basis of a Notice of Intent. This Notice of Intent (No.3807) consisted of a table cross-referenced to the relevant sections of the PEASD report.
Sep 2001	The Picton Dry Separation Plant commenced operations under DEP Licence 7712/1 for the processing of 50,000 tonnes of ore per annum sourced from an external supplier.
Dec 2001	The Dardanup Mineral Sands Project Slimes Storage Paddocks' (also known as Notice of Intent 3894) was prepared by Soil & Rock Engineering to supplement the information provided in the PEASD (GHD, 2001). It provided the design and construction details of the slimes storage facilities.
Jun 2002	The Dardanup Mine was commissioned under DEP Licence 7789/1.
Jul 2002	Upgrades to the Picton Plant were undertaken in accordance with DEP Works Approval 3522. The Licence was amended to incorporate an increase in throughput of 250,000 tpa and to change the source of the ore from an external supplier to heavy mineral concentrate from the Dardanup Mine.
Jan 2004	Approval to construct additional solar evaporation ponds on Wellington Location 3556 was granted under Works Approval 3890 and NOI 4503.
Jul 2004	Approval to mine the northern continuation of the Dardanup Mineral Sands Deposit within tenements M70/748 and M70/675 was granted under NOI 4732 as part of a land purchase from Iluka Resources Ltd within M70/748.
Jan 2005	Approval was granted by DOIR to include Wellington Locations 3563 and 3565 into the grant of Mining Lease 70/748 to a depth of 30m from the natural surface.
Sep 2008	A referral was submitted to the Environmental Protection Authority (EPA) for consideration of a western extension to the Dardanup Mineral Sands Project to include the Western Extension (Burekup) Mineral Sands Deposit. In response to the referral, the EPA advised that the proposal had the potential to be assessed under the expedited assessment process as an Environmental Protection Statement (EPS).
Nov 2008	Settlement of a formal agreement to purchase the mining leases M70/652 and M70/720 (containing the Western Extension (Burekup) Deposit) between Doral and Iluka Resources Limited took place. Access agreements for the land not owned by Doral but pertaining to the western extension were put in place.
Dec 2008	Version 4 of the EPS was submitted to the EPA. The Environment Protection Authority Service Unit compiled Report and Recommendations 1310 and put the proposal on the agenda for the final meeting of the EPA Board on 12 December 2008. The EPA Board recommended that the EPS be made available for public review over a two week period from 5 January to 19 January 2009. Ministerial Statement No.789 was granted in March 2009 to allow the western extension to proceed.
Dec 2008	A referral for a proposed action for the western extension to the Dardanup Mine (referral number 2008/4673) was made to the Department of Environment, Water, Heritage and the Arts DEWHA) under the *Environment Protection Biodiversity Conservation Act 1999.* DEWHA assessed the referral as not a controlled action under the Act.
Dec 2009	A change to the Burekup West mine disturbance footprint area was requested under Section 45C of the *Environmental Protection Act (1986).* This was approved by the EPA in July 2010 as Attachment 1 to Ministerial Statement 789.

Date	Approvals History
Mar 2010	A further change to the northern extent of the Burekup West mine disturbance footprint area was requested under Section 45C of the *Environmental Protection Act (1986).* This was approved by the EPA in July 2011 as Attachment 2 to Ministerial Statement 789.
Aug 2010	Doral received DEC Licencing Branch acknowledgement of a change in the nominal throughput of the Picton Dry Separation Plant from 250,000 to 350,000 tpa of heavy mineral concentrate.
Aug 2011	A referral for a proposed action for the southern extension to the Dardanup Mine (referral number 2011/6087) was made to the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) under the *Environment Protection Biodiversity Conservation Act 1999.* In September 2011 SEWPaC advised that the project is a controlled action under the Act and would be subject to assessment by preliminary documentation. In May 2012 Doral made the preliminary documentation available for public comment.
Aug 2011	A referral was submitted to the Office of the Environmental Protection Authority (OEPA) for consideration of a southern extension to the Dardanup Mineral Sands Project. In response to the referral, the OEPA advised that the proposal had the potential to be assessed under Section 45C of the *Environmental Protection Act (1986)*.
May 2012	The Section 45C Request for a Southern Extension to the Dardanup Mineral Sands Project was submitted to the OEPA.
July 2012	SEWPaC approved the Dardanup Southern Extension with conditions.
August 2012	EPA approved the Dardanup Southern Extension as Attachment 3 to Ministerial Statement 484
February 2013	The Department of Environment and Conservation (DEC) issued an amended operational licence to the Doral Dardanup Mine on the 1st February 2013 to incorporate the Southern Extension to the Dardanup Mine.
May 2013	A referral for the proposed inclusion of the Waterloo Block into the Dardanup Southern Extension (EPBC 2013/6879) was submitted to the Department of the Environment (DotE, formerly SEWPaC) on 27th May 2013 and was confirmed as a controlled action on 28th June. The referral was published for public comment on 12th September 2013.
June 2013	The Section 45C Request for the inclusion of the Waterloo Block into the Southern Extension of the Dardanup Mine was submitted to the OEPA on 11 June 2013.
August 2013	The request for an Extractive Industries Licence for the inclusion of the Lot 110 Waterloo Block into the Southern Extension of the Dardanup Mine was submitted to the Shire of Dardanup on the 2nd August 2013 and was passed by Council on the 25th September. The Extractive Industries Licence was granted on 1st October 2013.
December 2013	The OEPA approved the Waterloo Block inclusion to the Southern Extension of the Dardanup Mine as Attachment 4 to Ministerial Statement 484 on 20th December 2013.
December 2013	The Department of the Environment approved the inclusion of the Waterloo Block into the Dardanup Southern Extension with conditions on 23rd December 2013
January 2014	The Department of Environment Regulation (formerly DEC) issued an amended operational licence to the Doral Dardanup Mine on the 23rd January 2014 to include the Waterloo Block.
December 2014	Notification to OEPA, DER, DMP of a proposed non-substantial change to mining operations at Dardanup to allow for the excavation of ore beneath solar evaporation ponds on Lot 3556, M70/675
January 2015	Confirmation by the OEPA that no further assessment required by the OEPA
January 2015	Confirmation by the DER that a works approval is not required
March 2015	Approval granted by DMP of the submitted Mining Proposal for the Proposal To Conduct Mining Beneath Solar Evaporation Ponds On M70/675

2.4. MINE OPERATIONS OVERVIEW

Mining of the Dardanup Mineral Sands Deposit produces Heavy Mineral Concentrate (HMC), which is hauled by truck to the Picton Dry Separation Plant, located 10km to the west of the mine, for separation using magnetic processes. The Picton Dry Separation Plant has a licence to process 350,000tpa of HMC sourced from both the Dardanup Mine and external suppliers. Ilmenite, leucoxene and zircon product is hauled by truck to either the Bunbury Port or Fremantle Port for export.

Ore is mined progressively via a series of open-cut pits using dry mining techniques. Dewatering of groundwater inflows into the pit is required to enable dry mining to occur. Mining utilises a conventional mining fleet which includes excavators, dump trucks and bulldozers.

Ore is fed directly by front end loader to an ore feed hopper at the feed preparation plant consisting of a double deck screen and scrubber. Oversize material greater than 3.0 millimetres (mm) is removed through the feed preparation plant.

From the feed preparation plant, the ore is transported via pumps and pipelines to the wet concentrator, where the process requires all particles >2.4mm to be removed from the ore. The wet concentrator operates at a nominal throughput rate of 300t per hour.

Clay tails are pumped to solar evaporation ponds (SEPs) located to allow settlement and drying. Dried clay tails are then removed from the ponds (during the dry months) and placed in-pit. The co-disposal of clay tails with the sand tails into pit voids is also conducted.

The following standard design and operating practices for the management of SEPs have been implemented over the life of the project in order to maintain the structural integrity of the embankment walls and to prevent over topping:

- All SEP floors are constructed to design slope using laser levels prior to pouring. The SEP floors are designed with a slope of 1:300 or 1:400 to assist with even and homogenous fills and the prevention of free water pools unable to flow to the weir box;
- SEP wall height must be at least 2.5m above the floor for clay and overburden structures and at least 3.0m above the floor for tailing sand structures;
- SEPs constructed with dry clay material or overburden is track rolled using a D7 dozer. The angle of repose for the outer pond wall is 1.0 vertical:1.5 horizontal;
- Only light vehicles have access to standard pond walls following construction. If SEP walls are to be modified as haul roads the running width must be at least 6.5m for one-way traffic and 14m for two-way traffic.

Process water is sourced from in-pit drainage, captured rainfall in winter and from the Harvey Water irrigation channel in summer. The Mine and processing plants operate as a closed water system however it has one licenced and two emergency discharge points for surface water management during the winter months.

Support infrastructure includes internal haul roads, office and amenity facilities, maintenance infrastructure, an overland conveyor, access roads, power lines and pipeline infrastructure.

Mine voids are backfilled with overburden, sand and clay tails. Following backfill, the areas are rehabilitated to a landform and land use similar to the surroundings and in consultation with landowner requirements.

A mine layout plan showing the historic disturbance types for the Mine is provided in Figure 2-3 which shows the following key areas:

- Project area;
- Cadastral boundaries;
- Tenement boundaries;
- Office/main infrastructure areas;
- Disturbance areas including mine pits and solar evaporation ponds.

Figure 2-4 shows the current site layout plan as defined in Schedule 1 of the MRF Regulations. All land at the mine has been assessed as being within the "Land Under Rehabilitation" category, given the Site has been rehabilitated to back to the agreed end landuse. Submission of a relinquishment document to DMIRS to relinquishment the tenements is proposed for Q3 2019.

2.4.1. GROUND DISTURBANCE

A total of 770.30ha has been disturbed at the Dardanup Mine (since mining commenced in 2002) with all 770.30ha of land rehabilitated, as of the end of 2018. A summary of disturbance and rehabilitation is provided in Table 2-2.

Table 2-2: Area Disturbed and Rehabilitated

Tenement	Disturbance Type	Total Disturbance (ha)	Total Rehabilitation				Rehabilitation Stage verified by DMIRS (Y/N)
			1	2	Relinquished	Total	
M70/748	Pit	92.68		92.68		92.68	No
	Permanent SEP	22		22		22	No
	Mine Infrastructure	0.81		0.81		0.81	No
	M70/748 TOTAL	**115.49**	**0**	**115.49**	**0**	**115.49**	
M70/675	Pit	194.62		194.62		194.62	No
	Permanent SEP	105.07		105.07		105.07	No
	Mine Infrastructure	87.94		87.94		87.94	No
	Temporary SEP/Backfill	6.6		6.6		6.6	No
	M70/675 TOTAL	**394.23**	**0**	**394.23**	**0**	**394.23**	
M70/652	Pit	68.74		68.74		68.74	No
	Mine Infrastructure	26.24		26.24		26.24	No
	Temporary SEP/Backfill	0		0		0	No
	M70/652 TOTAL	**94.98**	**0**	**94.98**	**0**	**94.98**	
M70/720	Pit	91.76		91.76		91.76	No
	Mine Infrastructure	25.59		25.59		25.59	No
	Temporary SEP/Backfill	0.49		0.49		0.49	No
	M70/720 TOTAL	**117.84**	**0**	**117.84**	**0**	**117.84**	
M70/643	Pit	16.56		16.56		16.56	N/A
	Mine Infrastructure	5.84		5.84		5.84	N/A
	Temporary SEP/Backfill	0		0		0	N/A
	M70/643 TOTAL	**22.4**	**0**	**22.4**	**0**	**22.4**	
M70/893	Pit	19.12		19.12		19.12	N/A
	Mine Infrastructure	6.24		6.24		6.24	N/A
	Temporary SEP/Backfill	0		0		0	N/A
	M70/893 TOTAL	**25.36**	**0**	**25.36**	**0**	**25.36**	
All	**TOTAL**	**770.3**	**0**	**770.3**	**0**	**770.3**	

3. IDENTIFICATION OF CLOSURE OBLIGATIONS AND COMMITMENTS

Mine closure is subject to the requirements that arise from State and Commonwealth legislation, mining tenement conditions, commitments made in Mining Proposals, commitments made in environmental approval application documents, conditions on environmental approvals (such as Ministerial Statements, pollution licences and clearing permits) and any other commitments given to external stakeholders. The closure requirements for the Dardanup Mine are identified in the following sections.

3.1. LEGISLATIVE REQUIREMENTS

Doral has identified a number of general legislative obligations relevant to closure of the Dardanup Mine which are presented in Table 3-1.

Table 3-1: State Legislation Closure Obligations

Legislation and reference	Section Reference	Requirement Relevant to Closure
Aboriginal Heritage Act 1978.	Part IV	Heritage sites are not to be altered, excavated, damaged, concealed or any portion of the site removed in anyway, unless granted via Section 16 or 18 under the Aboriginal Heritage Act 1978.
Agriculture and Related Resources Protection Act 1976	Part V, Division IV (47)	The occupier of any private land shall control declared plants and declared animals on and in relation to that land.
Contaminated Sites Act 2003. *Contaminated Sites Regulations 2006.*	Part I, Section 11 Part II (6)	The proponent or individuals are to report known or suspected areas of contaminated sites.
Contaminated Sites Act 2003.	Part III, (23)	Sites classified as Contaminated - Remediation Required as described under the Contaminated Sites Act 2003 are to be remediated.
Environmental Protection (Controlled Waste) Regulations 2004		Disposal of asbestos is to be separated, wrapped and labelled and disposed in accordance with Part III,(6)(44)
Environmental Protection (Controlled Waste) Regulations 2004		The proponent is to treat all products listed in schedule 1 of the Environmental Protection (Controlled Waste) Regulations 2004 as a controlled waste.
Environmental Protection Act 1986.	Part V, (49)	Proponent shall not cause pollution or an unreasonable emission of noise, odour or electromagnetic radiation.
Environmental Protection Act 1986.	Part V, (51)	The proponent shall not clear native vegetation without the relevant approval (e.g. clearing permit) in place.
Health Act 1911.	Part IV (2) (87)	The proponent shall ensure (stagnant) pools, ponds, open ditches, and drains do not become offensive to the public or allow these areas to become prejudicial to human health.
Health Act 1911. *Environmental Protection (Controlled Waste) Regulations 2004.*	Part IV (3) (95) Part III	Removal of sewerage systems is to be conducted in accordance with Local Government Law and by a licensed contractor in accordance with the Environmental Protection (Controlled Waste) Regulations 2004.

Legislation and reference	Section Reference	Requirement Relevant to Closure
Mines Safety and Inspection Regulations 1995.	Part III, (2)(3.11)	Notification of suspension of mining operations must be in writing and include the requirements specified in Section 3.14 of the regulations.
Mines Safety and Inspection Regulations 1995.	Part III, (2)(3.16)	At notification of abandonment the proponent is required to notify the department how the following has been achieved: • Secure the site against inadvertent public access. • Prevent and mitigate mine subsidence. • Plant and equipment removed or secured and left in a safe condition. • Hazardous substances removed or properly disposed.
Mines Safety and Inspection Regulations 1995.	Part XVI, (2)(16.35)	The proponent shall submit a plan with the notification which shows: (a) the specific locations in which radioactive waste has been buried; and (b) the absorbed dose rates in air one metre above the final surface.
Mines Safety and Inspection Regulations 1995.	Part XVI, (2)(16.35)	After the mine is abandoned, rehabilitation sites are to be inspected and monitored at such intervals and in such a way as is approved by the State mining engineer.
Mines Safety and Inspection Regulations 1995.	Part XIII, (13.8)	The principal employer at, and the manager of, a mine must ensure that geotechnical aspects are adequately considered in relation to the design, operation and abandonment of quarry operations.
Mining Act 1978	Part IV (84AA)	A mine closure plan is required to be approved by the Department and reviewed every 3 years, or as specified by the Department.
Mining Act 1978.	Part III (1)(20)(3a)	Make safe all holes, pits, trenches and other disturbances on the surface of the land which are likely to endanger the safety of any person or animal.
Mining Act 1978.	Part III (1)(20)(3b)	Take all necessary steps to prevent fire and damage to trees or other property.
Mining Regulations 1981.	Part V, (6)(97)	Avoid activity that obstructs any public thoroughfare or undermines any road, railway, dam or building in such manner as to endanger the public safety.
Mining Regulations 1981.	Part V, (6)(98)	The proponent shall not allow detritus, dirt, sludge, refuse, garbage, mine water or pollutant from the tenement to become an inconvenience to the holder of any other mining tenement or to the public, or in any way injure or obstruct any road or thoroughfare or any land used for agricultural purposes.
Soil and Land Conservation Act 1945.	Part V (32)	The proponent shall take adequate precautions to prevent or control soil erosion, salinity or flooding; or the destruction, cutting down or injuring of any tree, shrub, grass or any other plant on land where land degradation is occurring or likely to occur.
Wildlife Conservation Act 1950	(16 and 23F)	A person may not take for any purpose protected fauna or flora without a licence, or rare and endangered flora without the written consent of the Minister.

3.2. MINING TENEMENT CONDITIONS

The Dardanup Mine operates on Mining Tenements M70/652, M70/675, M70/748, M70/720, M70/643*, and M70/893* (*denotes Minerals to Owner). The conditions of each of the tenements legislated by the Mining Act 1978 have been reviewed and the conditions relevant to closure included within Table 3-2.

Table 3-2: Mining Tenement Closure Conditions

Tenement No.	Condition No.	Conditions relevant to Closure
M70/652	28	All topsoil being removed ahead of all mining operations from sites such as pit areas, waste disposal areas, ore stockpile areas, pipeline, haul roads and new access roads and being stockpiled for later re-spreading or immediately as rehabilitation progresses.
M70/675	18	
M70/720	28	
M70/748	18	
M70/675	19	Rehabilitated areas being levelled or gently sloped or made to a design in reasonable keeping with the natural surroundings and being replanted with suitable grass, cereals, shrubs or other suitable vegetation with measures such as fertiliser application and watering being taken to promote growth and, where considered necessary by the District Mining Engineer, brush matting or other suitable cover being provided to prevent sand drift and dust nuisance.
M70/652	29	At completion of operations, all buildings and structures being removed from site or demolished and buried to the satisfaction of the Director, Environment Division, DMP.
M70/720	29	
M70/748	19	
M70/748	21	At the completion of operations or progressively where possible all access roads and other disturbed areas being covered with topsoil, deep ripped and revegetated with local native grasses, shrubs and trees to the satisfaction of the State Mining Engineer and on freehold land, the landholder.
M70/652	31	At the completion of operations, or progressively where possible, all access roads and other disturbed areas being covered with topsoil, deep ripped and re-vegetated with local native grasses, shrubs and trees to the satisfaction of the Director, Environment Division, DMP.
M70/675	21	
M70/720	31	
M70/652	37	On the completion of operations or progressively when possible, all waste dumps, tailings storage facilities, stockpiles or other mining related landforms must be rehabilitation to form safe, stable, non-polluting structures which are integrated with the surrounding landscape and support self-sustaining, functional ecosystems comprising suitable, local provenance species or an alternative agreed outcome to the satisfaction of the Director, Environment Division, DMP.
M70/675	21	
M70/720	39	
M70/748	28	
M70/675	23	The lessee submitting to the Director, Environment Division, DMP, a brief annual report outlining the project operations, minesite environmental management and rehabilitation work undertaken in the previous 12 months and the proposed operations, environmental management plans and rehabilitation programmes for the next 12 months. This report to be submitted each year in: • March.
M70/652	32	
M70/720	32	
M70/748	24	
M70/652	38	A Mine Closure Plan is to be submitted in the Annual Environmental Reporting month specified in tenement conditions in the year specified below, unless otherwise directed by an Environmental Officer, DMP. The Mine Closure Plan is to be prepared in accordance with the "Guidelines for Preparing Mine Closure Plans" available on DMP's website: • 2019.
M70/675	25	
M70/720	36	
M70/748	25	

3.3. MINISTERIAL STATEMENT CONDITIONS

The Dardanup Mine has been formally assessed by the Environmental Protection Authority (EPA) in accordance with the provisions of Part IV of the Environmental Protection Act 1986 on three occasions. Ministerial Statement No. 484 documents the approval to implement the Dardanup Mine subject to a number of conditions and procedures and supersedes and replaces the original Ministerial Statement

Number 239. Ministerial Statement No. 789 documents the approval to implement the Western Extension (inclusive of the Burekup Mineral Sands Deposit) subject to a number of conditions and procedures. The specific conditions from Ministerial Statement 484 and 789 relevant to closure of the Mine are contained within Table 3-3 and Table 3-4 respectively.

Table 3-3: Ministerial Statement 484 Closure Conditions

No.	Conditions Relevant to Closure
4	*Environmental Management Program*
4-1	Prior to commencement of ground-disturbing activities, the proponent shall prepare an Environmental Management Program to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection, the Department of Minerals and Energy, Agriculture Western Australia, the Water and Rivers Commission and the owners of land on which mining takes place. The Program shall include: 1 construction of facilities and stockpiles with consideration given to visual impact on public and private locations; 2 limitation of clearing and land disturbance to that required for safe operation; and 3 consultation with Western Power and relevant landowners to determine the most acceptable means of extending the existing 22 kV agricultural supply transmission line to the mining area, and shall consist of the following environmental management plans: 1 Surface Water and Groundwater Monitoring and Management Plan (see condition 5); 2 Rehabilitation Management Plan (see condition 6); and 3 Decommissioning Management Plan (see condition 7).
4-2	The proponent shall implement the Environmental Management Program required by condition 4-1.
6	*Rehabilitation Management Plan*
6-1	Prior to the commencement of mining, the proponent shall develop a progressive rehabilitation plan, in order to rehabilitate the mine site to an environmentally stable condition, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection, the Department of Minerals and Energy, Agriculture Western Australia, the Water and Rivers Commission and the owners of land on which mining takes place.
6-2	The proponent shall implement the Rehabilitation Management Plan required by condition 6-1. Note: The final land use after mining will be determined between the land owners and the proponent.
7	*Decommissioning Management Plan*
7-1	At least six months prior to decommissioning, the proponent shall prepare a Decommissioning Management Plan to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Department of Minerals and Energy. This Plan shall address: 1 removal or, if appropriate, disposal on-site of plant and infrastructure; 2 rehabilitation of all disturbed areas to agreed final land use(s); and 3 identification of contaminated areas, including provision of evidence of notification to relevant statutory authorities.
7-2	The proponent shall implement the Decommissioning Management Plan required by condition 7-1

Table 3-4: Ministerial Statement 789 Closure Conditions

No.	Conditions Relevant to Closure
6	*Flora, Vegetation and Aquatic Ecosystems*
	Wetland Buffer

No.	Conditions Relevant to Closure
6-1	The proponent shall clearly delineate and maintain a buffer of at least 200 metres around the Conservation Category Wetland UFI2362.
	Indirect impacts on Flora, Vegetation and Aquatic Ecosystems
6-2	At all times, the proponent shall ensure that mining excavations and dewatering do not reduce water availability so as to adversely affect flora, vegetation and aquatic ecosystem health, by monitoring: 1. groundwater levels and vegetation health in the vicinity of mining operations; 2. perched water levels, soil moisture and vegetation health in Conservation Category Wetland UFI2362 and Resource Enhancement Wetland UFI2165; 3. soil moisture levels and vegetation health in the low woodland of *Casuarina obesa* near Dowdells Line; and 4. changes to the existence of permanent pools in Henty Brook over summer; This monitoring shall be carried out before, during and for at least 12 months after dewatering and mining has ceased, on a monthly basis or at a monitoring frequency that is to the satisfaction of the Department of Environment and Conservation.
6-3	The proponent shall submit the results of the monitoring required by condition 6-2 to the Department of Environment and Conservation every six months following the commencement of ground disturbing activities.
8	*Closure and Rehabilitation*
8-1	Prior to commencement of ground disturbing activities, the proponent shall conduct surveys of the proposal area to collect baseline information, including photographic records, on the following: 1 Pre-mining soil profiles; 2 Groundwater levels; 3 Surface water flows; 4 Vegetation complexes; and 5 Landscape and landforms.
8-2	As mining progresses, the proponent shall commence rehabilitation of the mined area in accordance with the following: 1. Re-establishment of vegetation in the rehabilitation area to be comparable with that of the pre-mining vegetation such that the following criteria are met within three years following the cessation of productive mining: (1) Species diversity is not less than 70 percent of the known original species diversity; (2) Priority flora are re-established with not less than 50 percent success after three years and 65 percent success after five years; and (3) Weed coverage less than 10 percent. 2. Re-establishment of the soil profile to ensure repair of any damage to wetland perched water containment and to emulate the pre-mining hydraulic properties of the area generally. 3. Remediation of acid sulfate soil and contaminated groundwater generated by mining operations. 4. A schedule of the rate of rehabilitation acceptable to the CEO of the Department of Environment and Conservation.
8-3	In liaison with the Department of Environment and Conservation, the proponent shall monitor progressively the performance of rehabilitation against the criteria in condition 8-2.
8-4	The proponent shall submit annually a report of the rehabilitation performance monitoring required by condition 8-3 to the CEO of the Department of Environment and Conservation and shall address in the report the following: 1. Progress towards meeting the criteria required by condition 8-2 and milestone criteria; and 2. Contingency management measures in the event that criteria are unlikely to be met.

3.4. EPBC ACT APPROVAL DECISION CONDITIONS

The Dardanup Southern Extension (2012) including the Waterloo Block (2013) have been formally assessed by the Department of the Environment and Energy (DEE, formerly the Department of the Environment) in accordance with the provisions of the *Environmental Protection and Biodiversity Conservation Act 1999* and

approved with conditions. The specific conditions from the approval decision for EPBC Referrals 2011/6087 and 2013/6879 are contained within Table 3-5 and Table 3-6.

Table 3-5: EPBC Referral 2011/6087 Approval Decision Closure Conditions

No.	Conditions Relevant to Closure
3	Within three years of the date of this approval the person taking the action must register a legally binding conservation covenant over the Woodland Habitat Rehabilitation and Offset Area (WHROA). The conservation covenant must provide enduring protection and rehabilitation of no less than 19 ha including the establishment of 1600 black cockatoo habitat trees.
4	To offset the impacts to black cockatoos, within 60 days of commencement of construction, the person taking the action must submit to the Minister for approval a Woodland Habitat Rehabilitation Plan (WHRP). This plan must be used to establish and maintain the WHROA in accordance with the Offset Management Plan (2012) provided in the Preliminary Documentation. The WHRP must include, but not be limited to the following: a) milestones and objectives of the WHROA b) a description and map to clearly define the location and boundaries of all of the offset areas. This must be accompanied by the offset attributes and a shapefile c) details of management actions to protect and enhance the extent and condition of habitat values of the offset areas including but not limited to rehabilitation, weed control and feral animal control d) details of the location and type of habitat creation (including but not limited to artificial nesting boxes and relocated logs) e) the timing, responsibilities, performance criteria and corrective actions, to be implemented if performance criteria are not met with in specified timeframes, for management actions f) a monitoring plan, including timing and methods for assessment of rehabilitation success to be undertaken by a qualified ecologist or suitably experienced environmental scientist to assess the success of the management actions against identified milestones and objectives g) a process to report to the department, the management actions undertaken in the offset areas and the outcome of those actions, including identification of any need for adapting management actions h) a description of the potential risks to successful management and rehabilitation in the offset areas, and a description of the contingency measures that would be implemented to mitigate these risks • i) details of parties responsible for management, monitoring and implementing the plan, including their position or status as a separate contractor. The approved WHRP must be implemented.
6	The person taking the action must develop a Perched Groundwater and Tree Health Monitoring Program (the program) to be conducted for the life of the project, including the rehabilitation phase, to ensure mining excavations do not reduce water availability. The program, including trigger values and contingency measures, must be developed in consultation with local DEC officers. The program must be provided to the department within 60 days of establishment of the program.
8	The Mine Closure Plan (DMS-EMP-6.3) and Rehabilitation Management Plan (DMS-EMP-6.1) must include the DSE and be submitted to the department for approval within 90 days of the commencement of construction. The approved DMS-EMP-6.3 and DMS-EMP-6.1 must be implemented.

Table 3-6: EPBC Referral 2013/6879 Approval Decision Closure Conditions

No.	Conditions Relevant to Closure
2	To offset the loss of habitat for black cockatoos, within 2 years of the date of this approval, the person taking the action must provide written evidence to the Department [of Environment] that a legally binding conservation covenant has been registered over the offset areas identified as Management Areas A, B, C and D at Attachment B, at Lot 110, Simpson Road, Henty, WA. The conservation covenant must provide protection and rehabilitation of no less than 14.95 ha of black cockatoo habitat.

No.	Conditions Relevant to Closure
3	To mitigate impacts to black cockatoos, prior to the commencement of the action, the person taking the action must prepare and submit an Environmental Management and Offset Strategy (EMOS) for the Ministers approval. The EMOS must include, but not be limited to: a) Milestones and objectives of the EMOS; b) Avoidance and mitigation measures to reduce impacts to black cockatoo habitat prior to, during and post mining operations; c) A description and map to clearly define the location and boundaries of all the offset areas. This must be accomplished by the offset attributes and shapefile; d) Details of rehabilitation measures for offset areas. These details should include but not be limited to, commencement timeframes, species to be utilised, stocking rates, measures to be utilised to ensure success, success targets, contingency measures in the case of not meeting targets and monitoring requirements; e) Measures to exclude weeds and feral animals from offset areas; f) Timeframes for the implementation and completion of the above measures and strategies; g) Details of monitoring, reporting, and contingency measures if performance indicators are not met; and h) Roles and responsibilities of personnel associated with implementing each of the above measures. Methods for assessment of rehabilitation must be undertaken by a qualified ecologist or suitably experienced environmental scientist. The person taking the action must not undertake any clearing of habitat for black cockatoos within the project area unless the EMOS has been approved by the Minister. If the Minister approves the EMOS, then the approved EMOS must be implemented.
5	The person taking the action must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, including measures taken to implement the EMOS required by this approval, and make them available upon the request to the department. Such records may be subject to audit by the Department or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the Department website. The results of audits may also be publicised through the general media.
8	If the person taking the action wishes to carry out any activity otherwise than in accordance with the EMOS as specified in the conditions, the person taking the action must submit to the Department for the Minister's written approval a revised version of that EMOS. The varied activity shall not commence until the Minister has approved the varied EMOS in writing. The Minister will not approve a varied EMOS unless the revised EMOS would result in an equivalent or improved environmental outcome over time. If the Minister approved the revised EMOS, that EMOS must be implemented in place of the EMOS originally approved.

3.5. CONDITIONS OF LICENCES AND PERMITS

The Dardanup Mine is subject to the following licence and permits that have conditions pertinent to closure:

- Willoughby South Creek – Beds and Banks Permit: PMB168635(1)
- Burekup West Dewatering Licence: GWL168577(1). Note GWL168577(1) shall expire on 31st March 2015 and does not require renewal under the authority of the Department of Water[1].

The following documents have been reviewed and were found not to have any conditions relevant to closure:

- Groundwater production bore licence to take water: GWL 111126(2);
- *Environmental Protection Act 1986* Licence for Prescribed Premises Licence Number: L7789/2001/8 (Dardanup Mine Site).

Table 3-7: Willoughby South Creek- Beds and Banks Permit Closure Conditions

No.	Conditions relevant to Closure
Section 5. Site Rehabilitation	The following rehabilitation works will be undertaken: • The original channel profile will be reinstated as per the survey data collected: • Banks will be stabilised; and • Bank and riparian zones will be revegetated with native tree, shrub and sedge species. Species such as *Eucalyptus rudis*, *Melaleuca rhaphiophylla*, *Melaleuca preissiana* and *Casuarina obesa* represent the original vegetation in the area and will be used wherever possible in the rehabilitation of the riparian zone. Advice on the most appropriate methods for the above rehabilitation works will be sought (at the time of implementation) from the DEC and other rehabilitation specialists. It is the intention of Doral Mineral Sands to improve the current ecological values of the creek lines that are disturbed. The re-established creek line will be fenced 20m either side of the stream invert and re-establish native trees and under storey.

Table 3-8: Burekup West Groundwater Dewatering Licence Closure Conditions

Condition:	Condition relevant to closure.
17	The groundwater bore monitoring program *(and reporting)* shall be maintained for a period covering at least two winters' rainfall seasons after cessation of dewatering extraction

3.6. ENVIRONMENTAL COMMITMENTS

In the process of gaining environmental approvals for the Dardanup Mine, Doral has made commitments to undertake specific actions related to closure within the following documents:

- Dardanup Mineral Sands Project Consultative Environmental Review (CER)[2] (Table 3-9);
- Western Extension to the Dardanup Mineral Sands Project Environmental Protection Statement (EPS) and Mining Proposal[3] (Table 3-10);
- Mining Proposal Amendment to Registration Number 21253: Mining Proposal for an Amendment to Burekup West (M70/652 and M70/720). August 2010 (Table 3-11);
- Mining Proposal Amendment to Registration Number 21253: Mining Proposal for a Northern Amendment to Burekup West (M70/652). August 2011 (Table 3-12);
- Submission for Assessment under Section 45C of the Environmental Protection Act 1986 – Proposed Amendment to Ministerial Statement 484 (Dardanup Southern Extension). May 2012. (Table 3-13);
- Submission for Assessment under Section 45C of the Environmental Protection Act 1986 – Proposed Amendment to Ministerial Statement 484; Inclusion of the Waterloo Block into the Dardanup Southern Extension. June 2013. (Table 3-14);
- The Shire of Dardanup Extractive Industries Licence (Table 3-15).

The following documents have been reviewed and were found not to have any additional commitments relevant to closure:

- Submission for Assessment under Section 45C of the Environmental Protection Act 1986 – Proposed Amendment to Ministerial Statement 789. December 2009. Doral Mineral Sands Pty Ltd;
- EPBC Referral Reference Number 2008/4673 (Western Extension to the Dardanup Mineral Sands Project);

- EPBC Referral Reference Number 2013/6879 (Waterloo Heavy Mineral Sands Mining Project, Henty, Western Australia).

Table 3-9: CER Closure Commitments

No.	Commitments relevant to Closure
4	Ensure that backfilled mine areas have the capacity to transmit water from east to west in a fashion similar to that which currently occurs.
5	Rehabilitate land disturbed by mining activities to restore agricultural productivity to levels at least equal to those which currently exist.
6	Consult with the Department of Agriculture, the Water Authority of Western Australia and landowners to include native vegetation in rehabilitation strategies, with the view to contributing to the management of localised and regional hydrogeological problems of high water tables and salinity.
11	Enrich and establish native vegetation along existing permanent public roads and roads developed or disturbed as a result of project activities.

[2] The response to submissions document has also been reviewed and no additional commitments identified.

[3] Both the EPS and Mining Proposal have been reviewed and the commitments relevant to closure are effectively the same. Where small differences in wording occurs (e.g. 'Doral will fence…' compared to 'Fence…') the wording from the EPS has been used.

Table 3-10: Western Extension (including Burekup Mineral Sands Deposit) EPS and Mining Proposal Closure Commitments.

No.	Commitments relevant to Closure	Actions to Achieve Commitment (from EPS Table ES-3)
1	Doral will return the land to its current form as a minimum.	Update the existing Dardanup Project Rehabilitation and Decommissioning Plan to include the western extension. The Plan will include an ASSMP Closure Report. Implement the Rehabilitation and Decommissioning Plan.
4	Doral commit to ensuring backfilled mine areas have the capacity to transmit water in a fashion similar to that which currently occurs.	• Progressively fill the pit void with a heterogeneous mixture of sand tailings, dried clay tailings and oversize; • Incorporate the western extension proposal into the Groundwater Management Plan and enact the Plan; and • Incorporate the western extension into the Rehabilitation and Decommissioning Plan and enact the Plan.
12	Doral will fence the CCW and the REW prior to commencing site works.	• Fence CCW and REW wetlands; • Maintenance of fencing prior to and post rehabilitation for approximately 3 years post mining; and • Covenant the CCW.
13	Doral will use seed of local provenance for revegetation.	Collect seed at the appropriate time of year and store to preserve seed viability.
14	Doral will monitor the condition of the vegetation that is adjacent to the disturbance area during the life of the mining operation.	Monitoring of vegetation condition to be conducted every three months during mine operation; every month during dewatering activity in areas designated as Groundwater Dependant Ecosystem (GDE); and annually for 3 years post mining.
16	Doral commit to fencing the Low Woodland of *C.obesa* to manage disturbance and cattle grazing.	• Fence the Low Woodland of *C.obesa;* • The disturbance corridor for the conveyor will be rehabilitated post mining using seed of local provenance; and • Maintenance of fencing prior to and post rehabilitation for approximately 3 years post mining.

No.	Commitments relevant to Closure	Actions to Achieve Commitment (from EPS Table ES-3)
20	Doral will rehabilitate mine disturbance areas to strengthen or improve corridors for fauna movement and habitat.	Rehabilitate mine disturbance areas by planting trees within strategic corridors such as adjacent to road reserves and fencelines to link, strengthen or improve corridors for native fauna. Species selection will focus on fauna habitat and be of local provenance where possible.
26	Doral will rehabilitate land disturbed by mining activities to restore agricultural productivity to levels at least equal to those which currently exist.	Update the Rehabilitation and Decommissioning Plan for the Dardanup Mineral Sands Project to include the western extension proposal. Enact the Plan. Management measures will include: • The return of clay fine material and subsoil to emulate pre-mine hydraulic properties of the region. • After replacement of subsoils, the surface will be contoured to provide drainage and then harrowed in areas of pasture establishment. • Soil amendments, fertiliser application and seeding rates will be undertaken in consultation with the Department of Agriculture.
27	Doral commit to finalising covenant areas and management strategies for the proposed offset areas to provide a net environmental benefit for the western extension proposal.	• Secure and rehabilitate approximately 20ha of Guildford Vegetation Complex, referred to as the Willoughby Offset Area. Provide $250,000 over 5 years to manage the Willoughby Offset area. • Offset the (approximate) 450 trees to be cleared with the planting of 5,000 trees within the Willoughby Offset Area. • Secure and rehabilitate the CCW. A CCW Covenant Area has been agreed in principle in preliminary discussions with the owner and DEC.
28	Doral will produce an ASSMP Closure Report.	Prepare an ASSMP Closure Report (prior to Mine Closure)

Table 3-11: Amendment to Mining Proposal 21253 Closure Commitments. August 2010

No.	Commitments relevant to Closure	Actions to Achieve Commitment (from MP Table SC-2)
2	Doral propose to offset the native vegetation to be cleared in the proposed amendment by planting an additional 2000 local native species of trees and shrubs.	These additional plantings will occur in strategic rehabilitation areas to provide an improved habitat for native fauna within the proposed amendment, rather than within the Willoughby Offset Area. [to be completed by December 2014]

Table 3-12: Amendment to Mining Proposal 21253 Closure Commitments. August 2011

No.	Commitments relevant to Closure	Actions to Achieve Commitment (from MP Table SC-2)
1	Doral will plant an additional 200 local native trees and shrubs in the northern Burekup mining area.	Plant trees within strategic corridors such as adjacent to road reserves and fencelines to link strengthen or improve corridors for native fauna. Plant species will focus on fauna habitat and be of local provenance wherever possible.

Table 3-13: Dardanup Southern Extension s45C Request Closure Commitments.

No.	Commitments relevant to Closure
1	Update Dardanup Mine EMP's (including the Rehabilitation Management Plan Dardanup Mine and Burekup West, DMS-EMP-6.1) to reflect the scope and environmental effects of the Dardanup southern extension.

Table 3-14 Inclusion of Waterloo Block into Dardanup Southern Extension s45C Request Closure Commitments.

No.	Commitments relevant to Closure
1	Update Dardanup Mine EMP's to reflect the scope and environmental effects of the inclusion of the Waterloo Block. - Rehabilitation Management Plan Dardanup Mine and Burekup West (DMS-EMP-6.1);

Table 3-15 The Shire of Dardanup Extractive Industries Licence, inclusion of the Waterloo Block into the Dardanup Southern Extension.

No.	Commitments relevant to Closure
1	Extraction area is to be rehabilitated and re-vegetated in accordance with the approved plan within 12 months of the completion of the operation to the satisfaction of the Director Engineering Services.

3.7. OTHER STAKEHOLDER COMMITMENTS

Doral has an open process for engaging with local and affected stakeholders (See Section 4 for more information). During this process and through the engagement processes to secure land access for the Project a number of commitments have been made that are relevant to closure of the Project. These are listed in Table 3-16.

Table 3-16: Other Stakeholder Commitments

Stakeholder	Property Reference	Commitments relevant to Closure
Adrian Tyrrell	Lot 22 On Diagram 83297	Final soil surface level must be designed and constructed with laser level for flood irrigation. Hay shed on the eastern boundary of pit to be kept or replaced to same standard at Doral's cost. Post rehabilitation land acceptance letter signed 08/12/17.
Warrick Tyrrell	Lot 3558 On Plan 202219	Doral committed to installing fencing so that access to cattle yards on Lot 3557 can be maintained from Lot 3558. Post rehabilitation land acceptance letter signed 10/04/18.
Ken Tyrrell	Wellington Location 3553 On Plan 202219	Livestock access to cattle yards must be maintained, by either keeping existing yards and fencing or if required shift yards and fences with Ken's approval, at Doral cost. Post rehabilitation land acceptance letter signed 10/04/18.
Rob Depiazzi	Bernice/Mark Depiazzi leases Lot 18 On Plan 232787 from Rob Depiazzi (deceased)	Previous landowner (Rob Depiazzi) requested that subsoil needs more sand as it is very high clay at present. Doral has committed to incorporating a thin sand tails layer into the reconstructed soil profile. Bernice/Mark have requested a small dam for stock water.

Stakeholder	Property Reference	Commitments relevant to Closure
		Post rehabilitation land acceptance letter signed 29/05/18.
Tom Busher	Lot 201 On Diagram 12309	Area was rehabilitated in 2010, surface remediation work required in 2012/13 season to remedy subsidence. Land was purchased by Gemhurst Pty Ltd. Post rehabilitation land acceptance letter signed 28/05/18.
Iluka Resources Ltd	Lot 21 On Diagram 83379	House at front with of Lot must be kept. All other buildings can be removed but Iluka must be notified to salvage for charity.
Harvey Water	Swan Channel Spray Channel	Doral shall re-establish the Swan and Spray channels to a similar standard and at the same location as existed pre-mining. Acceptance email from Harvey water 25/03/19.

4. STAKEHOLDER ENGAGEMENT

Over the life of the Project (since 2002), Doral has been in regular consultation with Federal, State and Local Government agencies as well as undertaken a range of Community Consultation exercises which exist as both formal and informal discussion between a range of stakeholders and Doral.

With specific reference to Table 2-1 Project Approvals History and Table 3-16 Other Stakeholder Commitments, Doral has identified the following key stakeholders who are regularly engaged with throughout the mining operation and similarly consulted regarding closure of the Dardanup Mine:

Government agencies:

- Department of the Environment and Energy (DEE);
- Department of Water and Environmental Regulation (DWER);
- Department of Mines, Industry Regulation and Safety (DMIRS);
- The Shire of Dardanup;
- Department of Biodiversity, Conservation and Attractions (DBCA).

Local Landowners / Neighbours;

- Iluka Resources (Landowner);
- Adrian Tyrrell (Landowner);
- Warrick Tyrrell (Landowner);
- Ken Tyrrell (Landowner);
- Tyrrell Gardiner (Landowner);
- Rob Depiazzi (Leases property owned by Peter and Owen Depiazzi);
- Phil Depiazzi (Landowner);
- Don Partridge (Neighbour);
- Neighbouring residents to the Dardanup site.

Regular reporting of closure aspects including progress and monitoring results is also documented as follows:

- Annual Environmental Report, submitted each March to DWER, DMIRS, DBCA and DEE and posted on the Doral website;
- Annual Expenditure report submitted in August each year relating to expenditure on offsets and revegetation to DWER and DBCA;
- Periodic updates of this Mine Closure Plan submitted to the DMIRS and DEE.

Regulatory consultation of site environmental management and closure progress and review is also conducted throughout site inspections and audits conducted on the site. Recent inspections and audits include;

- 20/09/10 – Ministerial Statement 484 and 789 audit conducted by (EPA) David Anthony;
- 07/06/11 – DMP Site inspection conducted by Eugene Bouwhuis, Tony White;
- 23/03/12 – DER Licence Compliance Audit by Danielle Eyre, Tatyana Eather;
- 26/04/12 – DMP Site inspection conducted by Tony White, Demelza Dravnieks, Ian Misich;

- 13/11/13 – DER Licence Compliance Audit by Humera Blakers, Jamie Piotrowski;
- 20/11/13 – DMP Site inspection conducted by Tyler Sudovic, Iome Christa;
- 10/05/17 – DMP Site inspection conducted by Jessica Allen and Ryan Hepworth.

No stakeholder consultation or issues requiring resolution in relation to mine closure have been identified by Doral during this iteration of this Plan.

Future consultation with regulators, stakeholders and landowners however shall remain regular and transparent until such time as all tenements have been relinquished. Doral shall ensure effective feedback to regulators with regards to closure progress, through formal reporting mechanisms, meetings and site-based inspection participation. Specific commitments made to landowners that are relevant to closure are documented within Table 3 16.

A Stakeholder communication summary table of items specifically related to closure is shown below in Table 4-1.

Table 4-1: Doral Dardanup Mine – Mine Closure Plan Stakeholder Table

STAKEHOLDERS	DATE	DESCRIPTION OF CONSULTATION	STAKEHOLDERS COMMENTS / ISSUES	PROPONENT RESPONSE AND / OR RESOLUTION	STAKEHOLDER RESPONSE	APPLICABLE MCP SECTION
Adrian Tyrrell	Pre-2009	Discussion of future mining Lot 22	Return of rehabilitated land for flood irrigation	Final soil surface level must be designed and constructed with laser level for flood irrigation	Agreed	3.7
			Hay shed on eastern boundary of pit	Hay shed on eastern boundary of pit to be kept or replaced	Agreed	3.7
	20/04/12	Site discussion	Some small areas of subsidence on Lot 22	Doral has subsidence survey and monitoring in place and will not return land which has subsided. Further rehabilitation works to repair subsidence is planned.	Accepted	7.11, 5.1
	17/04/15	Site meeting of future farm plan and drainage	Discussion of farm plan	Drainage to be partially constructed as agreed to ensure irrigation requirements are met. To be monitored over winter 2015.	Accepted	3.7, 4, 5.1
			Happy with subsidence repair work although some more required on edges	Routine subsidence monitoring to continue, repairs to be made on edges as agreed	Accepted	7.11, 4, 5.1, 10.1
	08/12/17	Meeting	Final signoff of land acceptance for Lot 22	Signed acceptance	Acceptance	4
Ken and Warrick Tyrrell	Pre-2009	Discussion of future mining Lot 3553	Access to cattle yards	Livestock access to cattle yards must be maintained with fences at Doral's cost	Agreed	3.7
	10/04/18	Meeting	Final signoff of land acceptance for Lots 3553 and 3558	Signed acceptance	Acceptance	4
Rob Depiazzi (Bernice/Mark)	Pre-2009	Discussion of mining on Lot 18	Subsoil needs more sand	Requested that subsoil needs more sand as is very high clay at present. Doral will incorporate a thin layer of sand tails into the reconstructed soil profile.	Agreed	3.7, 9.4
			Dam for stock water	A small dam will be left as requested for stock water	Agreed	3.7, 5.1
	29/05/18	Meeting	Final signoff of land acceptance for Lot 18	Signed acceptance	Acceptance	4

Table 4-1: Doral Dardanup Mine – Mine Closure Plan Stakeholder Table

STAKEHOLDERS	DATE	DESCRIPTION OF CONSULTATION	STAKEHOLDERS COMMENTS / ISSUES	PROPONENT RESPONSE AND / OR RESOLUTION	STAKEHOLDER RESPONSE	APPLICABLE MCP SECTION

Iluka Resources Limited	Pre-2009	Discussion regarding house at Lot 21	House to remain	Doral to leave house located at Lot 21 and any other buildings may be removed prior to notification to Iluka to salvage for charity	Agreed	3.7
	19/06/06	Phone discussion re: house on Edwards Rd	Phone line	Phone line to residence will be cut due to mining progress and shall be re-instated post mining	Agreed	3.7
	14/11/13	Site tour by rehabilitation staff	Tour of Doral site and rehabilitation progress to date of Iluka land	Site tour undertaken. No significant issues raised, some discussion on fencing and access requirements	Acceptable	4
	05/03/14	Emailed Rehabilitation plan Burekup North Lots 11, 12, 103	Rehabilitation Plan as negotiated	Plan showing proposed access and fencing, small stock dam.	Agreed	4, 5.1
	23/03/15	Email message regarding organic pasture requirements	Iluka requests that Doral do not apply the 3 in 1 normal fertilizer as per normal practice but rather use organic alternatives such as chicken manure for this nutrient top up program	Doral will comply with this request and continue consultation with Iluka	Agreed	4, 5.1
	17/04/15	Emailed Rehabilitation Plan Burekup Lots 103,104	Rehabilitation plan as negotiated	Plan showing fencing of Lots 103,104	Agreed	4
	30/04/15	Meeting on conservation covenants	Iluka shall supply all title certificates and signed covenant documentation as requested	Doral will arrange and facilitate the application of a conservation covenant to the CCW of Lot 11 as committed in the Burekup West approvals	Agreed	3.6, 4
	01/07/15	Site tour by Iluka rehabilitation representatives	Feedback on current rehabilitation works on Iluka lands was positive	Fencing and road access installed as per agreed, stockpiled organic soil nutrients observed	Accepted	4

Table 4-1: Doral Dardanup Mine – Mine Closure Plan Stakeholder Table

STAKEHOLDERS	DATE	DESCRIPTION OF CONSULTATION	STAKEHOLDERS COMMENTS / ISSUES	PROPONENT RESPONSE AND / OR RESOLUTION	STAKEHOLDER RESPONSE	APPLICABLE MCP SECTION
	12/02/19	Meeting and email correspondence	Final signoff of land acceptance for Lots 11, 12, 3559, 102, 103, 104, 1.	Signed acceptance	Acceptance	4
Phil and Kevin Depiazzi	2013	Discussion and documentation of land access agreement for mining of Lot 109	Return of land to pasture	Doral to return the land to productive pasture as soon as reasonably practicable	Agreed	3.7
	Summer 2015	Proposed discussion to outline mine progress				4
Harvey Water	Pre-2009	Discussion of infrastructure re-establishment	Spray and Swan Channels	Doral to re-instate the earthen Swan Channel at Burekup West and the concrete Spray channel at Edwards as specified by Harvey Water	Agreed	3.7
	25/03/19	Site visit and email correspondence	Spray and Swan Channels	Email confirming acceptance of returned irrigation infrastructure	Agreed	4
The Shire of Dardanup	Pre-2009	Discussion including town hall meeting regarding mine progression to Dardanup Western Extension	Road Closures	Road Closures for Harris Rd and St Helena Rd conditions and standards to be in suitable to Shire officers	Agreed	3.6, 4
	21/03/12	Town hall meeting to public outline of mining operations and proposed road closure of Simpson Rd	No issues relating to mine closure		Accepted	3.6, 4
	15/06/12	Extractive Industries Licence	Licence granted 13/09/12	Submission of application for Extractive Industries Licence for Southern Extension including Mining Proposal	Approved	3.6, 4
	02/08/13	Extractive Industries Licence	Licence granted 27/09/13	Submission of application for Extractive Industries Licence for Waterloo Block including Mining Proposal	Approved	3.6, 4
	11/06/15	Meeting to discuss closure expectations of shire	Re-establishment of single seal bitumen to same standard as previous for sections of Offer and Edwards Rd. Shire to provide engineering cross sections	Doral shall reinstate roads to Shire standards final road design	Agreed	3.6, 4, 5.1

Table 4-1: Doral Dardanup Mine – Mine Closure Plan Stakeholder Table

STAKEHOLDERS	DATE	DESCRIPTION OF CONSULTATION	STAKEHOLDERS COMMENTS / ISSUES	PROPONENT RESPONSE AND / OR RESOLUTION	STAKEHOLDER RESPONSE	APPLICABLE MCP SECTION
			Culvert under Dowdell's line	Proposal to re-instate of the Dowdells Line conveyor underpass be done with cement stabilized backfill rather than cause disruption to traffic	Acceptable	3.6, 4, 5.1
	10/04/18	Site inspection and following correspondence	Edwards road reinstatement	Accepted reinstatement of Edwards Rd via email notification	Accepted	4
DWER	Feb 2009	Bed and Banks	Approval granted	Request for Bed and banks permit for the temporary diversion of Willoughby South Creek	Approved	3.5
	March 2015	Letter, dewatering licence relinquishment	Burekup West dewatering licence is due to expire on 31st March 2015 and will not be renewed as monitoring evidence of the 2 winters post de-watering provided shows no adverse effects	Evidence provided to support relinquishment of dewatering licence	Approved	3.5, 4
	April 2015	Bed and Banks	Approval granted	Renewal of Bed and Banks Permit for the temporary diversion of Willoughby South Creek	Approved	3.5
	Summer 2015	Proposed discussion with DoW to discuss rehabilitation progress				
DMIRS	Pre-2009	Mining proposal	Approved in 2008	Submission of Mining Proposal for Western Extension	Approved	3.2, 4
	June 2012	Mining Proposal	Noted	Submission of *For Interest Only* Mining Proposal for the Southern Extension	Accepted	3.2, 4
	May 2012	Mine Closure Plan	Approved in November 2013	Submission of Mine Closure Plan for the Dardanup Mine	Approved	3.2, 4
	March 2014	Mine Closure Plan	Noted	Submission of reviewed Mine Closure Plan for the Dardanup Mine	Further information requested	3.2, 4

Table 4-1: Doral Dardanup Mine – Mine Closure Plan Stakeholder Table

STAKEHOLDERS	DATE	DESCRIPTION OF CONSULTATION	STAKEHOLDERS COMMENTS / ISSUES	PROPONENT RESPONSE AND / OR RESOLUTION	STAKEHOLDER RESPONSE	APPLICABLE MCP SECTION
	March 2015	Mine Closure Plan	Noted	Submission of reviewed Mine Closure Plan for the Dardanup Mine	Further information requested	3.2, 4
	Sept 2015	Mine Closure Plan	Noted	Submission of revised Mine Closure Plan for the Dardanup Mine	Accepted	3.2, 4
	March 2017	Mine Closure Plan	Noted	Submission of the Mine Closure Plan for the Dardanup Mine	Accepted	3.2, 4
The Office of the EPA	March 2015	Phone discussion	Decommissioning Plan as per Ministerial Statement 484 may be included into the MCP document	Include decommissioning Plan as per Ministerial Statement 484 into the MCP document	Acceptable	3.3, 8.2
	March 2015	Mine Closure Plan	Received	Submission of reviewed Mine Closure Plan for the Dardanup Mine incorporating the Decommissioning Plan	Awaiting final version following DMP request for further information	3.3, 8.2
	Sept 2015	Decommissioning Plan		Submission of Decommissioning Plan as requested in MCP	Accepted	3.3, 8.2, App F
DEE	March 2013	Annual Environmental Review Report	Noted	Notification of the publication of the Doral Annual Environmental Review	Accepted	3.4
	March 2014	Annual Environmental Review Report	Noted	Notification of the publication of the Doral Annual Environmental Review	Accepted	3.4
	March 2015	Annual Environmental Review Report	Noted	Notification of the publication of the Doral Annual Environmental Review	Accepted	3.4

Table 4-1: Doral Dardanup Mine – Mine Closure Plan Stakeholder Table

STAKEHOLDERS	DATE	DESCRIPTION OF CONSULTATION	STAKEHOLDERS COMMENTS / ISSUES	PROPONENT RESPONSE AND / OR RESOLUTION	STAKEHOLDER RESPONSE	APPLICABLE MCP SECTION
	21/07/15	Email, Phone to notify of conservation covenant progress	Noted	The signed formal documents for the application of conservation covenants relating to Lot 107 (EPBC 2011/6087) and Lot 110 (EPBC 2013/6879) were lodged with Landgate on 3rd June 2015 and were completed on 20/11/15 (Lot 107) and 04/02/16 (Lot 110)	Accepted	3.4
	March 2016	Annual Environmental Review Report	Noted	Notification of the publication of the Doral Annual Environmental Review	Accepted	3.4
	March 2017	Annual Environmental Review Report	Noted	Notification of the publication of the Doral Annual Environmental Review	Accepted	3.4
	March 2018	Annual Environmental Review Report	Noted	Notification of the publication of the Doral Annual Environmental Review	Accepted	3.4

5. POST-MINING LAND USE AND CLOSURE OBJECTIVES

The post-mining vision for the Dardanup Mine is to return an agricultural landscape that retains the values of the site to the local community.

This is currently planned to be achieved by returning the site primarily to agricultural production, along with conservation and road reserve land uses.

5.1. POST-MINING LAND USE OBJECTIVES

The Dardanup Mine Site is classified into three post-mining land uses, with specific objectives for each land use. The planned post-mining land use and their relevant objectives are described in the following sections and the spatial location of where they apply are illustrated in.

5.1.1. LAND USE: AGRICULTURAL

Post mining land use objective: To return the land to a condition capable of supporting dairy and/or beef production with pasture production rates equivalent to or better than pre-mining production rates.

Within this land use type there is four primary sub-types for which specific rehabilitation parameters are customised:

- Irrigated pasture on Pinjarra plain landform;
- Dryland pasture on Pinjarra plain landform;
- Dryland pasture on Whicher scarp landform;
- Creeklines and riparian vegetation.

5.1.2. LAND USE: CONSERVATION

Post mining land use objective: To conserve and protect areas of environmental significance (including those used as environmental offsets) such that their environmental values are maintained.

Areas of environmental significance, namely the Willoughby's Offset Area, CCW wetland, Woodland Habitat Rehabilitation and Offset Area (WHROA) and the Waterloo Offset area will be used as environmental offsets and have permanent conservation covenants applied, as shown in Figure 5-1.

5.1.3. LAND USE: ROAD RESERVE

Post mining land use objectives:

Primary: To re-establish roads to engineering and construction standards acceptable to the Shire of Dardanup.

Secondary: To improve the quality of native vegetation in road reserves such that improved conservation outcomes are achieved through the connection of areas of remnant vegetation (i.e. wildlife corridors).

5.2. CLOSURE OBJECTIVES

The following closure objectives have been developed for the Dardanup Mine. Many of these apply across the Site, where the objective is different for different land uses this is identified.

5.2.1. COMPLIANCE

All legal and stakeholder obligations relevant to closure and completion of the site are met.

5.2.2. LANDFORMS

Final landforms are returned to topography similar to pre-mining level (Figure 5-2) and meet landowner specifications.

Final landforms can support the designated post-mining land use, specifically:

- Agriculture land use: Top 1 metre of soil profiles are consistent with pre-mining soil profiles and where different enable improved agricultural productivity (e.g. covering of rocky laterite surface with soil);
- Conservation land use: Created landforms are able to support native vegetation;
- Road Reserve land use: Backfilled mine pits do not materially subside over time and can support road construction.

Soils and landforms exhibit erosion rates consistent with surrounding areas and do not compromise post-mining land uses.

5.2.3. NATIVE VEGETATION (CONSERVATION LAND USE)

Improve the condition of areas of native vegetation with significant conservation values.

Protect areas of native vegetation that contain significant values.

5.2.4. RADIATION

Surface level radiation levels are within acceptable standards.

5.2.5. WATER

Surface and groundwater levels and quality are consistent with surrounding areas.

Surface and groundwater flows are consistent with surrounding areas.

5.2.6. INFRASTRUCTURE

All mining equipment and structures are removed from site.

Waste generated during deconstruction is managed in a manner consistent with waste minimisation principles.

Re-established infrastructure is installed to standards accepted by key stakeholders.

6. DEVELOPMENT OF COMPLETION CRITERIA

Completion criteria have been developed for the Dardanup Mine as presented in Table 6-1.

Table 6-1: Completion Criteria

Closure Objective	Completion Criteria	Measurement Tool
Compliance		
All legal and stakeholder obligations relevant to closure and completion of the site are met	Completed checklist and evidence demonstrating compliance with all legal and stakeholder obligations. Successful completion of Mine Closure commitments in relevant approval documentation	Obligations Checklist (Appendix G) Landowner acceptance of rehabilitation Acceptance, closure approval and licence relinquishment by government agencies
Landforms		
Final landforms are returned to topography similar to pre-mining level and meet landowner specifications.	Final topography is constructed to pre-mining conditions as surveyed (Figure 5-2). Final landforms and vehicle accesses are constructed to meet landowner specifications	Physical topographical survey to represent pre-mining conditions GPS guided equipment used to ensure material is replaced accurately Physical survey monitoring conducted to identify any areas of ground surface subsidence or erosion. Regular consultation with relevant landowners during rehabilitation
Final landforms can support the designated post-mining land use, specifically: *Agriculture land use*: Top 1 metre of soil profiles are consistent with pre-mining soil profiles and where different enable improved agricultural productivity. *Conservation land use*: Created landforms are able to support native vegetation *Road Reserve land use*: Backfilled mine pits do not materially subside over time and can support road construction.	Agriculture: The measured agricultural productivity of each lot is equal to or more than either it's pre-mining yield assessment or an equivalent surrounding landform type. No subsidence maintenance required after 4 years. Native re-vegetation self-sustaining after 3 years Plant density and survival rates sufficient to meet offset requirements Road Reserves: Shire of Dardanup sign off that Geotechnical and Engineering standards have been met.	Regular pasture productivity measurement conducted and professional advice received. (Refer Appendix B and C) GPS guided equipment used to ensure material is replaced accurately Subsidence survey monitoring Regular native re-vegetation health and overall seedling survival monitoring Road construction technical reports and Shire of Dardanup acceptance of compliance with standards.
Soils and landforms exhibit erosion rates consistent with surrounding areas and do not compromise post-mining land uses.	Creeklines and beds are stable (no active gully or stream bank erosion).	Inspection and photo-monitoring.
Native Vegetation (Conservation land use)		

Closure Objective	Completion Criteria	Measurement Tool
Successful re-vegetation of Willoughby Offset area	Planting of 5000 trees ≥75 % seedling survival Species richness is ≥75% of species planted ≤50% weed foliage cover	Fencing to remove stock and feral pests Seedling orders and planting programs Regular Transect and Quadrat monitoring Photo-monitoring Conservation covenants issued
Successful revegetation of Woodland Habitat Rehabilitation Offset Area (WHROA)	A total surviving count of 1,720 trees (1,600 Black Cockatoo trees) ≥75% survival of over-storey and understorey seedlings Survival of ≥75% of species planted in each area Reduction of 40% weed cover within two years after implementation and 50% reduction after three years of implementation	Fencing to remove stock and feral pests Seedling orders and planting programs Regular Transect and Quadrat monitoring Regular vegetation health and soil moisture monitoring Photo-monitoring Conservation covenants issued
Successful revegetation of Waterloo Offset Area	Stems per hectare and species diversity as per Waterloo Offset RMP ≥75% survival of over-storey seedlings ≥75% survival of under-storey seedlings Survival of ≥75% of species planted in each area No declared weeds within the rehabilitated area two years after implementation; and Reduction of 40% weed cover within two years after implementation and 50% reduction after three years of implementation Trees to show consistent growth during monitoring and based on this either be a minimum of 3 m in height after three years or show that they will attain that height in the short-term future without the need for remedial action	Fencing to remove stock and feral pests Seedling orders and planting programs Regular Transect and Quadrat monitoring Regular vegetation health monitoring Photo-monitoring Conservation covenants issued
Protect and enhance areas of native vegetation that contain significant values; Conservation Category Wetland (CCW) *Casuarina Obesa* area	Protection and enhancement of significant native vegetation areas through successful application of fencing, re-vegetation and weed control.	Conservation covenant issued (CCW). Fencing to remove stock and feral pests Seedling orders and planting programs Regular vegetation health and soil moisture monitoring Photo-monitoring
Radiation		
Surface level radiation levels are within acceptable standards.	Soil surface gamma radiation levels are accepted by the Department for Mines and Petroleum.	Post-mining surface gamma radiation measurement.
Water		

Closure Objective	Completion Criteria	Measurement Tool
Surface and groundwater levels and quality are consistent with surrounding areas.	Groundwater levels in monitored bores are stable within the range of variation of surrounding monitoring bores and show the same seasonal patterns as surrounding monitored bores. Groundwater quality (pH, EC, Total Dissolved Salts, Total Acidity, Total Alkalinity, chloride, sulfate, Al, Fe and Mn) is within the range monitored within the surrounding areas. Surface water quality (pH, EC, TSS, sulfate and TPH) is within the range monitored within the surrounding areas.	Groundwater level monitoring Annual Environmental Reporting Surface and groundwater quality measurement utilising appropriate field meters and samples analysed at a NATA accredited laboratory
Surface and groundwater flows are consistent with surrounding areas.	Groundwater levels in monitored bores are stable within the range of variation of surrounding monitoring bores and show the same seasonal patterns as surrounding monitored bores. Drainage lines flow in the same direction and to the same catchments as they did pre-mining.	Groundwater level monitoring Annual Environmental Reporting Visual inspection and site audit.
Infrastructure		
All mining and processing equipment and structures are removed from site.	No mining and processing equipment present on site.	Visual inspection and photographic record.
Waste generated during deconstruction is managed in a manner consistent with waste minimisation principles.	Waste disposed of at appropriately licenced waste disposal facilities. Recycling of materials where available	Waste disposal records. Inspection during deconstruction.
Re-established infrastructure is installed to standards accepted by key stakeholders.	Infrastructure is installed, functioning and accepted by landowner.	Visual inspection Written acceptance by landowner.

7. COLLECTION AND ANALYSIS OF CLOSURE DATA

7.1. CLIMATE

The Bunbury area experiences a Mediterranean climate with warm to hot, dry summers and cool, wet winters. The long-term (1880–1985) annual average maximum temperature recorded at the Bureau of Meteorology's Bunbury Post Office (Station 009514) is 21.8°C and the annual average minimum temperature is 11.6°C. The long-term (1887–1985) average rainfall for the Bunbury Post Office (Station 009514) was 870.7mm/year. Bunbury has an annual evaporation of 1600 mm and monthly rainfall exceeds evaporation from May to September inclusive.

7.2. GEOLOGY

The Dardanup Mine occurs in the southern Perth Basin and is composed of up to 8km of Permian and Quaternary sediments. Near the surface are the Quaternary – Late Tertiary Guildford and Yoganup Formations, which overlay the Mesozoic Leederville Formation (Figure 7-1). All of these formations have either been formed or strongly influenced by marine regression and transgression events since the Early to Mid-Tertiary (ca. 50 Mya) (Soil Water Consultants, 2007a).

The Leederville Formation provides the base material on which the Dardanup Mine is situated. The Leederville sediments generally comprise interbedded sand, siltstone and shale, and are exposed at the surface at the Blackwood Plateau and occasionally on the Whicher Scarp.

The marine sediments of the Yoganup Formation were deposited onto the Leederville Formation. These marine sediments are mineralised with resistant heavy minerals, such as zircon, ilmenite, rutile and leucoxene. The Yoganup Formation sediments are typically marine and dunal sands, which have a clay fraction as a result of clay illuviation and reworking of clayey basement materials. During the Mid-Pleistocene (1.4–1.1 Mya) sea-levels were 20m AHD below present sea levels. This major marine regression event favoured alluvial and fluvial conditions on the coastal plain, resulting in the deposition of the Guildford Formation, and the formation of the Abba and Pinjarra Plains. The clayey sediments of the Guildford Formation were deposited directly on to the previously deposited beach sediments of the Yoganup Formation.

Overlying the Guildford Formation is a relatively thin layer of dunal sand, corresponding to the Bassendean Dunal System. These dunal sands have experienced considerable post-depositional modification and subsequently they only exist today as remnant isolated shallow rises in the area of the Dardanup Mine.

7.3. SOILS

7.3.1. REGIONAL LANDFORM AND SOILS MAPPING

The soils of the Dardanup Mine have been mapped at a regional scale by the Department of Agriculture (Barnesby & Proulx-Nixon, 1994, Figure 7-2 and Table 7-1).

The Dardanup Mine occurs upon both the Pinjarra Plain and the Whicher Scarp. As illustrated in Figure 7-2 there are three main landforms and associated soils within the minesite:

- The soils on the low lying areas of the project, the Pinjarra Plain consist primarily of poorly drained clayey soils of the Guildford Formation, with or without overlaying shallow sand layer (Pinjarra System);

- The footslopes of the Whicher Scarp are dominated by sandy gravels and deep sands, both overlaying clayey soils at depth (Forrestfield System);
- The scarp slopes and terraces of the Whicher Scarp are dominated by sandy and loamy gravels deep sands and wet soils in drainage valleys (Whicher Scarp System).

The Goodwood Valleys System while occurring within the minesite area is outside the area of mining.

Table 7-1: Regional Soil Landscape Mapping Unit Descriptions

Map Code	Soil Landscape System Name	Description
213Fo	Forrestfield System	Undulating foot slopes of the Darling and Whicher Scarps. Duplex sandy gravels, pale deep sands and grey deep sandy duplexes.
213Pj	Pinjarra System	Poorly drained coastal plain (Swan Coastal Plain from Perth to Capel). Variable alluvial and aeolian soils.
214Gv	Goodwood Valleys System	Valleys, of the Donnybrook Sunkland. Sandy gravel, loamy gravel and deep sand.
214Ws	Whicher Scarp System	Low scarp slopes and terrace. Sandy gravel and pale deep sands, loamy gravel and non-saline wet soils.

7.3.2. PRE-MINING SOIL PROFILES AND DISTRIBUTION

Site specific soil survey has been undertaken over the western extension and southern extension parts of the Dardanup Mine.

Within the western extension shallow (maximum depth of 4m) and deep (maximum depth of 11m) trenches were excavated to investigate soils across the site (Soil Water Consultants, 2007a). Based on the depositional history of the area and the morphological characteristics of the soil profiles exposed by trench excavation, four distinct Soil Mapping Units (SMU) were defined during the survey which are described below. The exploration drilling database was utilised to assist in defining the distribution of the SMU's. The known pre-mining distribution of these SMUs are shown in Figure 7-3.

All of the SMUs described below are underlain by the clayey Guildford Formation, with the exception of areas to the north and east of the site where the Yoganup Formation (and the orebody) occurs to the surface. The Guildford clay remains unsaturated throughout the majority of the year, as evidenced by the extensive mottling and laterisation. Water movement through the clayey matrix is extremely slow (<0.01m/day); however preferential flow DotEs occur through isolated coarse sandy lenses.

Within the southern extension 40 boreholes were drilled and together with exploration drilling data was used to identify five generalized subsurface profiles (Profiles) (Coffey Geotechnics, 2011). The distribution of these Profiles is shown in Figure 7-4.

7.3.2.1. SMU1: UNIFORM BROWN HEAVY CLAY

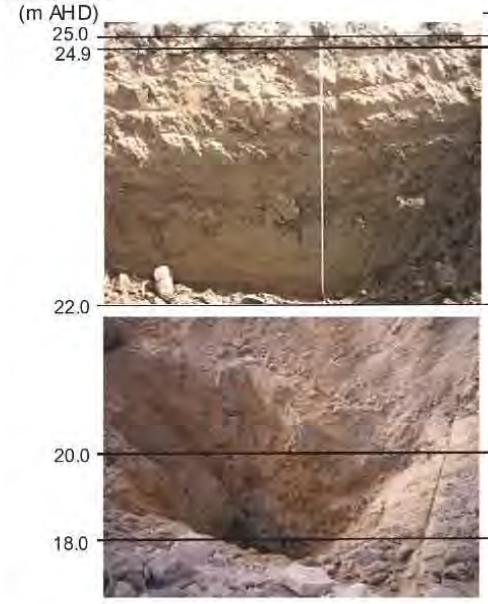
SMU1 likely represents the basal portion of remnant stream channels through the area. The uniform brown clay soil extends from the surface to depths of up to 4m and is deposited directly onto the blue-grey sandy clay soils of the Guildford Formation (Plate 7-1).

The topsoil is structurally degraded, resulting in slaking and dispersion, causing the soils to hardset. The underlying brown clay soils are well structured and abundant roots occur throughout. This material is

moderately saline with a relatively high sodicity and poor structural stability. The blue-grey sandy clay soils of the Guildford Formation occur beneath the brown clay and shows signs of shrink-swell properties.

Plate 7-1: Typical Soil Characteristics: SMU 1- Uniform Brown Heavy Clay

Morphological description:



Depth (cm)	Soil material	Description
0 10	Topsoil	Dark brown sandy loam to sandy clay, firm crumb structure, plough layer evident, abundant root growth, gradual boundary to
	Overburden	Brown sandy clay to clay, firm polyhedral peds, cutans and slickenslides present on all structural surfaces, abundant root along structural surfaces, clear boundary to
300	Overburden	Blue grey sandy clay, large firm polyhedral peds, cutans, slickenslides present on structural surfaces, abundant (50%) iron oxide mottles decreasing with depth, common (10%) gravel present near upper boundary, localised zones of coarse sand saturated with groundwater, common roots present on structural surfaces, gradual boundary to
500	Overburden	Massive, consolidated laterite layer
700	Ore	Blue grey to pale grey clayey sand to sandy loam, occasional iron oxide mottles, mineralised with heavy minerals, saturated with groundwater.

Soil properties:

Physical properties

Depth (cm)	Soil material	Structure	Particle size distribution				Bulk Density (g/cm^3)	Soil Strength (MPa	Slaking potential	Dispersive potential	Hardsetting potential
			Sand (%)	Silt (%)	Clay (%)	Texture					
0 – 10	Topsoil	Well	67.1	8.2	24.9	Sandy clay loam	1.88	1.2 – 2.0	Very high	High	Very high
100 – 110	Overburden	Well	64.5	12.0	23.5	Clay loam	1.83	1.2 – 2.0	Very high	High	Very high
320 – 330	Overburden	Well	57.9	11.2	30.9	Sandy clay	1.79	1.2 – 2.0	Very high	High	Very high
360 – 370	Overburden	Well	81.9	2.3	15.8	Sandy loam	1.88	1.2 – 2.0	Very high	High	Very high

Chemical properties

Depth (cm)	Soil material	Nutrients (mg/kg)					Org C (%)	Re. Fe (mg/kg)	EC (mS/m)	pH_W	pH_{Ca}	PRI	Exch Cations (meq/100g)				
		NO_3^- -N	NH_4^+ -N	Colwell P	Colwell K	Extr S							Ca	Mg	Na	K	CEC
0 – 10	Topsoil	23	4	85	190	36	4.2	1638	46	5.3	4.9	299	6.3	1.5	2.8	0.1	10.7
100 – 110	Overburden	18	2	26	90	23	2.6	435	40	5.5	5.0	110	4.1	2.3	2.1	0.5	9.0
320 – 330	Overburden	2	1	15	52	18	0.9	200	29	5.8	5.3	83	1.9	4.6	1.3	0.1	7.9
360 – 370	Overburden	1	1	14	40	11	0.1	260	10	5.9	5.4	89	1.6	4.3	0.8	0.1	6.8

7.3.2.2. SMU2: GRADATIONAL PALE GREY SAND- YELLOW SANDY LOAM

SMU2 is equivalent to the pale grey sand - yellow sandy loam soils (Pinjarra Phase 1) of Barnesby and Proulx-Nixon, 1994. The surface soils consist of 10-40cm of pale grey sand grading into a bright yellow to mottled yellow sandy loam at depth (around 1 metre) with a clear boundary to the underlying blue-grey sandy clay soils of the Guildford Formation (Plate 7-2).

The surface soils of SMU1 are not structurally degraded like those of SMU1 and SMU4. This is due to their sandy texture with insufficient clay to bridge the sand grains into a rigid framework and are therefore well drained and friable.

Plate 7-2: Typical Soil Characteristics: SMU 2 – Gradational Pale Grey Sand to Yellow Sandy Loam

Morphological description:

Depth (cm)	Soil material	Description
0		
10	Topsoil	Dark brown to grey sand to loamy sand, single-grain to weak structure, very low soil strength coherence between sand grains, abundant root growth through matrix, gradual boundary to
100	Subso	Bright yellow to mottled yellow sandy loam, moderate to firm crumb peds, abundant roots along structural surfaces, clear boundary to
150	Overburden	Blue grey mottled sandy clay, firm polyhedral peds, abundant iron oxide mottling, common root growth along structural surfaces, gradual boundary to
300	Overburden	Dark grey siliceous clay, very firm polyhedral to platey peds, common iron oxide mottling, common root growth along structural surfaces, gradual boundary to
	Overburden	Blue grey sandy clay, large firm polyhedral peds, cutans, slickensides present on structural surfaces, abundant (50%) iron oxide mottles decreasing with depth, common (10%) gravel present near upper boundary, localised zones of coarse sand saturated with groundwater, common roots present on structural surfaces, gradual boundary to
750	Ore	Blue grey to pale grey clayey sand to sandy loam, occasional iron oxide mottles, mineralised with heavy minerals, saturated with groundwater.

Soil properties:

Physical properties

Depth (cm)	Soil material	Structure	Particle size distribution				Bulk Density (g/cm^3)	Soil Strength (MPa)	Slaking potential	Dispersive potential	Hardsetting potential
			Sand (%)	Silt (%)	Clay (%)	Texture					
0 – 10	Topsoil	Moderate	81.1	12.6	6.3	Loamy sand	1.55	< 0.5	Very high	Very low	Low
50 – 60	Subso	Moderate – well	84.5	12.0	3.5	Loamy sand	1.69	0.5 – 1.2	Very high	Very low	Moderate
150 – 160	Overburden	Well	59.1	7.3	6.7	Sandy clay	1.87	1.2 – 2.0	Very high	Moderate	Very high
700 – 710	Overburden	Well	47.0	7.0	46.0	Sandy clay	–	–	Very high	Very high	Very high

Chemical properties

Depth (cm)	Soil material	Nutrients (mg/kg)					Org C (%)	Re. Fe (mg/kg)	EC (mS/m)	pH_W	pH_{Ca}	PRI	Exch Cations (meq/100g)				
		NO_3^- -N	NH_4^+ -N	Colwell P	Colwell K	Extr S							Ca	Mg	Na	K	CEC
0 – 10	Topsoil	10	11	19	82	12	2.6	563	19.0	5.6	5.0	58	4.3	1.9	0.9	0.6	7.7
50 – 60	Subso	18	2	26	90	23	2.6	435	40	5.5	5.0	110	4.1	2.3	2.1	0.5	9.0
150 – 160	Overburden	1	2	20	65	11	0.5	1236	10	5.9	5.5	120	1.3	5.2	1.0	0.2	7.7
700 – 710	Overburden	1	1	17	65	10	0.1	630	11	6.0	5.2	55	2.6	3.1	1.6	0.2	7.5

7.3.2.3. SMU3: PALE GREY- BROWN SANDY DUPLEX

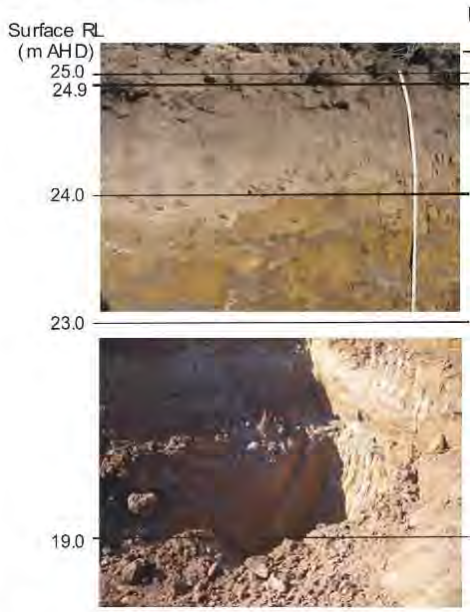
SMU3 consists of up to 1 metre of pale grey – brown sand overlying the blue-grey sandy clay soils of the Guildford Formation with an abrupt textural boundary (Plate 7-3).

This well defined duplex soil boundary results in the sandy surface soils become saturated in winter months with water perching on the clayey soil. The defined duplex boundary facilitates perching and subsequent lateral flow of water.

Due to the sandy texture and low water holding capacity of the surface soil it is likely to dry rapidly during spring, resulting in earlier spring/summer pasture 'dying-off' than other surrounding soil types.

Plate 7-3: Typical Soil Characteristics: SMU 3 – Pale Grey to Brown Sandy Duplex

Morphological description:



Surface RL (m AHD)	Depth (cm)	Soil material	Description
25.0	0		
24.9	5	Topsoil	Greyish brown sand to loamy sand, single-grain structure, very weak coherence between sand grains, loose fabric, abundant roots growing through the matrix, gradual boundary to
		Subsoil	Pale grey to brown sand to loamy sand, single-grain structure, very weak coherence between sand grains, loose fabric, abundant root growing through matrix, abrupt boundary to
24.0	100	Overburden	Blue grey siliceous clay, very firm polyhedral to platey peds, common iron oxide mottling, common root growth along structural surfaces, gradual boundary to
23.0	200	Overburden	Blue grey sandy clay, large firm polyhedral peds, cutans, slickenslides present on structural surfaces, abundant (50%) iron oxide mottles decreasing with depth, common (10%) gravel present near upper boundary, localised zones of coarse sand saturated with groundwater, common roots present on structural surfaces, gradual boundary to
19.0	600	Ore	Blue grey to pale grey clayey sand to sandy loam, occasional iron oxide mottles, mineralised with heavy minerals, saturated with groundwater.

Soil properties:

Physical properties

Depth (cm)	Soil material	Structure	Particle size distribution				Bulk Density (g/cm^3)	Soil Strength (MPa)	Slaking potential	Dispersive potential	Hardsetting potential
			Sand (%)	Silt (%)	Clay (%)	Texture					
0 – 10	Topsoil	Weak – Moderate	81.1	12.6	6.3	Loamy sand	1.57	< 0.5	Moderate	Very low	Very low
20 – 30	Subsoil	Single-grain	96.7	1.6	1.7	Sand	1.65	< 0.5	Very High	Very low	Very low
120 – 130	Overburden	Well	61.4	9.4	29.2	Sandy clay loam	1.78	1.2 – 2.0	Very High	Moderate	Very high
410 - 420	Overburden	Well	57.7	13.2	29.1	Sandy clay loam	1.83	1.8 – 2.5	Very High	High	Very high

Chemical properties

Depth (cm)	Soil material	Nutrients (mg/kg)					Org C (%)	Re. Fe (mg/kg)	EC (mS/m)	pH_W	pH_{Ca}	PRI	Exch Cations (meq/100g)				
		NO_3^- -N	NH_4^+ -N	Colwell P	Colwell K	Extr S							Ca	Mg	Na	K	CEC
0 – 10	Topsoil	2	2	86	120	15	2.0	483	18	5.4	4.7	69	4.3	2.1	0.8	0.6	7.8
20 – 30	Subsoil	2	1	40	83	15	1.4	200	12	5.9	5.4	54	2.6	1.2	0.2	0.1	4.1
120 – 130	Overburden	1	1	15	79	10	0.3	980	10	6.1	5.7	101	2.3	4.0	0.9	0.2	7.4
410 - 420	Overburden	1	1	17	65	10	0.1	630	11	6.0	5.2	55	2.6	3.1	1.6	0.2	7.5

7.3.2.4. SMU4: YELLOW-BROWN MOTTLED DUPLEX

SMU4 consists of bright yellow to brownish orange surface sandy clays (up to 1.5 metres in depth) overlying the blue-grey sandy clay of the Guildford Formation with an abrupt textural boundary (Plate 7-4). These surface soils are coarser than those in SMU1 and therefore better drained.

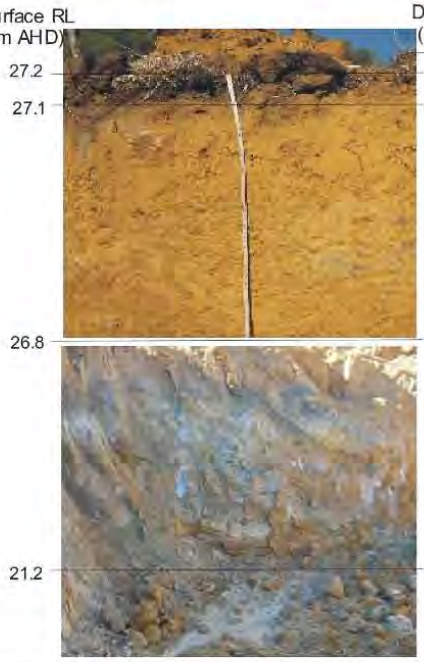
The surface sand clay has a sandy clay texture which is structurally sensitive. These soils slake rapidly when rewet and show moderate dispersion resulting in hardsetting.

Considerable shrink-swell properties have been observed with cracks up to 8cm wide and 40cm deep documented. These properties are due to the high sodicity of this soil and indicate the potential presence of smectite in the clay fraction.

The subsoil consists of bright yellow sandy clay with a very good structure, with firm crumb peds. These subsoils are less dispersive than SMU1, due to the presence of iron oxides and have relatively high plant available water content.

Plate 7-4: Typical Soil Characteristics: SMU 4 – Yellow-Brown Mottled Duplex

Morphological description:



Surface RL (m AHD)	Depth (cm)	Soil material	Description
27.2	0	Topsoil	Dark greyish brown sandy loam to sandy clay, firm crumb structure, plough layer evident, abundant root growth, gradual boundary to
27.1	25	Overburden	Bright yellow to brown sandy clay, moderate to firm crumb peds, mottles increasing with depth, abundant roots along structural surfaces, clear boundary to
26.8	150	Overburden	Blue grey sandy clay, large firm polyhedral peds, cutans, slickenslides present on structural surfaces, abundant (50%) iron oxide mottles decreasing with depth, common (10%) gravel present near upper boundary, localised zones of coarse sand saturated with groundwater, common roots present on structural surfaces, gradual boundary to
21.2	600	Ore	Blue grey to pale grey clayey sand to sandy loam, occasional iron oxide mottles, mineralised with heavy minerals, saturated with groundwater.

Soil properties:

Physical properties

Depth (cm)	Soil material	Structure	Particle size distribution				Bulk Density (g/cm^3)	Soil Strength (MPa)	Slaking potential	Dispersive potential	Hardsetting potential
			Sand (%)	Silt (%)	Clay (%)	Texture					
0 – 15	Topsoil	Moderate – Well	71.1	12.6	16.3	Sandy loam	1.59	1.0 – 2.0	Very high	Very high	Moderate
60 – 80	Overburden	Well	54.7	6.2	39.1	Sandy clay	1.83	1.2 – 2.5	Very high	Moderate	High
260 – 280	Overburden	Well	55.8	9.6	34.6	Sandy clay	1.88	1.2 – 2.5	Very high	High	Very high

Chemical properties

Depth (cm)	Soil material	Nutrients (mg/kg)					Org C (%)	Re. Fe (mg/kg)	EC (mS/m)	pH_W	pH_{Ca}	PRI	Exch Cations (meq/100g)				
		NO_3^- -N	NH_4^+ -N	Colwell P	Colwell K	Extr S							Ca	Mg	Na	K	CEC
0 – 15	Topsoil	8	4	86	120	15	2.4	483	18	5.4	4.7	69	4.3	4.1	1.8	1.6	11.8
60 – 80	Overburden	4	1	40	83	15	1.8	600	12	5.9	5.4	54	3.6	4.2	0.9	0.8	9.5
260 – 280	Overburden	1	2	20	65	11	0.5	736	60	5.9	5.5	120	1.3	5.2	1.8	0.2	8.5

7.3.2.5. PROFILE A

The surface soil layers exhibit gradational boundaries into each other, typically with a clear and distinct boundary into the underlying colluvial deposits of clayey sand (Table 7-2). The typical depth to the clayey sand and thickness of overlying sand/silty sand of increased towards the south/southeast of the Profile A distribution.

Table 7-2: Generalised Subsurface Profile: Profile A

Unit	Soil Type	Typical Depth to Top of Layer (m)	Typical Layer Thickness (m)	Description/Remarks
A1	SAND / Silty SAND	Surface	0.1 to 0.2	Fine to medium grained; dark grey / dark grey brown / black. Cohesionless, abundant root growth. Clear boundary into underlying sand/silty sand.
A2	SAND / Silty SAND	0.1 to 0.2	0.2 to 1.8	Fine to coarse grained; grey / pale yellow grey / pale brown, trace to some clay and silt. Moderate to firm crumb peds. Sharp boundary into clayey sand.
A3	Clayey SAND	0.4 to 1.8	> depth of 3.0m	*(Colluvium)* Fine to coarse grained; pale blue grey mottled orange / orange mottled pale blue grey / pale orange brown, trace to some fine to medium grained laterite gravel; low to medium plasticity clay. Firm polyhedral peds.

7.3.2.6. PROFILE B

Similar to Profile A, gradational boundaries occur between the surface soil layers, however Profile B comprises pale brown / orange brown subsoil separated from the clayey sand layer by a distinct gravel/gravelly layer (Table 7-3).

Table 7-3: Generalised Subsurface Profile: Profile B

Unit	Soil Type	Typical Depth to Top of Layer (m)	Typical Layer Thickness (m)	Description/Remarks
B1	SAND/Silty SAND	Surface	0.2	Fine to medium grained; grey/dark grey / dark brown / black; with root material. Clear transition into sand/silty sand
B2	SAND/Silty SAND	0.2	0.6 to 1.8	Fine to medium grained; pale brown / orange brown / pale yellow; trace to some clay and silt. Gradual transition into clayey sandy gravel
B3	Clayey Sandy GRAVEL / Gravelly SAND	0.6 to 2.5	1.0 to 3.0	Fine to medium grained gravel; orange brown / red brown; laterite gravels. Fine to coarse grained sand; Clear change into clayey sand.
B4	Clayey SAND / Sandy CLAY	2.3	> depth of 3.0m	Similar to Unit A3 of Profile A. *(Guildford Formation)* Fine to coarse grained; pale blue grey mottled orange / orange mottled pale blue grey / pale orange brown (dark brown within BH22), trace to some fine to medium grained laterite gravel; low to medium plasticity clay.

Notes for Table 6:

1) *Gravelly layer extends to 5.5m at BH29*
2) *Depth to gravelly material increases towards the south of the project site*

7.3.2.7. PROFILE C

Within Profile C a clear boundary occurs between the orange brown sandy clay and the pale blue grey mottled orange/red sandy clay of the Guildford Formation (Table 7-4). The topsoil of Profile C has a higher clay content relative to adjacent soil profiles and the clay content increases with depth. The topsoil was observed to be hard-set with surface shrinkage-swell cracking, likely to be associated with the reworking of the soil due cattle grazing during the wetter parts of the year.

Table 7-4: Generalised Subsurface Profile: Profile C

Unit	Soil Type	Typical Depth to Top of Layer (m)	Typical Layer Thickness (m)	Description/Remarks
C1	Silty Clayey SAND / Clayey SAND	Surface	0.1 to 0.2	Fine to medium grained, pale brown; abundant root growth; firm crumb peds; gradual boundary to Unit C2
C2	Sandy CLAY / CLAY	0.1 to 0.2	2.8 to 2.9	Low to high plasticity clay (increasing with depth), orange brown / brown minor mottling of grey / red brown mottled orange and grey, trace to some gravels of quartz and laterite, trace to some sand; firm crumb peds; clear boundary to Unit C3.
C3	Sandy CLAY / Clayey SAND	3.0	> depth of 6m	*(Guildford Formation)* Fine to coarse grained; pale blue grey mottled orange / orange mottled pale blue grey / pale orange brown, trace to some fine to medium grained laterite gravel; low to medium plasticity clay.

Note for Table 9:

(1) Ilmenite lenses encountered from 1.5m to 1.6m in BH33

7.3.2.8. PROFILE D

The surface soils of Profile D are deposited on the clayey soils typical of the Yoganup Formation (Table 7-5). The typical depth to the clayey sand and thickness of overlying sand increases towards the south.

Table 7-5: Generalised Subsurface Profile: Profile D

Unit	Soil Type	Typical Depth to Top of Layer (m)	Typical Layer Thickness (m)	Description/Remarks
D1	SAND/Silty SAND	Surface	0.1 to 0.3	Fine to coarse grained, dark grey/black to grey *(with trace to some laterite gravel BH02 and BH07)*
D2	SAND	0.1 to 0.3	1.0 to 2.9	Fine to coarse grained, grey to pale yellow brown / pale grey / pale yellow grey; trace to some clay
D3	Clayey Sandy GRAVEL	0.5 to1.0	0.5 to 2.0	Fine to medium grained laterite gravel; grey mottled orange / orange brown / red brown. Sand, fine to coarse grained, pale grey. (Gravelly sand encountered in BH07)
D4	Clayey SAND / Sandy CLAY	1.0 to 3.0	>depth of 3.0m	*(Generally Yoganup Formation)* Fine to coarse grained, pale blue grey mottled orange; with some fine to coarse laterite and quartz gravel. Quartz gravel content increasing to the south of the site. Occasional very coarse quartz sand deposits. Very fine grained ilmenite mineral was observed throughout the formation.

Notes for Table 12:

(1) Unit D3 only encountered in BH06, 07, 16, 18, 25 and 37 (likely to be interbedding with gravely soil units of Profile E to the east)

(2) Unit D4 is pale grey / pale blue grey with no mottling in BH37, 38 and 40 located within the younger element of the Yoganup Formation.

7.3.2.9. PROFILE E

Profile E encompasses the Whicher gentle slopes with the typical thickness of the sandy soils significantly greater in the northern part of the profile distribution (Table 7-6). The surface soil layers exhibit clear boundaries into each other, with the topsoil typically non-sodic becoming moderately sodic in the underlying subsoil.

Table 7-6: Generalised Subsurface Profile: Profile E

Unit	Soil Type	Typical Depth to Top of Layer (m)	Typical Layer Thickness (m)	Description/Remarks
E1	SAND	Surface	0.1 to 0.7	Fine to medium grained; dark grey / grey / brown; with some gravel
E2	Sandy GRAVEL/Gravelly SAND	0.1 to 0.7	0.2 to 1.5 >3.0m depth	Fine to medium grained laterite gravel; orange / orange brown / red brown. Sand, fine to coarse grained; pale orange; trace to some clay. Laterite gravel likely to be interspersed laterised beds / iron-cemented ferricrete.
E3	Clayey Gravelly SAND	0.8 to 1.0	>3.0m depth	*(Yoganup Formation)* Fine to medium grained; pale orange to yellow; fine to medium grained gravel of laterite

7.3.3. AVAILABLE SOIL RESOURCES

As at March 2019, all soil resources have been used to rehabilitate the Mine. A description of the characteristics of soil resources used in rehabilitation is provided below and a summary of typical properties of these materials is provided within Table 7-7.

7.3.3.1. TOPSOIL

Doral strips and stores topsoil at locations close to where it will be required for future rehabilitation. Topsoil is stripped from all locations and is distinguished from subsoil by colour. Where different qualities of topsoil are identified topsoil is stockpiled separately. Qualities that are used to segregate topsoil into separate stockpiles are:

- Landform position; sand (e.g. from Whicher scarp landforms), clay (e.g. Pinjarra plain landforms);
- Vegetation type; native, pasture;
- Dieback presence;
- Noxious weed infestation;
- Waterways (riparian topsoil is stockpiled separately).

All disturbance areas have been rehabilitated and covered with sufficient topsoil, with only a small volume of topsoil left on site for use on an as needs as basis for any small areas that may need rectifying (i.e. subsistence, areas washed by rain etc.).

7.3.3.2. SUBSOIL

From the soil studies completed, two different subsoil types have been identified; pale grey sands (subsoil from SMU3) and yellow sandy loams (subsoil from SMU 2 and 4).

Pale grey sands have a single grained structure, low plant available water content and low chemical fertility.

Yellow sandy loams are well structure with high plant available water content and good ability to retain plant nutrients. This material is considered optimal for return to reconstructed soil profiles.

No subsoil stockpiles remain.

7.3.3.3. OVERBURDEN

All of the clay materials stripped during mining (the Guildford Formation blue grey sandy clay, the brown clay of SMU1 and yellow-grown mottled sandy clay of SMU4) are classified as overburden.

Overburden materials are well structured clays (or sandy clays) with or without gravel. These soils are strongly to moderately acidic with very low salinity. Structural stability of these materials are variable with macro and micro stability ranging from very good through to very poor, which is consistent with the moderate to high sodicity rating of these materials. These materials have very slow to slow permeability.

No overburden stockpiles remain on site.

7.3.3.4. DRIED CLAY FINES

Clay fines generated from wet concentration are dried in solar evaporation ponds. Once dried enough to be moveable by machinery these materials are available for use.

Industry experience indicates that this material can be useful to apply at low rates to mix with sandy soils, particularly in the foothill landforms, where they can improve the soils plant available water content.

Application rates must be carefully managed as these materials if placed at the soil surface and not mixed with sand to a loamy texture can become hard setting. Furthermore, if placed on top of sandy materials and a sharp textural boundary exists, loamy and clayey surface soils can form a hydraulic break over the sandy soils and prevent water infiltration.

All dried clay fines have been backfilled into mine voids.

7.3.3.5. TAILINGS SAND

Tailings sand generated from wet concentration are typically disposed of directly to mine voids. These materials contain very low proportions of clay (typically less than 1 or 2%) and no gravel, as this was removed as oversize.

These materials are single grain sands, with very rapid permeability.

All tailings sand has been hydraulically returned to mine voids.

7.3.3.6. CO-DISPOSED TAILINGS (SAND/CLAY MIX)

Clay fines and tailings sand are from time to time co-disposed within the mine voids. These materials are a mix of clay fines slurry and sand tailings resulting in a less rapid permeability than just tails sand.

7.3.3.7. OVERSIZE/ GRAVEL

At the feed preparation plant, gravel and oversize is removed from the ore. At Dardanup this material tends to be a mix of gravel and clay balls and overall is considered clayey material. It is typically disposed to mine voids with overburden material.

No oversize/gravel stockpiles remain on site.

Table 7-7: Typical Properties of Soil Resources

Soil Resource		Topsoil[A]	Subsoil[A]	Overburden[A]	Dry Clay Fines[B]	Tailings Sand[B]	Co-disposed Tailings[B]	Oversize[B]
Texture		Sandy to Sandy clay	Sandy loam	Sandy Clay to Clay	*Clay*	*Sand*	*Variable*	*Sandy Clay*
Structure		Single-grain	Well	Well	*Massive*	*Single Grain*	-	-
Gravel (>2mm) %		0%	0.4%	2 - 40%	*0%*	*0%*	*0%*	*>50%*
pH [pHCa (1:5)]		Moderately Acidic 5 to 5.5	Moderately Acidic 5.3	Strongly to Moderately Acidic 4.7 – 5.5	*Moderately Acidic*	*Moderately Acidic*	*Moderately Acidic*	*Moderately Acidic*
Salinity [EC (1:5) mS/m]		Very Low to Low 4 - 41	Very Low 8.5	Very Low 8.5 – 17.3	*Very Low*	*Very Low*	*Very Low*	*Very Low*
Permeability [Saturated Hydraulic Conductivity (m/d)]		Moderate to Rapid [0.5-3.5 m/d]	Moderately Slow [0.42 m/d]	Very Slow to Slow [0.01–0.1 m/d]	*Slow*	*Very Rapid*	*Slow*	*Moderate to Rapid*
Plant Available Water Content		0.052 – 0.089	0.083	0.073 – 0.149	*Moderate*	*Low*	*Moderate*	*Low*
Structural Stability	Macro	Poor to Very Poor	Very Poor	Moderately Good to Very Poor	*Poor*	*Poor*	-	-
	Micro	Very Good to Very Poor	Very Good	Very Good to Poor	-	*Poor*	-	-
Sodicity [ESP (%)]		3.37 - 27.6 Low to High	13.8 Moderate	9 – 24% Moderate to High	-	-	-	-
Organic Carbon %		1.6-3.2% Low to High	0.2% Moderate	0.2 – 0.3% Moderate	*Low*	*Low*	*Low*	*Moderate*
Nutrients		Low to High	Low	Low	*Low*	*Low*	*Low*	*Low*

Notes: A Data based on test work.

B Based on observation and industry knowledge

7.3.4. ACID SULPHATE SOILS

The western portion of the Dardanup Mine site is mapped as having Moderate to Low risk that Acid Sulfate Soils (ASS) are likely to occur at depths within 3m of natural soil surface. Desktop and field studies conducted for the Western Extension (146 drill holes across the study area from depths of 7–20m and analysed every metre of the drill holes for pHF and pHFOX. A total of 2,054 soil samples were tested and 100 soil samples were analysed for SCR) identify that potential ASS material associated is largely confined to pyritic sediments associated with the upper Leederville Formation, which occur beneath the orebody.

The ASS Management Plan (DMS-EMP-10.2 see Appendix A) documents strategies to minimise the disturbance of identified ASS by direct excavation or dewatering (where possible); to ensure that ASS material is appropriately neutralised if exposed; and to monitor groundwater and dewatering effluent to assess quality against appropriate assessment criteria.

During the mining of the Burekup deposit, when ground disturbance and pit dewatering occurred in areas of identified Potential Acid Sulfate Soils (PASS) located beneath the ore body, daily monitoring of the nearest downstream bore was conducted to detect if the PASS material is exposed and impacting on the acidity of the groundwater. Results from the daily monitoring of dissolved oxygen, Sulfate, Nitric and Ferric Ions did

not indicate any exposure of PASS causing acidification of groundwater and groundwater monitoring data does not show any significant changes in groundwater chemistry.

An ASS investigation into the acid generating potential of soils located within the Dardanup Southern Extension was conducted and reported that no acidity requiring specific management was identified in soils located within the Dardanup Southern Extension.

7.3.5. POST-MINING SOIL PROFILES

Records have been retained of what type of material has been utilised to backfill the mining pits and of what type of materials have been used to establish the post-mining soil profile, as described in Table 7-8 for locations shown in Figure 7-5.

Table 7-8: Mine Pit Backfill Material Description

Block ID	Year	Block Description	Mining Depth	Backfill	Soil Profiles
BW01	2010	Burekup West North of Harris Road	11.3 - 16.4m	Clay Overburden	100mm Topsoil, 300mm Tailsand, 400mm Subsoil
BW02	2009	Burekup West Mining Block 13	9.0 - 11.0m	Clay Overburden	Nil - Not Completed
BW03	2010	Burekup West South of Harris Road	12.8 -14.1m	Clay Overburden	100mm Topsoil, 500mm Subsoil
BW04	2010	Burekup West Mining Block 7 + 9	9.5 - 10.5m	Sand Tails	100mm Topsoil, 300mm Tailsand, 400mm Subsoil, 1.0m O/Burd
R01	2010	Burekup West Harris Road Reserve	12-14m	Compacted 1.0m Lifts to 97% Clay Overburden	Clay Table Drains Compacted Graded Gravel Bitumen
W1	2009	Willoughby	12-14m	Sand Tails	200mm Topsoil, 300mm Subsoil, 1.0m Clay Overburden
W2	2009	Willoughby	8-14m	Sand Tails	Nil - Solar Evap Pond
W3	2009	Willoughby Extension	12.2 - 14.2m	Sand Tails	Nil - Solar Evap Pond
W4	2010	Willoughby West	7.4 - 10.5m	Sand Tails	Nil - Solar Evap Pond
W5	2011	Willoughby South	6.5 - 12.7m	Dry Slime	Nil - Not Completed
BW05	2011	Burekup West Mining Blocks 6 + 8	14.0 - 16.8m	Clay Overburden	100mm Topsoil, 300mm Tailsand, 400mm Subsoil
BW06	2011	Burekup West Blocks 10 + 11	11.7 - 14.5m	Sand Tails	Nil - Not Completed
BW07	2011	Burekup West Blocks 13 + 14	11.3 - 14.0m	Clay Overburden	Nil - Not Completed
R02	2012	Burekup West StHelena Road	8.9 - 12.6m	2m Clay o/Burd compacted to 95% Tails Sand	200mm Gravel For road 2.0m Overburden on verge and 100mm Topsoil
				compacted 600 then 300mm Lifts 200mm Gravel	
BN01	2011, 12	Burekup North Block 43 - 58	7.0 - 11.3m	Clay Overburden	130mm Topsoil, 138mm Subsoil, 150mm Tail Sand, Ripped & Cross Ripped
BN02	2013	Burekup North Block 60	1.5 - 2.8M	Clay Overburden	100mm Topsoil 130mm Subsoil 200mm Tails Sand
BN03	2013	Burekup North Block 54	2.3 - 2.6M	Clay Overburden	100mm Topsoil 130mm Subsoil 200mm Tails Sand
BN04	2013	Burekup North Block 36 - 50	1.8 - 14.0M	Co Disposed Tails	100mm Topsoil, 100mm Subsoil, 100mm Tails Sand, 1000mm Caly Overburden
BW08	2011,12	Burekup West Blocks 15	7.5 - 11.2m	Co Disposed Tails ~15% Slime Flocced into tails	Nil - Not Completed
BW09	2011	Burekup West Blocks 18	7.5 - 11.1m	Clay Overburden	Nil - Not Completed
BW10	2012	Burekup West Blocks 18	9.8 - 10.8m	Sand Tails	Nil - Not Completed
BW11	2012	Burekup West Blocks 17	8.0 - 10.6m	Sand Tails	Nil - Not Completed
BW12	2012	Burekup West Blocks 18	8.0 - 10.6m	Sand Tails	Nil - Not Completed
ED01	2012	Edwards Winter Sand Supply	9.4 - 11.3m	Sand Tails Winter Sand Supply	Nil - Not Completed
ED02	2012	Edwards Winter Sand Supply	8.4 - 10.5m	Sand Tails	Nil - Not Completed
ED03	2010	Edwards West	4.5 - 6.5m	Oversize Dry Slime	200mm Topsoil, 500mm Subsoil
ED04	2008	Edwards	5.5 - 10.0	Oversize	200mm Topsoil, 500mm Subsoil
ED05	2009	Edwards	10m	Oversize	Nil - Not Completed
ED06	2009	Edwards	7.0 - 11.0m	Sand Tails	200mm Topsoil, 500mm Subsoil, 1.0m Clay Overburden
ED07	2009	Edwards	7.0 - 11.0m	Sand Tails	Nil - Not Completed

Block ID	Year	Block Description	Mining Depth	Backfill	Soil Profiles
ED08	2013	Burekup West Blocks 21 to 24	9.7 - 10.6M	Oversize Dry Slime	Not completed
ED09	2013	Burekup West Blocks 21 to 25	9.7 - 10.6M	Oversize	Not completed
SO1	2013	Burekup West Block 33	9.1 - 13.4M	Co Disposed Tails	Not completed
SO2	2013	Burekup West Block 31	9.9 - 14.2M	Clay Overburden	Not completed
SO3	2014	Burekup West Block 31	8.9 - 15.5M	Co Disposed Tails	Not completed
SO4	2014	Burekup West Block 30	12.4 - 14.6M	Dry Slime	Not completed
SO5	2013	Burekup West Block 30	12.4 - 14.6M	Oversize - NOT YET COMPLETE	Not completed
S2	2014	South Simpson Block 2	2.0 - 4.5M	Sand Tails, Dry Slime and Clay Overburden	Not completed
S3	2014	South Simpson Block 3	1.5 - 4.1m	Oversize and Dry Slime	100mm Topsoil, 100mm Subsoil
S4	2014	South Simpson Block 4,5,6,25,26	7.0 - 14.9m	Co Disposed Tails	Not completed
S7	2014	South Simpson Block 7,10,20,21	7.0 - 14.9m	Co Disposed Tails	Not completed
S18	2014	South Simpson/Waterloo Block 18	3.0 - 10.0M	Co Disposed Tails	Not completed
D8	2014	Depiazzi Block 8	9.0 - 9.5M	Clay Overburden	Not completed
WP1	2007	West Pit	10.2m	Co Dispoded Trial Cell	100mm Topsoil, 600mm Subsoil, 1.0m O/Burden
WP2	2006	West Pit	6.0 - 8.0m	Clay Overburden	100mm Topsoil, 600mm Subsoil, 1.0m O/Burden
WP3	2007	West Pit		Co Disposed Tails ~15% Slime Flocced into tails	100mm Topsoil, 600mm Subsoil, 1.0m High Clay Oversize or Clay overburden
WP4	2007	West Pit		Sand Tails	100mm Topsoil, 600mm Subsoil, 1.0m O/Burden
O1	2008, 09	Offer	2 - 3.5m	Dry Slime	200mm Topsoil, 400mm Tail Sand Ripped & Cross Ripped with Slime Fill
O2	2008, 09	Offer	2 - 3.5m	Dry Slime	200mm Topsoil, 400mm Tail Sand Ripped & Cross Ripped with Slime Fill
O3	2007	Iluka Tails	2 - 4m	Sand Tails	Nil - Solar Evap Pond
O4	2008	Offer	4m	High Clay Oversize	Nil - Not Completed
O 5	2005	Original Pit Area	4.5 - 8.0m	Sand Tails	Nil - Solar Evap Pond
C1	2008	Carbone	2 - 6.5m	Dry Slime	150mm Topsoil, 300mm Tail Sand Ripped & Cross Ripped with Slime Fill
C2	2009	Carbone	3 - 6.5m	Dry Slime	150mm Topsoil, 300mm Tail Sand Ripped & Cross Ripped with Slime Fill
WW1	2009	Wayne's World	8m	Dry Slime	150mm Topsoil, 300mm Sub soil
G01	2009	Gilgie Pit	8 - 11.2m	Dry Slime	Nil - Not Completed
TN1	2009	Tyrrell Nth	5.6 - 8.8m	Sand Tails	100mm Topsoil, 100mm Subsoil, 500mm O/Burden
TN2	2009	Tyrrell Nth	6.0 - 8.2m	Co Disposed Tails ~15% Slime Flocced into tails	100mm Topsoil, 100mm Subsoil, 500mm O/Burden
TN3	2009	Tyrrell Nth	6.0 - 8.2m	Sand Tails	Nil - Not Completed
TN4	2009	Tyrrell Nth	6.0 - 8.2m	Sand Tails	200mm Topsoil, 500mm Subsoil, 1.0m Clay Overburden
TS1	2008	Tyrrell South	8.5 - 9.0m	High Clay Oversize	Nil - Not Completed
TS2	2008	Tyrrell South	7.0 - 9.0m	High Clay Oversize, Dry Slime & Ccay Overburden	Nil - Not Completed
TS3	2013	Tyrrell South Block 25	1.4 - 4.7m	Clay Overburden	Sand Tails, 1m overburden, 200mm sand tails, 100mm subsoil, 100mm topsoil
TS4	2008	Tyrrell South Block 27	7.0 - 9.0m	High Clay Oversize	Nil - Not Completed
TS28	2014	Tyrell South Block 28	3.0 - 5.0M	Dry Slime, Oversize and Clay Overburden	Not completed

7.4. WATER

7.4.1. SURFACE WATER

The Dardanup Mine is located within the Collie River system which drains to the Leschenault Estuary, near Australind. The majority of the mine site is within an unnamed catchment that flows through constructed drainage channels, with a small area to the north within the Henty Brook catchment and a small area to the south west of the site being within the Paradise Creek catchment (Figure 7-7).

The Mine is located within the Collie River Irrigation District proclaimed under the Rights in Water and Irrigation Act 1914.

The Harvey Water Irrigation Channel flows through the Mine as show in Figure 7-6 and Figure 7-7. Three irrigation distribution channels also occur within the site, the Spray Channel (see Figure 7-8), Swan A Channel and Swan Main Channel (see Figure 7-9).

There are a number of ephemeral minor water courses and three creeks (Offer, Willoughby and Paradise Creeks) that flow in a north-west direction across the site. Of these waterways only Offer and Paradise Creeks flow under the Harvey Water Irrigation Channel, the others all discharge directly into the Harvey Water Irrigation Channels (see Figure 7-10).

There are also a number of public work drains within and around the project area, including one east of the Conservation Category Wetland (Figure 7-11) and one within the Dowdells Line road reserve.

Physico-chemical water quality variables for the area are within the ranges expected for 'slightly to moderately disturbed' ecosystems (Doral, 2008).

The western portion of the site is relatively flat low-lying land which contains wetlands as described within Section 7.5

7.4.2. GROUNDWATER

7.4.2.1. CONCEPTUAL HYDROGEOLOGY

The conceptual hydrogeology at the site compliments the stratigraphy as described in Table 7-9. Two aquifers are recognised locally, the sediments that make up the Guildford and Yoganup Formations contain the Superficial aquifer and the underlying Leederville Formation contains the Leederville aquifer. The lithological units described in Table 7-9 are schematically represented in cross section in Figure 7-1.

Table 7-9: Generalised Geology and Hydrogeology of the Dardanup Mine (adapted from Parsons Brinckerhoff, 2012a)

Lithology	Typical thickness (m)	Aquifer systems
Superficial Formation: **Guildford Formation** Predominantly of fluvial origin and sourced from erosion of weathered granitic material from the Darling Scarp (WAWA, 1994). The formation comprises brown to dark grey clays, with isolated lenses of silt and sand near the base.	22	**Superficial Aquifer:** Discontinuous aquifer
Yoganup Formation A shoreline deposit consisting of beach sands and conglomerate, located predominantly along the foot of the Darling Scarp (WAWA, 1994). The		Unconfined/Semi-confined aquifer

Lithology	Typical thickness (m)	Aquifer systems
Formation comprises white to yellowish-brown, unconsolidated, poorly sorted sand, gravel and pebbles, with local subordinate clay, ferruginised grains and heavy minerals (Low, 1971)		
Leederville Formation Interbedded units of sands and shales. Broadly divided into an upper, predominantly shaly section and a lower sandy section. Individual beds are generally discontinuous (WAWA, 1994).	150 – 200	Leederville aquifer
Bunbury Basalt Fresh, columnar jointed olivine basalt with a maximum thickness of 63 m (WAWA, 1995)	<63	Aquitard/Aquiclude
Yarragadee Formation Weakly consolidated sandstone, siltstone and shale. The contact between the Formation and the underlying Cockleshell Gully Formation is gradational (WAWA, 1994)	200-1,300	Yarragadee aquifer
Cockleshell Gully Formation Eneabba Member: Angular – subangular, weakly cemented quartz sandstone containing accessory pyrite and garnet, and weakly consolidated siltstone and shale (generally multi-coloured) (Deeney, 1989). Cattamarra Member: Angular – subangular, weakly cemented quartz sandstone containing accessory pyrite, and weakly consolidated siltstone and shale (generally grey, brown or olive green) (Deeney, 1989).	2,000	Lower Yarragadee aquifer

7.4.2.2. SITE HYDROGEOLOGICAL CHARACTERISTICS

Doral has untaken groundwater testing and monitoring since production began in 2002. Recently Doral engaged Parsons Brinckerhoff to develop a calibrated numerical groundwater model for the Dardanup Mine. This model was originally developed for the Burekup Mineral Sands Deposit environmental impact assessment in 2006 and has been revised progressively over the past six years to calibrate the model against groundwater monitoring that has been undertaken during mining operations (Parsons Brinckerhoff, 2012a).

Groundwater flow in the Superficial and Leederville aquifers is generally in a north-westerly direction toward the coast (Parsons Brinckerhoff, 2012a).

Groundwater monitoring indicates that the hydraulic head in the Superficial aquifer is between 0.1 mBGL and 6 mBGL, with some surface areas becoming inundated during the winter months. There is a difference in piezometric head between the Superficial and the Leederville aquifers which is likely to cause localised upward leakage into the Superficial aquifer where confining beds are absent.

Based on aquifer test results, the transmissivity of the Superficial aquifer ranges between 0.5 m^2/day and 79 m^2/day. The highest transmissivity values represent the sand-dominated Yoganup Formation (which is the mine's primary ore body). The high clay content of the Guildford Formation results in surface water ponding in some areas; particularly during the winter months.

Hydraulic heads within the Superficial aquifer range between 100 mAHD in the southeast of the site to 15 mAHD in the northwest of the site. The hydraulic gradient of the groundwater table follows topography and is, hence, highest near the scarp before declining towards the coast.

Aquifer test results show that the transmissivity of the Leederville Aquifer ranges between 4.9 m^2/day and 46 m^2/day. Hydraulic head measured in piezometers screened within the Leederville aquifer show similar hydraulic heads to the Superficial aquifer.

The Leederville aquifer is hydraulically isolated from the Superficial aquifer where a marker horizon of grey clay and silts is present. Some degree of hydraulic connectivity between the two formations may exist where the silt and clay marker horizon is thin or absent. This can result in upward leakage from the Leederville aquifer.

The Superficial aquifer is directly recharged by rainfall infiltration and by localised upward hydraulic head from the underlying Leederville aquifer. Discharge occurs as baseflow to surface drainage features, wetlands, rivers, evapotranspiration and downward leakage.

Regional recharge to the Leederville aquifer is provided through infiltration of rainfall on the Blackwood Plateau to the south and by localised downward leakage from the Superficial aquifer or upward leakage from the Yarragadee Formation. Discharge is to vertically adjacent aquifers and the ocean.

7.4.2.3. GROUNDWATER QUALITY

Groundwater quality ranges from fresh to brackish in the Superficial aquifer depending on proximity to recharge areas and the local lithological composition (Parsons Brinckerhoff, 2012a). Monitoring of groundwater bores on site shows that groundwater to the north and south of the main mining areas are brackish to saline (Figure 7-12). Historical monitoring shows groundwater pH ranges from 4.5 - 6.5 (neutral to slightly acidic) (Doral, 2012).

7.4.2.4. GROUNDWATER MANAGEMENT AREA

The Dardanup Mine is partially located within the Dardanup Groundwater Management Sub-Area of the Bunbury Groundwater Area. Dowdells Road represents the eastern boundary of the Dardanup Sub-Area. The eastern half of the mine is located on an unproclaimed groundwater area.

7.5. WETLANDS AND GROUNDWATER DEPENDENT ECOSYSTEMS

7.5.1. WETLANDS

The majority of wetlands in the area of and around the Dardanup Mine are Melaleuca wetlands over pasture. Most of these are classified as ‘multiple use’ (wetlands with few important ecological attributes and functions remaining), primarily based on the wetland geology (Parsons Brinckerhoff, 2012b).

The Dardanup Mine contains the following wetlands (as shown in Figure 7-13):

- Conservation Category Wetland (CCW) UFI 2362 (sumpland);
- Resource Enhancement Wetland (REW) UFI 2165 (sumpland).

While these wetlands are considered of limited regional conservation value they have been conserved during operations and values incorporated into the post-mining land use. The CCW has been fenced and annual revegetation planting has taken place since 2010. Discussions with the National Trust for the conservation covenant to be placed over the CCW are underway and due for completion in mid-2015.

Fencing is yet to be undertaken at the REW due to the inability to gain clear advice from DPaW regarding the true site of the wetland and the realistic expectation for the fencing and rehabilitation of the area. The area of the REW has been intensively grazed for many years and has conflicting land use requirements of the owner. These issues are yet to be resolved.

No conservation significant wetlands have been identified in the Southern Extension area.

7.5.2. GROUNDWATER DEPENDENT ECOSYSTEMS

A study into the groundwater dependence of vegetation within the western extension of the Dardanup Mine found that the majority of vegetation in the vicinity of this area is not dependent on groundwater (Soil Water Consultants, 2007b). Rather, the vegetation is reliant on soil moisture. Isolated areas of lower depth to groundwater occur, where the vegetation has a degree of dependence on groundwater. Groundwater dependent vegetation is restricted to vegetation shown in Figure 7-14.

Monitoring of canopy health of these trees has been undertaken monthly since February 2009. Monitoring data has so far shown that stress observed in monitored and control sites is typically a reflection of the rainfall received such as in 2010 when very low rainfall was received. Vegetation health monitoring trends have not indicated impacts due to mining and dewatering throughout the monthly monitoring during dewatering activities and for the 24 months post dewatering in the Burekup West regions.

Within the southern extension 16 of the 35 vegetation types present have species that may be influenced by changes to groundwater levels (Figure 7-15). These communities have a condition rating of 'Degraded'.

In addition there are two vegetation types (CcXp and CcKa) that have values in common with TEC SCP3 (*Corymbia calophylla* and *Xanthorrhoea preissii* woodlands) and SCP3b (C*orymbia calophylla – Kingia australis* woodlands and shrublands). These sites are classified as being in 'Degraded' condition and demonstrate less than 17% floristic similarity with the TEC communities (Mattiske Consulting, 2011).

Mining in the southern extension and subsequent dewatering is expected to result in localised drawdown of the Superficial Aquifer, as modelled by PB (2012). However, research of soil profiles and groundwater characteristics have indicated that GDEs have access to a perched groundwater system which will not be affected by dewatering of the Superficial Aquifer (Aurora Environmental, 2012a).

Monitoring since the commencement of the Southern Extension operations has not shown any significant impact to surrounding vegetation.

7.6. VEGETATION

Five major vegetation studies have been undertaken at the Dardanup Mine, by Mattiske Consulting, Coffey Environments and Ecoedge. The first, over the footprint of the original Dardanup Mine was conducted in 1991, then the western extension (Burekup Deposit) was surveyed in 2006 and 2007. The Southern Extension was first surveyed by Coffey Environments in 2008 which was later re-verified by Mattiske in 2011. The Waterloo Block addition to the Southern Extension was conducted in 2013 by Ecoedge. The description below draws upon the studies and summarises key findings across the entire site.

7.6.1. NATIVE VEGETATION

The Dardanup Mine is largely cleared with a small total area of remnant vegetation. All areas of remnant vegetation in the area have been affected by grazing and fire and are generally of degraded condition (see Figure 7-16 and Figure 7-17).

The predominant vegetation of the Dardanup Mine area prior to disturbance is considered to have been an open forest of *Eucalyptus calophylla* (Marri), with *E. marginata* (Jarrah) co-occurring on higher and better-drained sites. The western, north-western and southern parts of the Mine support a mixture of vegetation types, including a woodland of *E. rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* (Swamp Paperbark), and low woodlands and thickets of Swamp Paperbark, of *M. preissiana* (Moonah) and of *Casuarina obesa* (Swamp Sheoak).

7.6.2. CONSERVATION SIGNIFICANT FLORA

No Declared Rare Flora (DRF) species have been recorded at the Dardanup Mine.

No flora, pursuant to the *Environment Protection Biodiversity Conservation Act 1999*, have been recorded within the Dardanup Mine.

No priority Flora species as listed by the DBCA have been recorded at the Dardanup Mine.

During the 2006 surveys for the Western Extension two Priority flora species that had been listed on databases within the proposed Western Extension disturbance area were searched for and not found within the disturbance area.

7.6.3. THREATENED ECOLOGICAL COMMUNITIES

Two communities defined as having values in common with the SCP3 and SCP3b Threatened Ecological Communities (TEC) (Aurora Environmental, 2012a) are located within the road reserve of Simpson Road and are outside the site disturbance area.

No TECs have been identified in the other studies within the Dardanup Mine area.

7.6.4. WEEDS

Due to the prevailing land uses and pre-mining historic practices at the Dardanup Mine and surrounding areas there are many weeds present at the site.

When the initial botanical survey work was conducted at the site in 1991, 29 introduced and naturalised plant species were identified.

In 2006 of the footprint of the Western Extension 86 taxa recorded in the flora survey were introduced or weed species (Mattiske Consulting Pty Ltd, 2006). Four of these were Declared Plants pursuant to Section 37 of the *Agriculture and Related Resources Protection Act 1976*. They were:

- *Acacia dealbata* (Silver Wattle) P1, P2;
- *Rubus fruticosus agg.* (Blackberry) P1, P4;
- *Asparagus asparagoides* (Bridal creeper) P1;
- *Gomphocarpus fruticosus* (Narrowleaf Cotton Bush) P1, P4.

Rubus fruticosus agg. (Blackberry) and *Asparagus asparagoides* (Bridal creeper) are listed by the Commonwealth as Weeds of National Significance (WoNS).

Doral has an ongoing weed control programme within native revegetation areas and additional targeted weed control across the whole site focussing on *Solanum linnaeanum* (Apple of Sodom), *Gomphocarpus fruticosus* (Narrow-leaf Cotton Bush) and *Phytolacca octandra* (Inkweed).

7.7. DIEBACK

The majority of the Dardanup Mine site is not interpretable for dieback (*Phytophthora cinnamomi*), due to the absence of native vegetation over the majority of the area. Dieback investigations have been conducted on site with one area identified as containing dieback. The area has been signposted and access to this area has been restricted. Management of other vegetated areas has been to avoid impact by restricting access and conducting appropriate hygiene practices.

7.8. FAUNA

Due to the disturbed nature of the Dardanup Mine fauna assessments to date have reported limited fauna values and habitats for the mine project area. Several targeted fauna surveys have been undertaken at the site, specifically for the western extension in 2008 and for the southern extension in 2011, 2012, 2013 and 2014.

While there is a number of conservation significant fauna that occur within the region of the mine, only the following have been found within the Mine area:

- Western Ringtail Possum (*Pseudocheirus occidentalis*) – Vulnerable under the EPBC Act 1999 and Critically Endangered under the *Biodiversity Conservation Act 2016* (BC Act 2016). Western Ringtail Possums and their dreys have principally been observed in road reserves within the region of the mine;
- Southern Brush-tailed Phascogales (*Phascogale tapoatafa*), listed as Schedule 6 under the BC Act 2016, have been observed in road reserves and woodland that is being protected from mining within the southern extension.

Mature trees within the Mine area with hollows represent potential breeding sites for native mammals and birds, including Black Cockatoos. Targeted surveys undertaken in the western extension and southern extension areas have not found any active breeding sites. The following three species of Black Cockatoo have been observed from time to time feeding and passing through the mine area:

- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) – Endangered under the EPBC Act 1999 and Schedule 2 under the BC Act 2016;
- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) – Endangered under the EPBC Act 1999 and Schedule 3 under the BC Act 2016;
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) – Vulnerable under the EPBC Act 1999 and Schedule 3 under the BC Act 2016.

Significant offsets areas have been established within the Dardanup and Southern Extension areas to account for the clearing of identified Black Cockatoo foraging habitat.

7.9. LAND USE

Prior to mining the Dardanup Mine site was used as agricultural farmland, with agricultural lots intersected by road reserves. Agricultural production in the area is focussed on dairy and beef production, with a mix of irrigated and dryland pasture systems in use.

The Harvey irrigation water supply channel runs through the Dardanup Mine.

7.10. AGRICULTURAL PRODUCTIVITY

Pre-mining Agricultural Assessments have been undertaken for the lots within the Western Extension of the Dardanup Mine. As part of these assessments, soil profiles were described, existing and historic land uses were described, an expert[5] subjective assessment of pasture yield was made and pasture composition is described (John Wise Consultancy, 2006) refer Appendix B.

The lots that have been assessed are on the western side of the Dardanup Mine and all fall within the Pinjarra Land System.

Some lots had been laser levelled for flood irrigation purposes (Lots 17, 201, part of 3552, 103 and 104), Lot 22 had been levelled for either hay production and/or irrigation and the remaining lots were gently undulating with inundated depressions.

Winter waterlogging was common to all lots assessed and Lots 1 and 12 were noted to have limited vehicle accessibility during winter due to waterlogged clayey soils at the surface.

Most of the lots were considered to be very productive (in the range of 8-10 dry tonnes per hectare of pasture production per annum (t/ha)), with productivity limited in some areas within these lots by winter waterlogging in low lying areas and poor pasture species composition (to the range of 5-7 t/ha). Lots 18 and 201 were assessed as less productive (in the range of 3-6 t/ha) and it was considered this was on the basis of recent management practices (low soil chemical fertility and poor pasture composition) on these Lots rather than any specific soil, water and landform characteristic.

In Lots 1, 18, 3552 and to a lesser extent 22 and 201 it was noted that soil salinity could limit productivity.

Further soil assessments were undertaken on behalf of Doral by Primary Consulting Services in November 2011 and November 2014 across the Dardanup mine and indicated generally low pH soil conditions and low nutrient levels in the sandier soils however higher nutrient holding capacities in the clay soils. This monitoring serves as a baseline and future monitoring shall assist in ongoing pasture management. Refer Appendix C.

[5] John Wise (B. Sc. Agric.) is a consultant specialising in land use planning, property appraisals and agricultural advice. At the time of preparing these reports he had 10 years consulting experience following from 27 years of service within the Western Australian Department of Agriculture within the South West Land Division.

7.11. GEOTECHNICAL STABILITY (SUBSIDENCE)

Doral undertakes subsidence monitoring of backfilled mine pits, utilising both surveyed ground surface markers and visual inspection.

The surveyed method is considered accurate to within 10mm. Monitoring to date has identified that deep pits (approximately 10 metres) backfilled with clay overburden are subject to 100-200mm of subsidence in the first year of rehabilitation. Pits backfilled with sand tails or co-disposed sand and clay mixtures have not shown subsidence and maintain their constructed soil levels. Typical subsidence patterns are presented in Figure 7-18.

Inspections of rehabilitation areas are conducted regularly and where localised subsidence occurs corrective measures are implemented to reinstate the design surface profile (as described in Section 11). Figure 7-19 shows an example of a Year 1 Rehabilitation block where localised subsidence has been observed and corrected.

7.12. RADIATION

The generally accepted upper limit value for the ‘natural’ environmental background gamma radiation level emitted from the earth is in the order of 0.45µGy/h. This will however, vary according to location. Generally the Southwest coastal plain has a range of between 0.1 to 0.3 µGy/h which is similar to the general earth background. These levels shall be maintained throughout post-mining rehabilitation works in comparison with the pre-mining gamma surveys. Within the Dardanup region background gamma levels are generally in the order of 0.2µGy/h.

Doral undertakes both pre-mining and post-mining ground level (1m from surface) gamma radiation surveys prior to, and following the completion of mining and rehabilitation. This data is recorded to ensure that post-mining landforms are returned to acceptable background gamma radiation levels and similar to pre-mining levels (refer Figure 7-20).

In the case of the return of processing wastes to the mine void (e.g. sand tails, gravel, clay fines), the replacement of overburden and topsoil material should be such that the final background gamma radiation level shall also remain similar or below the pre-mining level. Post mining background surveys may be influenced by the return of materials such as gravel to the near surface, or by the replacement of topsoil and subsoil which was removed from a different area. Should returned post mining background gamma levels be unacceptable, then post rehabilitation earthworks may be required.

The Dardanup Mine contains five locations where reject tailings from Doral's Picton Mineral Separation Plant were disposed of prior to the commissioning of the dry plant tails co-disposal unit. The pre-2005 historically disposed of monazite containing tails contain elevated radionuclide levels (Annual average range of 2.21 – 4.78 Bq/g Thorium and Uranium) and each of these locations (as shown in Figure 7-21) is covered with five metres of neutral fill (sand, clay fines or overburden).

Since the commissioning of the dry plant tails co-disposal unit in 2006, the Final dry plant Tails are returned to the mine as a damp material and blended via a purpose-built hopper and injected into the outgoing mine sand tails for burial to the mine void. Controls incorporated into the tails hopper include a limited throughput as well as automatic shutdown if the mine tails output is reduced to ensure that the concentration of the outgoing monazite is conservatively kept below the maximum range of 140-180 ppm thorium (Th) and uranium (U). Monitored outgoing sand tails indicate an average of levels of 85 ppm Th and 7 ppm U (0.43 Bq/g) which is well within acceptable levels.

7.13. HERITAGE

Three major suites of heritage studies have been undertaken at the Dardanup Mine. Ethnographic and archaeological surveys were undertaken over the footprint of the original Dardanup Mine in 1991 (ISK Minerals, 1991), over the western extension (Burekup Deposit) in 2007 and 2008 (Doral, 2008) and the southern extension in 2011 (Aurora Environmental, 2012a). The description below draws upon all three studies and summarises key findings across the entire site.

No listed sites were present at the Dardanup Mine pre-mining. Surveys discovered a number of artefacts and one scatter of artefacts in the southern extension has been deemed an Aboriginal site within the meaning of section 5 of the *Aboriginal Heritage Act 1972*. Ministerial approval to disturb this site (DIA 31463, Doral Southern Extension Area 001) site through a Section 18 permit was obtained in 2012.

No ethnographic sites have been identified however waterways and wetlands in the Mine and surrounding areas have been noted in all surveys to have cultural value.

7.14. REHABILITATION COMPLETED (2002 TO 2016)

Rehabilitation of disturbed land at the Dardanup Mine consists of the following activities:

- Topsoil and subsoil harvesting;
- Pit backfill and soil profile construction;
- Pasture re-establishment, including soil amendments to assist in pasture growth;

- Establishment of native vegetation; and
- Weed control.

To date, a total of 770.30ha has been disturbed at the Dardanup Mine (since mining commenced in 2002) with all 770.30ha of land now rehabilitated. A summary is provided below:

2002 to 2005: A total of 349.65ha was disturbed with 1.1ha rehabilitated;

2006: A total of 59.64ha was disturbed. Substantial areas were partially backfilled and profiled. These works were in preparation for final soil profile rehabilitation to be undertaken in upcoming years;

2007: A total of 36ha was disturbed with 2.30ha rehabilitated. Rehabilitation works consisted of final backfill and contouring of the West Pit and Offer Pit. Contoured areas were allowed to self germinate resulting in the establishment of pasture;

2008: A total of 16.34ha was disturbed with 20.71ha rehabilitated. Rehabilitation works consisted of the final backfill and contouring of the North Tyrrell, West Pit and Offer Pit (Figure 5). The full 20.17ha were returned to pasture.

2009: A total of 76.5ha was disturbed with 22.3ha rehabilitated. Rehabilitation works consisted of final backfill and contouring of areas of the Offer, Tyrell North and Willoughby pits. The full 22.3ha was allowed to return to pasture.

2010: A total of 34.7ha was disturbed with 40.6ha of rehabilitation. Of the area disturbed 34.7ha was to allow the continuation of mining of the Burekup Mineral Sands Deposit. Predominantly the 40.6ha of rehabilitated area was allowed to self germinate resulting in the establishment of pastures, these areas included parts of the Willoughby, Offer, Burekup South and Central, Carbone and Edwards pits.

Rehabilitation of two sections of Tyrell North pit was completed with final contouring of the topsoil and the re-establishment of the Offer Road Reserve ready for mine closure. While the majority of the area was allowed to self germinate to pastures, 4 transplanted grass trees were successfully re-established along the road reserve.

Noxious weed control was carried out as part of rehabilitation works during 2010, targeting Solanum linnaeanum (Apple of Sodom) and Gomphocarpus fruticosus (Narrow-leaf Cotton Bush). An ongoing weed control program was established for areas planned for rehabilitation of native species.

2011: A total of 93.66ha was disturbed, 55ha of which was for mining purpose with the remainder disturbed for infrastructure, most of which was required to develop the Burekup North mining area. Rehabilitation totalled 22.38ha for the year most of which was carried out at Burekup South and included the re-establishment of Harris Road. Native vegetation was also successfully established in the Harris Road reserve. At the Offer Block the final 6.5Ha were returned to pasture and initial native vegetation tree belts were planted

Noxious weed control was carried out as part of rehabilitation works during 2011, targeting Solanum linnaeanum (Apple of Sodom), Gomphocarpus fruticosus (Narrow-leaf Cotton Bush) and Phytolacca octandra (Inkweed).

2012: A total of 47.67ha was disturbed for mining purposes and rehabilitation to pasture totalled 20.49ha in the mining blocks north of O'Connor Road. The rehabilitation areas referred to as Offer Road North and Offer Road South were established to the East of Offer road. In October 2012 the earthmoving contractor changed from Piacentini and Son to Minesite Construction Services. As a consequence of this change,

difficulties obtaining sufficient staff and machinery in the early summer rehabilitation season led to less rehabilitation earthworks than scheduled during the 2012/13 period and is reflected in the lower area rehabilitated in 2013.

Ongoing noxious weed control continued during 2012.

2013: In 2013 a total of 59.57ha was disturbed for mining purposes and rehabilitation to pasture totalled 5.7ha within Burekup West and the Southern Extension. As mentioned above, in 2012 less earthworks to final rehabilitation resulted during the 2012/13 rehabilitation season due to a changed earthworks contractor, however significant backfill of voids during this period shall assist is a larger completion of rehabilitation to pasture in the 2013/14 season.

Ongoing noxious weed control continued during 2013.

2014: In 2014 a total of 19.64ha was disturbed for mining purposes and rehabilitation to pasture totalled 57.3ha with significant rehabilitation achieved at Burekup North and Burekup Central. The Waterloo Offset area was fenced to protect the area from feral pest grazing and a total of 17,288 native seedlings were planted across the sites and including the offset areas.

Ongoing noxious weed and feral pest control continued during 2014.

2015: In 2015 a total of 13.86ha was disturbed for mining purposes and rehabilitation to pasture totalled 133.04ha. Fencing was conducted in the Burekup North region which was mainly for paddock re-establishment, however it did include the securing of the southern section of Creek 2 in preparation for planting. A total of 19,314 native seedlings, grown at the Leschenault Community Nursery and Hamel Nursery, were planted across the site, including the offset areas.

Ongoing noxious weed and feral pest control continued during 2015.

2016: Mining ceased in December 2015 and as such no further land disturbance was undertaken during 2016. Rehabilitation to pasture totalled 113.34ha. In May 2016, Simpson Road which was closed for mining of the Southern Extension was opened to the public. Fencing was conducted in the Southern Extension region, which included the completion of the Waterloo Offset fence along Simpson Creek in May in preparation for planting and paddock re-establishment. A total of 13,826 native seedlings, grown at the Leschenault Community Nursery and Hamel Nursery, were planted across the site, including the offset areas.

Ongoing noxious weed and feral pest control continued during 2016.

2017: In 2017, areas within the Southern Extension, central Burekup and northern Dardanup regions were topsoiled to final rehab. In total ~224ha was rehabilitated (total rehabilitation f 663.96ha). These areas included

- SEP dams 12-28, north of Offer Creek;
- SEP dams 1-7, east of the office area;
- SEP dams 30, 31 and 34;
- Willoughby SEP dams, south east of the office area;
- Dam 62 area and 'Roley Hill', south of OÇonnor Rd and north of Edwards Rd;
- T7 mining void, north of Simpson Rd.

Ongoing noxious weed and feral pest control continued during 2017.

2018: Rehabilitation to the final end landuse was completed in 2018, with all 770.30ha rehabilitated.

Ongoing noxious weed and feral pest control continued during 2018.

The location of rehabilitation areas by year is presented in Figure 7-22.

7.15. CLOSURE DATA GAPS

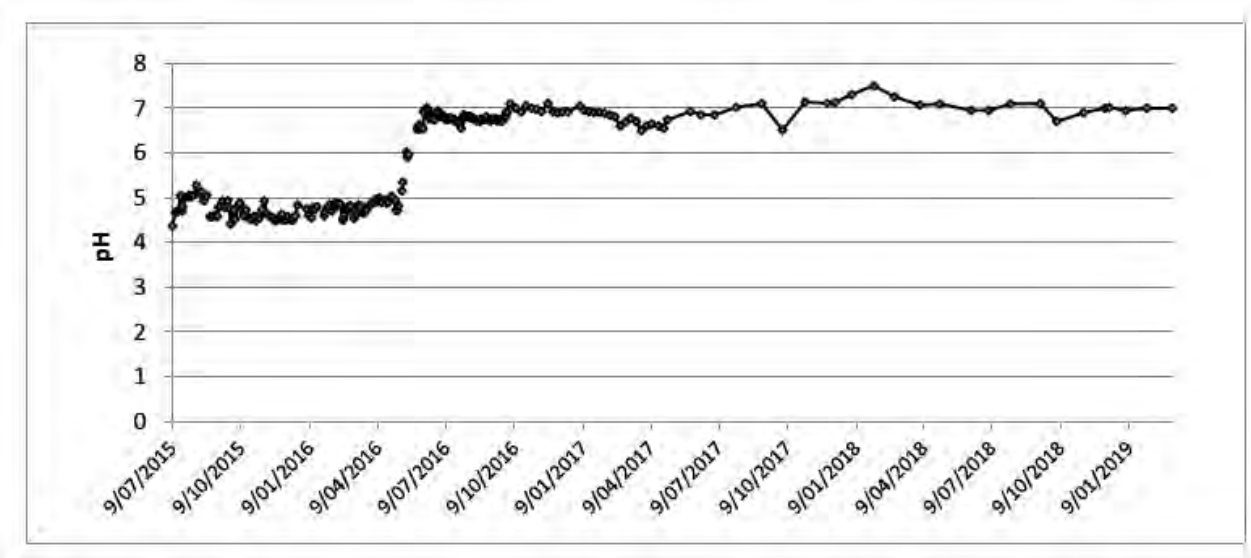
Risks to closure are routinely reviewed on an annual basis as part of the annual budget review and forecast setting, and as per the Annual Environmental Report compilation.

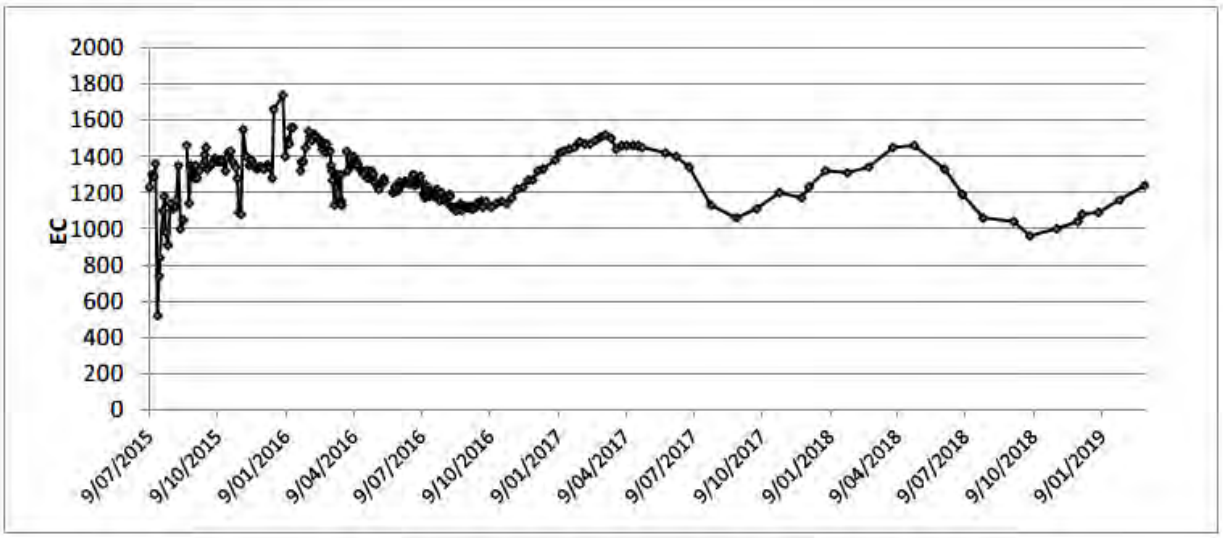
A previous data gap in the 2017 MCP, identified the potential need for a final working void at the Dardanup Mine. Doral have now assessed the need for this void and have concluded that a 200ML lake (at T5) is required. The void is located on Doral owned land and underwent a hydrogeological investigation prior to the end of mining. In 2018, after being partially drained for profiling, the void was shown to have collected sufficient rainfall runoff to flow temporarily via the spillway into the adjacent creek (Appendix D). This therefore is consistent with the surface water model and indicates that the rainfall catchment of the dam is sufficient to ensure its sustainability as a water body.

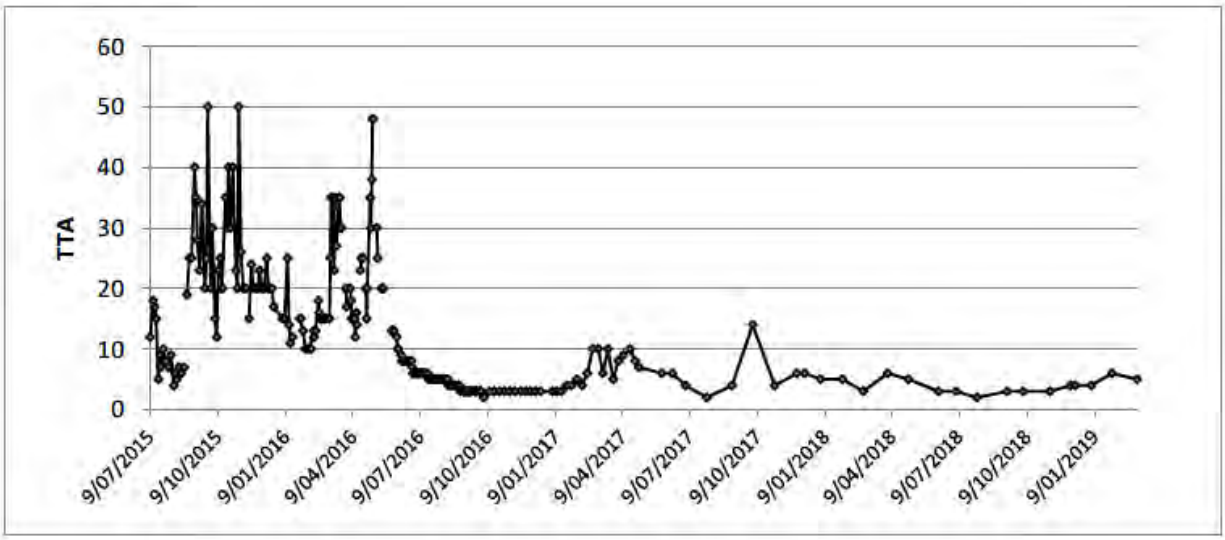
T5 Dam Monitoring Data

The T5 void dewater was routinely monitored during excavation and mining from July 2015 until the operation ceased in December 2015. Pit dewatering continued into early 2016 to enable the profiling of the dam.

Trend data for the surface water monitoring parameters of pH, EC, TTA, Acidity and Alkalinity of the T5 dam are as follows and show that the water quality is acceptable.




EC
2000
1800
1600
1400
1200
1000
800
600
400
200
0
9/07/2015
9/10/2015
9/01/2016
9/04/2016
9/07/2016
9/10/2016
9/01/2017
9/04/2017
9/07/2017
9/10/2017
9/01/2018
9/04/2018
9/07/2018
9/10/2018
9/01/2019


TTA
60
50
40
30
20
10
0
9/07/2015
9/10/2015
9/01/2016
9/04/2016
9/07/2016
9/10/2016
9/01/2017
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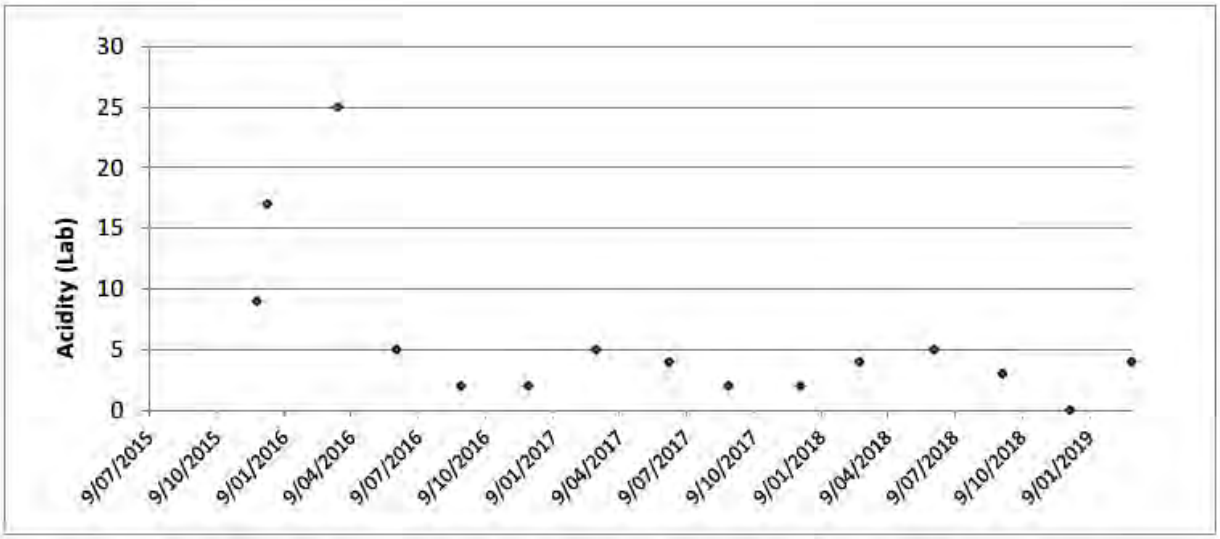
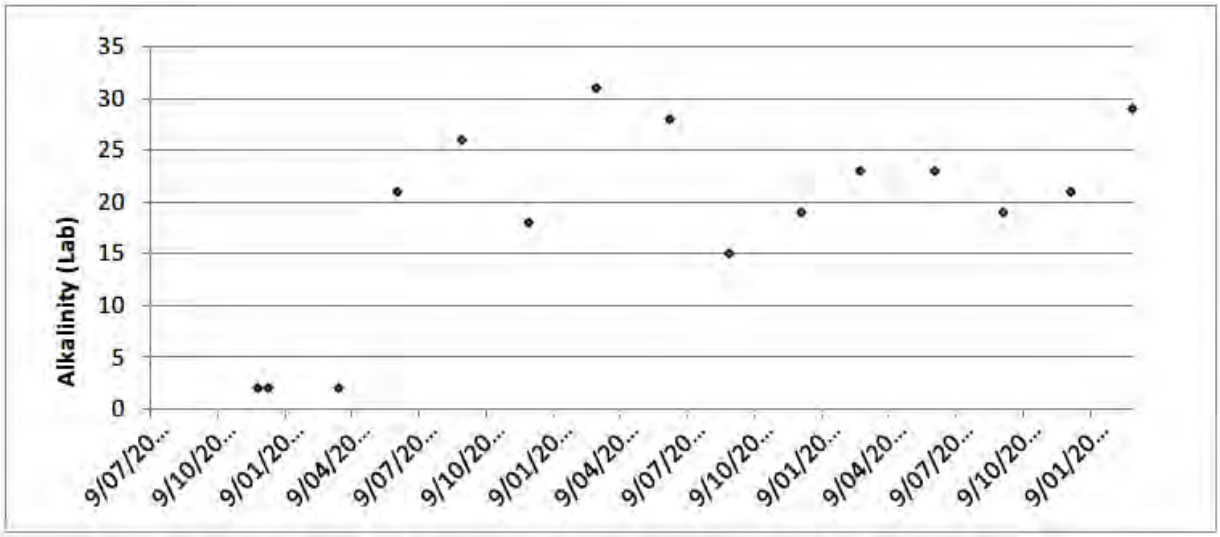
9/07/2018
9/10/2018
9/01/2019


Acidity (Lab)
30
25
20
15
10
5
0
9/07/2015
9/10/2015
9/01/2016
9/04/2016
9/07/2016
9/10/2016
9/01/2017
9/04/2017
9/07/2017
9/10/2017
9/01/2018
9/04/2018
9/07/2018
9/10/2018
9/01/2019


Alkalinity (Lab)
35
30
25
20
15
10
5
0
9/07/20...
9/10/20...
9/01/20...
9/04/20...
9/07/20...
9/10/20...
9/01/20...
9/04/20...
9/07/20...
9/10/20...
9/01/20...
9/04/20...
9/07/20...
9/10/20...
9/01/20...

T5 Dam monitoring data for metals and other water quality analytes is shown in the table below:

Date	2/12/2015	16/12/2015	21/03/2016	9/06/2016	5/09/2016	5/12/2016	7/03/2017	15/06/2017	4/09/2017	11/12/2017	1/03/2018	11/06/2018	12/09/2018	13/12/2018	7/03/2019
pH	4.63	4.5	4.65	6.93	6.74	6.9	6.7	6.85	7.1	7.12	7.25	6.95	7.1	7.01	7
EC @ 25 °	1340	1350	1160	1260	1120	1270	1510	1400	1060	1230	1340	1330	1040	1080	1240
temp	15.3	19.4	20.6	12.1	13.6	20.2	24.1	12.9	13.2	22	18.6	11.4	15.1	18.9	21.8
TTA	20	20	35	10	3	3	10	6	4	6	3	3	3	4	5
Al (Filtered)	0.15	0.2	0.55	0.018	<0.005	0.01	0.012	0.015	0.029	0.013	0.020	0.22	0.12	0.040	0.016
Aluminium Total		0.19	0.14	0.07	0.029	0.023	0.11	0.052	0.19	0.033	0.032	1.6	0.22	0.11	0.029
As		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.0001	0.0002	0.0003	0.0003	0.0002	0.0002	0.0010
Cd		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cr		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	0.0015
Fe (Filtered)	0.28	0.12	0.5	0.02	<0.005	0.022	0.096	0.033	0.032	0.044	0.048	0.063	0.054	0.049	0.034
Iron Total		0.2	0.84	0.12	0.014	0.034	0.25	0.23	0.03	0.044	0.061	0.41	0.075	0.11	0.086
Mn (Filtered)	0.012	0.014	0.018	0.012	0.13	0.002	0.012	0.0092	0.017	0.007	0.006	0.005	0.006	0.010	<0.001
Ni		0.002	0.002	0.001	<0.001	0.001	<0.001	0.0006	<0.005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0012
Se		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Zn		0.01	0.011	0.003	0.005	0.002	0.006	0.001	0.009	0.008	0.006	0.004	0.006	0.002	0.003
Acidity as CaCO3	9	17	25	5	2	2	5	4	2	2	4	5	3	<2	4
Alkalinity as CaCO3	2	2	2	21	26	18	31	28	15	19	23	23	19	21	29
Ammonia as NH3-N		0.020	<0.010	<0.010	<0.010	0.015	0.011	0.035	0.026	0.013	0.014	0.13	0.010	0.089	0.022
Cl	400	400	330	320	300	340	410	390	270	320	380	360	250	273	301
Ec	1350	1330	1120	1190	1050	1220	1420	1370	951	1100	1280	1250	875	975	1100
Dissolved Oxygen		4.2	8.4	11	11	9.3	8.8	11	10	9	9.4	10	11	9	9
FRP as P		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005			0.007	<0.005		
pH	4.8	4.8	5.2	7	7.1	7.2	7	7.3	7.1	7.5	7.5	7.1	7.2	7.2	7.7
SO4 (Sulphate)	23	20	16	24	25	29	30	24	21	25	29	28	21	23	28
Total Nitrogen		0.32	0.1	0.60	0.69	0.5	0.27	0.22	0.66	0.36	0.26	0.63	0.41	0.45	0.34
Total Phosphorus		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.02	0.007	0.012	<0.005
TDS	710	710	590	620	540	650	780	740	500	580	711	660	444	550	670

8. IDENTIFICATION AND MANAGEMENT OF CLOSURE ISSUES

8.1. PROCESS FOR IDENTFYING CLOSURE ISSUES AND MANAGEMENT RESPONSES

Consistent with Doral's' Environmental Management System (EMS) a risk assessment has been undertaken to identify, assess and develop management responses for closure risk issues. The scope of this risk assessment has been to consider all aspects that affect effective closure and is not restricted to an assessment of environmental impacts.

The likelihood and consequence of each potential closure risk issue were categorised in accordance with Table 8-1 and Table 8-2.

A 5 x 5 risk assessment matrix (Table 8-3) was then used to assess the overall risk associated with each potential risk issue. Once an initial risk ranking was documented additional control measures were identified (i.e. risks are treated) and the risk was then re-ranked to establish a target risk ranking. Management responses to target risk rankings are described in Table 8-4.

The results of the risk assessment are presented in Appendix E and the issues and management responses identified are described Section 8.2.

Table 8-1: Risk Assessment Likelihood Criteria

Description	Frequency	Criteria
Rare	Less once per five years	The environmental event may occur only in exceptional circumstances Practically impossible
Unlikely	Less than once per two years	The environmental event could occur at sometime Not expected to occur under normal circumstances
Possible	More than every two years	The environmental event should occur at some time Should occur under normal circumstances
Likely	More than once per year	The environmental event will probably occur in most circumstances Probably will occur under normal circumstances
Almost certain	More than once per month	It is expected to occur in most circumstances Common repeating occurrence

Table 8-2: Risk Assessment Consequence Criteria

Consequence	Legal and Regulatory	Public and Stakeholder Relations	Asset Loss / Cost	Environment
Insignificant	Insignificant regulatory penalty	Incidental environmental nuisance.	Low financial loss (<$2,000)	Possible incidental impacts to flora & flora in a locally affected environmental setting, no ecological consequences.
Minor	Minor regulatory penalty	Minor environmental nuisance to community.	Medium financial loss ($2,000-$20,000)	Reduction in abundance/biomass of flora/fauna in affected setting. No change to biodiversity or exposed ecosystem.

Consequence	Legal and Regulatory	Public and Stakeholder Relations	Asset Loss / Cost	Environment
Moderate	Average regulatory penalty	Major environmental nuisance to affected community. Small scale media attention.	High financial loss ($20,000-$50,000)	Partial loss of ecosystem function in affected setting. Intervention required for recovery.
Major	Above average regulatory penalty	Regional media attention. Community relations impacts. Short term share price effects.	Major financial loss ($50,000-$500,000)	Substantial reduction of abundance/biomass in affected setting. Significant impact to biodiversity and ecological function, and requires intervention to recover. Can be ameliorated over medium to long term.
Catastrophic	Maximum regulatory penalty	National media attention. Long term community relations impacts. Major share price effects.	Huge financial loss (>$500,000)	Loss of biodiversity on a regional scale. Total loss of ecological function in affected setting with little prospect of recovery to pre-impact conditions. Requires massive intervention over long period of time.

Table 8-3: Risk Assessment Rating Matrix

CONSEQUENCE	LIKELIHOOD				
	Rare	Unlikely	Moderate	Likely	Almost Certain
Catastrophic	H	H	E	E	E
Major	M	H	H	E	E
Moderate	L	M	H	E	E
Minor	L	L	M	H	E
Negligible	L	L	M	H	H

Table 8-4: Risk Assessment Management Description

Score	Management of Risk
Extreme	Unacceptable risk, immediate action is required, with senior management intervention.
High	Approved action plan is required to reduce risks. Senior management attention is required.
Medium	Specific management with internal audit and review. Management responsibility must be specified.
Low	Management through routine procedures.

8.2. MANAGEMENT OF CLOSURE ISSUES

8.2.1. COMPLIANCE WITH OBLIGATIONS AND REQUIREMENTS

Failure to understand and meet the relevant legal requirements and obligations to key stakeholder could result in significant cost impacts to Doral through rework and/or delays to completion and relinquishment. Section 3 of this document identifies all closure obligations.

8.2.2. GEOTECHNICAL STABILITY

Backfilled mine pits may experience some subsidence during the first couple of years of rehabilitation (see Section 7.11). This poses a risk to built structures if they are unknowingly constructed partially on consolidated un-mined land and partially on backfilled mine pits which may still be undergoing consolidation.

This risk is most significant for road infrastructure constructed on filled mine voids. This risk has been controlled through the application of civil engineering specifications and standards, including geotechnical compaction and stability testing, independent oversight of the backfilling and compaction testing and process (by the local council engineers) and use of tailings sand as the backfill material (rather than overburden or any other clay material which has a higher potential to subside).

Doral undertakes subsidence monitoring to identify and remedy areas of subsidence for at least three years prior to resale or hand back of the land. Where subsidence occurs, it is remedied by stripping the topsoil then adding additional subsoil material to fill the subsidence void and finally returning the topsoil.

Doral maintains a record of what type of material (i.e. overburden, sand tails, dry slime or co-disposed tailings) is used to backfill each mine pit block.

8.2.3. LANDUSE

It is important for Doral to understand the land use requirements that key stakeholders have for the site post-mining. Post-mining land uses have been discussed and agreed with landowners prior to entering agreements to access the land for mining and documented within the landowner agreements. Post-mining land uses have also been described and included within environmental approval documentation and mining proposals which have been submitted to and approved by government agencies, including DWER and DMIRS.

This plan describes how Doral delivers it rehabilitation and closure commitments.

8.2.4. LANDFORMS

Post-mining landforms are designed to be capable of supporting the agreed post-mining land uses as described below.

8.2.4.1. AGRICULTURE

There are two primary landform types created for agricultural post-mining land use. An ‘upland’ Whicher Scarp type landform and a ‘lowland’ Pinjarra Plain type landform. In both circumstances post-mining land surfaces are returned to near pre-mining surface elevations.

For the Pinjarra Plain type landform a standard soil profile has been designed for the top 1.2 metres of the backfilled mine pits (see Figure 9- 2). This soil profile is designed to recreate the pre-mining soil profile conditions and to alleviate the trafficability issues that affect clayey soils in this landscape position by adding sand to the profile in the subsoil layer. Prior to returning the topsoil, the sand and subsoil are cross ripped

to mix the sand into the subsoil material (see Figure 8-1 which shows deposited topsoil, sand and subsoil materials laid over overburden backfill within a mine pit). This design has been based upon recommendations from pre-mining agricultural assessments and mineral sands industry knowledge and practice on the Swan Coastal Plain.

For all the disturbed areas, mining infrastructure is removed, required agricultural infrastructure is reinstated (e.g. fences, irrigation drains) and topsoil is returned. Where the subsoils have been observed to be heavily compacted these are ripped to about 300mm depth prior to topsoil being returned.

Prior to stripping topsoil and subsoil, the soil profile is described within each specific mining block and recorded on a data sheet as shown in Appendix C.

On the upland soils, which is primarily the area disturbed by Solar Evaporation Ponds which have been created by cut and fill of in situ soil materials, the dry clay is removed and the pond walls are pushed back to create a surface level similar to pre-mining levels (see Figure 9-4). There are areas where extra sand and/or clay material is present and these will be pushed to form slope angles and surface levels consistent with the surrounding areas.

The process water dam will be dredged to remove clay fines material and will be profiled as an agricultural dam in the finished landform. Soil surfaces are reshaped such that the slopes leading into the final dam landforms are consistent with natural landform slopes in the surrounding area. Other agricultural dams will be replaced as they were prior to mining unless otherwise requested by the landowner.

8.2.4.2. CONSERVATION

Most of the conservation landuse areas have not been cleared for mining and the landform remains unchanged. For the smaller areas of tree belts and riparian zones in the disturbed areas the landform is as described for agriculture in Section 8.2.4.1.

8.2.4.3. ROAD RESERVE

Within road reserves the final land surface is created to meet the engineered road and drainage design and to meet the Local Councils road design and construction standards. Fill of mine voids in these areas is managed as described within Section 8.2.2 on geotechnical subsidence.

8.2.5. WEEDS

Failure to identify, monitor and control weeds could have two adverse outcomes. Competition from weeds could result in revegetation failure (either native or agricultural). Failure to control declared plants (e.g. Apple of Sodom (*Solanum linnaeanum*), Cotton Bush (*Gomphocarpus fruticosus*)) could result in legislative prosecution, or more significantly local community reputational impact.

Doral maintains, educates and empowers its workforce to identify and physically remove declared plants found on the minesite. Weed control programmes (implemented by professional weed control contractors) are implemented on an as needed seasonal basis in conservation areas and areas of native rehabilitation. Pre-mining inspections are used to identify weed infestations in topsoil prior to stripping and if present infested topsoil is stockpiled and managed separately to non-infested topsoil.

Doral is an active member and sponsor of the Leschenault Catchment Biosecurity Group, a registered non for profit organisation which aims to manage and control pests and exotic species in the Leschenault catchment area.

8.2.6. AGRICULTURAL PRODUCTIVITY

Doral has committed to landowners to rehabilitate disturbed land to agricultural productivity levels equal to or better than pre-mining levels. This is common practice in the mineral sands industry on the Swan Coastal Plain as using leading practices within the industry this is achievable. Failure to deliver on this commitment could significantly affect Doral's ability to relinquish mining tenements and sell land at completion.

Based on the pre-mining agricultural assessments undertaken on lots within the Pinjarra Plain, there is an opportunity to improve the soil profiles in some areas, by adding sand to the upper soil profile and improving landform drainage and waterlogging control.

The process for establishing soil profiles in mine voids as described in Section 8.2.4.1 is designed to mitigate this risk. The key activities taken to mitigate this risk are:

- Topsoil and subsoils are stripped, stockpiled and utilised in rehabilitation;
- Soil profiles to at least 1 metre deep are created in mining voids as described in Section 8.2.4.1;
- Brackish and saline groundwater is managed so that post-mining soils are not saline.

Pasture productivity is measured pre-mining, in analogous areas and on rehabilitated sites.

8.2.7. EROSION

Unstable and un-vegetated sandy surface soils present along surface water flow paths are susceptible to erosion which could undermine establishing vegetation and adversely affect downstream water quality. Measures implemented to control erosion within rehabilitated areas are:

- Where economics are marginal, mining is avoided within 10m of existing creek banks at full level;
- Re-established creek lines have a minimum 10m corridor of native vegetation planted on both sides;
- Topsoil from drainage courses are stockpiled separately and returned to the post-mining drainage channel landform;
- Soil profiles are modified within creek beds created in rehabilitation so there is no sand soils present on the surface;
- Rehabilitation creeklines are preferentially created at slopes less than 1:130. Where this is not achievable rock armouring is utilised to prevent scouring;
- Each rehabilitation creekline is subject to site specific design;
- Inspection and corrective actions are undertaken to correct small issues before they escalate to create significant damage.

8.2.8. GROUNDWATER

Mining at Dardanup Mine occurs through the Guildford Formation and within the Yoganup Formation, which together contain the Superficial aquifer within this area. In this region there is some degree of hydraulic connectivity between the Superficial and upper Leederville aquifers, where the silt and clay marker horizon is thin or absent (Parsons Brinckerhoff, 2012a). There are a number of landowner bores in the superficial and upper Leederville aquifers around the Dardanup Mine (URS, 2005).

Groundwater flow in the Superficial aquifer is generally in a north-westerly direction toward the coast and the aquifer is directly recharged by rainfall infiltration and by localised upward hydraulic head from the underlying Leederville and Yarragadee aquifers (Parsons Brinckerhoff, 2012a).

When the mine pits are backfilled the same aquifer conditions are not necessarily returned. There is the potential that a section of the pit is backfilled with overburden (sandy clay) and clay fines and that no aquifer is returned (ie no sandy highly permeable material is returned). This has the potential to act as a below ground dam with groundwater backing up behind the backfilled pit and with reduced recharge of the superficial aquifer to the west and north west of the mine pit.

This potential impact was identified and assessed in the original EIA (the CER) for the Project in 1991, which identified that placement of sand tailings in the pit will create conditions that replicate the hydraulic connectivity east to west that existed pre-mining.

The nature of the materials backfilled into mining pits is described within Section 4.3.5 with the site consisting of a mosaic of sand, clay and co-disposed backfill materials.

Since the initial impact assessments for the site there have been numerous groundwater reports and modelling studies completed, including recent calibration of the model against observed groundwater drawdown from Doral groundwater monitoring network (Parsons Brinckerhoff, 2012a). This modelling included assessment of recovery of groundwater levels post-mining and found that in general, groundwater levels are predicted to recover within 2-3 years of the cessation on mining. This modelling work was not able to incorporate the fact that any sand tailings and co-disposed tailings backfilled to the mine pits are fully saturated and as such is considered a realistic worst-case prediction.

8.2.9. CONTAMINATED SITES

Three potential sources of contamination have been identified for the Dardanup Mine.

Acid sulfate soils (ASS) could oxidise, creating acidified soil and/or water. A detailed site-specific ASS survey was undertaken over the western extension (Pinjarra Plain landform) and it was identified that no areas to be mined contained ASS however several areas of identified ASS were 2-3 metres below the mine pit basements. Monitoring of water and soil undertaken during mining of areas identified to contain ASS indicated only minimal acidification (see Section 7.3.4) and although the ASS Management Plan remains in place during the backfill and rehabilitation works, the risk of ASS contamination at/near closure has been shown to be very low.

The fuel storage and heavy vehicle maintenance areas at the site are considered likely to contain some level of hydrocarbon (diesel) soil contamination around and underneath them. Controls in place to minimise risk include sealed floors of machinery workshop areas and bunded fuel storage areas. A site contamination assessment was conducted following the decommissioning and removal of the previous Piacentini and Son vehicle workshop with only minor surface soil remediation required. Ongoing hydrocarbon management procedures and practices ensure that the risk of hydrocarbon contamination remain low and a final decontamination survey will be conducted as part of the overall site decommissioning plan.

As described in Section 7.12, since September 2006 sand tailings from Doral's Picton Mineral Separation Plant is transported to the Dardanup Mine and disposed of via the dry plant tails co-disposal unit at environmentally acceptable radionuclide levels. Five locations however exist which have historically disposed tails at specific locations and are capped with 5 metres of neutral fill. The underground storage of the tails represents a very low risk of any impact or surface contamination.

As described in 8.2.15, a detailed site assessment shall be conducted as per the *Contaminated Sites Act 2003*.

8.2.10. NATIVE REVEGETATION

Doral is committed to establishing native vegetation in environmental offset areas as well as corridors along road reserves and within drainage corridors in the agricultural areas. Details on how these will be managed are included within the following documents:

- Dardanup and Western Extension Mine Restoration Plan (Ecoedge, 2011);
- Willoughby Offset Rehabilitation Management Plan (Doral, 2010);
- Offer Road Conservation Category Wetland: Rehabilitation and Management Plan (Ecoedge, 2010a);
- Recreated creek rehabilitation plan (Ecoedge, 2010b);
- Dardanup Southern Extension Woodland Habitat Rehabilitation and Offset Area (WHROA) Rehabilitation Plan (Doral, 2013);
- Waterloo project Offset Strategy and Rehabilitation Management plan (Doral, 2013);

In summary the threats to vegetation establishment and measures implemented to mitigate include:

Threats	Management Measures
• Weed competition	• Weed control prior to planting and ongoing
• Grazing (livestock, rabbits and kangaroos are the primary threats)	• Fencing, tree guards, rabbit control baiting, managed Kangaroo population control
• Insufficient site preparation works (e.g. ripping prior to planting)	• Ripping and scalping
• Unsuitable post-mining soils conditions	• Species selection suitable for site conditions
• Unexpected waterlogging	• Species selection suitable for site conditions
• Erosion	• Inspection and corrective actions
• Dieback	• Dieback hygiene and management.

8.2.11. CONSERVATION OFFSETS

Doral has committed to the following conservation offset areas which will be placed under covenant for permanent conservation management:

- Willoughby Offset;
- Conservation Category Wetland (CCW);
- Southern Extension Woodland Habitat Rehabilitation Offset Area (WHROA),
- Waterloo Offset area.

Each of these areas has a site-specific rehabilitation management plan and all works are conducted in consultation with, and reported annually to, DWER, DMIRS, DoEE, and DBCA. These management plans contain descriptions of the activities that are undertaken to ensure the success of these areas including:

- Site preparation activities;
- Site specific revegetation species selection;

- Offsets revegetation activities;
- Weed control;
- Pest (and grazing) control;
- Dieback management.

8.2.12. DECOMMISSIONING PLAN

The Doral Decommissioning plan is committed to the following objectives;

- Removal or, if appropriate, disposal on-site of plant and infrastructure;
- Rehabilitation of all disturbed areas to agreed final land use;
- Identification of contaminated areas, including provision of evidence of notification to relevant statutory authorities.

With reference to Appendix F, mining and processing infrastructure has been removed from site following completion of mining in 2015.

The following mining and processing infrastructure has been removed from site unless noted:

- Disconnection, loading and removal of 34km of poly pipe (currently stored on site);
- Dismantling and removal of 4.5km of aerial power lines;
- Dismantling concentrator, thickener, workshops and offices;
- Dismantle and removal of field pumps and motor control centres;
- Dismantling feed preparation plant, workshops and associated infrastructure;
- Removal of salvage hardstand areas including Wayne's World shed (to remain as hardstand and pipe storage);
- Excavation and removal of 43 solar drying dam weir boxes;
- Removal of one of the three existing irrigation channel bridges (all bridges to remain, as agreed to by Harvey Water).

The following infrastructure will remain on site subject to regulatory approvals and landowner requirements:

- Groundwater production bore;
- Farm buildings and sheds (e.g. current mine administration office);
- Some mine roads and gravel hardstand areas, subject to landowner requirements.

Road base and concrete footings from infrastructure have also been buried and covered onsite with a minimum of 3 metres of soil material.

8.2.13. INFRASTRUCTURE REINSTATEMENT

Doral has requirements to reinstate the following infrastructure in consultation with the Shire of Dardanup at closure, all of which has been costed within the cost estimate:

Construction and sealing of Harris, St Helena and Dowdell Roads.

- In consultation with Shire of Dardanup, unsealed road has been approved for Edwards and Offer Rd. This has been constructed and approved by the Shire of Dardanup on 10 April 2018;

- The re-establishment of underground Telstra communications line within the Offer, Edwards Road reserve;
- Re-establishment of all cadastral boundaries by licensed surveying consultants (completed in 2018 by Harley Dykstra);
- Re-establishment of the Spray irrigation channel (complete) and approved by Harvey Water on 25/03/19.

8.2.14. REHABILITATION OF DISTURBED AREAS

All disturbed areas shall be appropriately rehabilitated and returned to the agreed final land use. As discussed in Section 5 and 8.2.3 post mining land uses have been discussed and agreed with landowners prior to entering agreements to access the land for mining. The majority of the Dardanup mine shall be returned to pasture with several conservation areas placed under restrictive conservation covenants.

8.2.15. IDENTIFICATION OF CONTAMINATED AREAS

As discussed in Section 8.2.9, three potential sources of contamination that have potential to have resulted from mining operations are hydrocarbons, acid sulfate soils and radiation.

Hydrocarbons

Doral engaged ABEC Environmental Consulting Pty Ltd (ABEC) in June 2016 to undertake a Preliminary Site Investigation (PSI) at the Dardanup Mine and Burekup Western Extension (ABEC, 2017a) in accordance with *Assessment and management of contaminated sites* (DER, 2014). The PSI identified that all mined/backfilled areas and undisturbed areas of the Site were unlikely to be contaminated as a result of the mining activities and that no further investigation of these areas was considered necessary. The desktop review and site inspection however identified that storage and use of hydrocarbon products within the workshop and maintenance area of the Dardanup Site (restricted to Lot 3551) were a potential source of contamination, which in the first instance may affect the soil comprising the compacted earthen pad where these substances were stored/used.

As a result of these findings, ABEC prepared a Sampling and Analysis Quality Plan (SAQP) (ABEC, 2018a) to guide additional staged investigations of the workshop and maintenance areas within Lot 3551, commencing with a soil sampling and analysis program.

The additional investigation at the Site (i.e. a Detailed Site Investigation) (ABEC, 2018b) was therefore conducted to:

- Confirm the presence or absence of contamination;
- Assess the nature and severity of contamination, if present;
- If contamination is present, define the vertical and lateral extent of contamination;
- Assess the actual risk to human health and/or the environment.

The DSI (ABEC, 2018b) comprised the excavation of 12 test pits targeted to areas of potential soil impacts, based on an understanding of the site history, site activities and visual observations, and the collection of validation samples from an excavation void following the removal of the washdown bay and associated sumps. Selected samples were sent to the Chem Centre for laboratory analysis of hydrocarbon COPC's. Only one location/sample, AST Bund, detected concentrations of TRH F2 and F3 in surface soils (0-0.3mbgl) above the laboratory LOR and the NEPM ESL and ML assessment criteria. Following the removal of the diesel AST and associated bund, a very small volume of contaminated soil (~1m3) (immediately under the bund) was

removed, and a second sample was collected and analysed for COPCs at 0.6m. All COPCs from this sample were below the laboratory LOR, confirming all impacted soil had been removed and that impacts were confined to the near surface only.

Results of the investigation indicates that as no contaminant concentrations of COPCs were identified (or remain) in the surface or near surface soils, no complete source pathway receptor linkage exists, meaning that soils within the workshop and maintenance area of Lot 3551 do not present a risk to the identified ecological or human health receptors.

The overall risk from the Site activities is therefore considered to be very low and further investigation of soils and groundwater are not warranted.

However, Lots 105 and Lot 3551 have been classified under the *Contaminated Sites Act 2003* as *Possibly Contaminated – Investigation Required* due to the possible presence of radionuclides from historic buried tails (see section 7.12), further investigations of the potential risk to human health and ecological receptors is required. This investigation is currently ongoing.

Acid Sulfate Soils

ABEC prepared an Acid Sulfate Soil Closure Report (ASSCR) for the Western Extension in accordance with Treatment and management of soil and water in acid sulfate soil landscapes (DER, 2015). The purpose of the ASSCR (ABEC, 2017a) was to document compliance with the Acid Sulfate Soil Management Plan (ASSMP) (Doral, 2011) and to identify any residual risks from ASS as a result of mining activities.

In order to identify residual risks from ASS, ABEC reviewed pre-and post-mining groundwater quality data, which was collected generally on a monthly or quarterly basis during and after the mining activities. Pre-mining groundwater monitoring data indicated that the groundwater quality was acidic with concentrations of Al and Fe that exceeded either ecological or human health assessment criteria. Post mining groundwater monitoring data, indicated that an increasing total acidity trend was apparent at most locations, however pH remained generally stable. An increasing Al concentration trend was apparent at some locations, however in general the concentrations remain in similar orders of magnitude to the pre-mining concentrations at several locations down-gradient from the Western Extension.

A risk assessment for possible receptors of impacts indicated that groundwater quality was at high risk of increased acidity and elevated metals concentrations if sulfides were in fact oxidised as a result of the mining activities. In addition, affected groundwater could lead to a moderate risk of impacts to the groundwater value as a source of water for non-potable domestic uses or long-term irrigation. However, on the basis that the pre-mining groundwater quality exceeded the assessment criteria for ecological and human health criteria for pH, Al and Fe, and that the post-mining groundwater quality was generally similar to that of the pre-mining groundwater quality, there has been no reduction in beneficial uses of groundwater overall. Furthermore, as there is no clear indication that mining has resulted in significant sulfide oxidation, management of PASS in accordance with the ASSMP during the mining activities was adequate. Based on the monitoring results, the Western Extension should not be reported as a known or suspected contaminated Site under the Contaminated Sites Act 2003.

8.2.16. CLOSURE PROVISIONING

Doral recognises the risks to its reputation, the ability to continue operations and the ability to secure access to future deposits that may result from inadequate funding of closure activities. To ensure that enough financial provision is provided for closure activities Doral reviews and updates closure provision annually as

part of the budget cycle. This allows for experience and learnings gained in progressive rehabilitation to be included within the provisioning process.

Doral's process for closure provisioning is described in Section 9.1.

8.2.17. SCHEDULING

Doral has had a plan for completing decommissioning and rehabilitation activities at the Dardanup Mine site for approximately 9 years prior to cessation of mining. Delays in implementation of decommissioning activities pose the threat of escalating closure costs and deteriorating Doral's public reputation within the local communities.

The closure implementation schedule is described within Section 9 and is reviewed and updated on an annual basis as part of the annual budgeting cycle.

Appendix F of this MCP comprises includes a site decommissioning plan schedule.

9. CLOSURE IMPLEMENTATION

9.1. IMPLEMENTATION STRATEGY

The Dardanup Mine currently operates with an earthworks contractor undertaking all earthmoving activities. During closure the same strategy will be continued with an earthworks contractor completing bulk earthworks to meet Doral's requirements.

Progressive rehabilitation has been underway simultaneously with production for over 10 years. The overall strategy for closure is to continue rehabilitation activities under the same management style as utilised currently. Production activities will cease and deconstruction and infrastructure reinstatement activities will commence.

9.2. ORGANISATIONAL STRUCTURE AND RESOURCES

The organisational structure and responsibilities planned for the initial stages of closure implementation phase of the project is illustrated in Figure 9-1. It is expected that as closure progresses the duties required for these roles will reduce to make these effectively part-time roles that Doral will either support from Picton or other minesite operations or will be filled as part-time contract positions. Other contractors will be engaged as required to complete the works.

9.3. TOPSOIL AND SUBSOIL MANAGEMENT

9.3.1. TOPSOIL AND SUBSOIL STRIPPING

The following procedures are applied to topsoil and subsoil stripping:

- Prior to removal of topsoil, millable timber will be recovered were possible;
- The removal of topsoil and subsoil from disturbed areas shall be maximised and, no matter how small the area of disturbance, topsoil and subsoil shall be salvaged. Subsoil is salvaged only from mine pits and topsoil is stripped from all disturbance areas;
- Topsoil from native vegetation and pasture areas shall be stripped and stockpiled separately;
- Small vegetation should be stripped with the topsoil;
- Topsoil from pasture areas shall be stripped to the depth of black/grey colouration in a single pass;
- To reduce dust generation topsoil and subsoil stripping will be maximised during the autumn months to minimise the period before natural germination;
- Topsoil and subsoil stripping required out of season will be sprayed with a binding tackifer or irrigated by water-cart to promote early germination.

9.3.2. TOPSOIL AND SUBSOIL HANDLING

Topsoil shall not be stripped under saturated soil conditions which would be conducive to soil damage. Similarly scheduling of topsoil and subsoil stripping should be such that dry windy conditions, particularly in mid-late summer are avoided.

Topsoil and subsoil shall not be used for any other purpose than stockpiling or direct placement for rehabilitation.

9.3.3. TOPSOIL AND SUBSOIL STORAGE

The following procedure shall be applied to topsoil and subsoil storage:

- Records of topsoil and subsoil removal and storage locations shall be maintained;
- Planning shall endeavour to facilitate the direct placement of topsoil and subsoil from disturbed areas to areas scheduled for rehabilitation;
- The height of topsoil stockpiles shall not exceed a maximum height of 3m;
- Stockpiles should be located where they will not be disturbed by future mining and preferably in a location where they will not be trafficked;
- Topsoil and subsoil stockpiles shall not be located where they will be mixed with other materials (e.g. drain spoil) or standing vegetation; and
- If there is drying of the surface of the topsoil and subsoil stockpiles prior to vegetation establishment dust suppression measures shall be employed as necessary.

9.3.4. TOPSOIL AND SUBSOIL PLACEMENT

Topsoil is placed on rehabilitation areas just prior to the growing season to avoid dust generation over the windy summer months.

Water spraying and/or other appropriate measures shall be used for dust control during the placement of topsoil and subsoil. Under high wind conditions, topsoil and subsoil placement may have to cease.

Following subsoil replacement, the surface will be ripped and cross ripped.

The final surface design and drainage layout will be similar to the pre-mining surface design with minor undulations and erosional features smoothed out.

GPS controlled techniques are used for topsoil and subsoil replacement as they allow a more accurate final land surface.

To alleviate any compaction caused by the movement of heavy machinery, all mined areas will be ripped. Ripping requirements will be tailored to suit specific rehabilitation areas. In native rehabilitation areas, deep ripping may be required. In pastured rehabilitation areas, less aggressive ripping (300mm) will be required after the replacement of subsoil, but prior to replacement of the topsoil.

9.4. PIT BACKFILL AND SOIL PROFILE CONSTRUCTION

9.4.1. PIT BACKFILL

Progressive pit backfill from new disturbance areas involves the direct placement of soil materials in mine voids where possible. Backfill material includes:

- Overburden either from within the pit or from stockpiles;
- Sand tails from the Wet Concentrator Plant;
- Dried clay tails from the excavation of SEPs;
- Co-disposed sand and clay tails;
- Oversize from Feed Preparation Plant and Wet Concentration Plant;
- Waste sand and clay material returned from the Picton Dry Separation Plant, blended to form sand tails.

Backfill methods are designed to satisfy the commitment for maintaining a hydrological regime suitable for sustaining the end land use, as per Proponent Commitment 4 in the CER (1991) and detailed in Section 4.3.1 of the PEASD (GHD, 2001). The method for pit backfilling includes:

- Pumping sand tails into previously mined voids to within 1.7m of the final rehabilitation surface;
- Final backfilling with solar dried clay fines and clayey overburden, removed from advancing pit development, to within 0.7m of the surface;
- The void is then capped with sub-soil and topsoil.

9.4.2. SOIL PROFILE CONSTRUCTION

Across the Dardanup Mine there are three primary pre-mining landforms (as described in Section 7.3):

- Pinjarra Plain lowlands, either duplex or deep clay soils;
- Footslope duplex soils (sands over mottled clays);
- Whicher scarp deep sands with gravels and laterite.

Post-mining soil profile reconstruction is modelled on these pre-mining landforms with adjustments made on the basis of practical (the limitations of the materials available) and economic constraints, while also exploiting the opportunities present to remove soil landscape constraints to agricultural productivity where possible. The target reconstructed soil profiles that correspond with each of the pre-mining landforms are described in Table 9-1.

Table 9-1: Characteristics of Constructed Soil Profiles

Reconstructed Soil Profile Description	Relevant pre-mining landform type	Identified constraints to agricultural productivity inherent in pre-mining landform	Features of reconstructed soil profiles that improve productivity
Pit backfill: Topsoil over subsoil with sand over clay (Figure 9-2)	Pinjarra Plain lowlands (Pinjarra System)	Waterlogging. Pugging and poor trafficability.	Increased sand content in subsoil resulting in improved drainage.
Pit backfill: Topsoil over sand or subsoil and clay ripped from below (Figure 9-3)	Footslope duplex soils (Forrestfield System)	Sandy surface soils, which dry quickly and from which nutrients leach rapidly.	Clay is ripped from the overburden below the surface sandy soils to improve water holding capacity (and nutrient retention). Clay overburden below surface soils assists to keep soil moisture accessible to pasture plants
SEP areas: Topsoil over sand and clay fines mix over *in situ* soil materials (Figure 9-4)	Whicher scarp sands (Whicher Scarp System)	Laterite to surface. Sandy surface soils, which dry quickly and from which nutrients leach rapidly.	Capping of soil materials over *in situ* laterites improves effective plant rooting depth. Remnant clay present in SEPs are ripped into the surface sandy soils to improve water holding capacity (and nutrient retention).

9.5. AGRICULTURAL AREAS

The following practices are applied across all agricultural areas.

9.5.1. PASTURE MANAGEMENT

Procedures for re-establishment of agricultural land follows the following practices. The focus of the program is to rapidly stabilise restored landforms with agricultural pastures. A pasture mixture will be sown and fertilised in autumn to ensure a vigorous re-establishment of the pasture.

The methodology is summarised broadly below:

- Stick picking to remove excessive quantities of large sticks and roots in the returned topsoil;
- Seedbed preparation using a combination of secondary tillage implements (e.g. Offset discs, scarifier, drag and harrows);
- Application of fertiliser and lime, for which the type, rate and number of applications will be determined via soil testing and agronomic advice;
- Application of seed mix tailored to landowner's specifications.

9.5.2. GRAZING

In the first spring after sowing, the primary objective is to develop a stable, productive soil profile by encouraging proliferation of pasture roots and soil biota. Pasture will be grazed lightly to promote tillering of ryegrass, a healthy component of clover, and to discourage pasture weeds (e.g. capeweed) from attaining dominance.

In subsequent years, it is expected that with appropriate management, pasture productivity will be comparable to other pastures in the locality. Grazing intensity will be gradually increased to levels considered appropriate for the district and seasonal conditions.

9.5.3. WEED AND PEST CONTROL

Weed control will primarily be achieved by ensuring pasture species are appropriately grazed such that they out-compete pasture weeds. Pastures will be monitored for problem weeds and pests. Where warranted, weeds will be controlled via herbicide application. Similarly, where warranted, pests such as red-legged earth mite will be controlled via insecticide application.

Invasive weeds or Declared Plants such as Silver Wattle, Blackberry, Bridal Creeper and Narrow leaf Cotton Bush will require spot spraying with a suitable herbicide should they occur in rehabilitated pasture.

Weed control procedures follow normal agricultural practices, with agronomic advice sought where necessary.

9.5.4. FERTILISER

Pastures are fertilised as part of an ongoing establishment and maintenance programme. The type, rate and number of fertiliser applications will be determined via soil testing and agronomic advice.

9.5.5. FARM INFRASTRUCTURE

Generally the pre-mining infrastructure is reinstated. Farm layouts are developed in consultation with the landowner and include surface design, fencing specifications, drain locations, stock water points and farm laneways.

For areas being returned to irrigated pasture the final topographic level of the paddocks are controlled to ensure flood irrigation can be implemented and drains are established to deliver irrigation water.

9.6. NATIVE REVEGETATION

The following practices are applied across all areas subject to native revegetation and are consistent with the Dardanup and Western Extension Mine Restoration Plan (Ecoedge, 2011).

Doral has developed specific management plans for each of the following native revegetation areas which provide further detail on the management and revegetation of these areas (including species lists):

- Willoughby Offset Rehabilitation Management Plan (Doral, 2010);
- Offer Road Conservation Category Wetland Management Plan (Ecoedge, 2010a);
- Offer Creek Rehabilitation Plan (Ecoedge, 2010b);
- Southern Extension Woodland Habitat Rehabilitation and Offset Area (WHROA) Rehabilitation Plan (Doral, 2013);
- Waterloo Project Offsets Strategy and Rehabilitation Plan (Doral, 2013).

9.6.1. PHOTOPOINT SETUP

At least one photopoint is established for each restoration area and is to be marked and recorded in the same way as existing environmental monitoring photopoints within the mine area. GPS coordinates and compass bearings are recorded for each photopoint, which is visited quarterly.

9.6.2. WEED CONTROL

Weed control is undertaken prior to planting (i.e. herbicide applications in autumn, spring and summer).

Necessary weed control should be determined by site weed inspections undertaken three times per year, in autumn, spring and summer. Each of the restoration sites should be assessed individually for the presence and severity of weed re-establishment. Weed species can then be treated with herbicide as required based on observations during site inspections.

There are two main aims of the weed control program: one, to prevent weed seed set and two, to reduce competition with planted seedlings for resources. The site weed inspection schedule will therefore need to be continually audited in order to determine whether an increase or decrease in the frequency of inspections is necessary in order to achieve this aim.

9.6.3. SLASHING

Slashing dead weed biomass on a site prior to planting has proven very useful in reducing weed germination and fungal and mould infestations. Slashing is best undertaken in combination with herbicide treatment. Slash post-spraying once the weeds have died using a tractor-slasher or ride on mower as appropriate. The biomass can usually be left when it falls, to act as mulch and eventually end up as organic matter in the soil.

9.6.3.1. RIPPING

Deep ripping has been proven highly effective for seedling survival on the clay and clay loam soils of the Pinjarra Plain and the lateritic soils of the Ridgehill Shelf. Ripping fractures compacted soil, facilitating aeration and the infiltration of water down into the soil profile. Ripping is necessary in areas that have not been mined. Recreated soil profiles do not require additional ripping.

Where necessary, the soil should be ripped where possible to 50 – 80 cm depth in late summer / early autumn, as this is when the soil compaction layer will shatter. Riplines should follow contours and be kept outside the foliage line of remnant vegetation.

Seedlings should be planted into rip lines for two reasons; first, plant roots will be able to make good use of the fissures created in the compaction layer, and second, follow-up weed control will be rendered much easier if seedlings are in rows as mechanised equipment can be utilised.

Where riplines are not necessary, planting should be undertaken in rows approximately 2 m apart. Plants should be placed every 1.5 – 2 m along the row and staggered, so that a zigzag effect is achieved.

9.6.3.2. MOUNDING

Mounding is recommended on all but elevated, deep sandy soils. The concentration of topsoil as a medium in which to plant trees is beneficial for survival and early growth.

Mounding is essential on wet sites. On wet sites mounds should be aligned to allow excess water to drain off the site without causing erosion.

The drainage furrows created on each side of the mound provide important additional drainage. For maximum effect, these should be continuous, and connected into the drainage network. The mound should be constructed at least 200mm to 300mm high, about 1000mm wide and located over the ripline (see Figure 9-5). Even larger mounds may be required on very wet sites.

9.6.4. FURROWLINING

Furrowlining can be used to break the water repellent layer on elevated, non-wetting, deep sands, and allow water to enter through the bottom of the furrow. This is also an effective means of weed control, and can give some shelter to small seedlings. Caution should be used where exposure could lead to wind erosion, or where water erosion could occur down the furrow. In these situations, ripping followed by a press wheel or tyre will provide a suitable entry point for water. Weed control can then be undertaken with herbicides. Furrows are usually 200 to 300mm deep and about one metre wide (see example in Figure 9-6). As furrowlining removes topsoil, fertilising of trees may be necessary.

9.6.5. REVEGETATION METHOD (SEEDLINGS/DIRECT SEEDING)

The considerable weed burden and wide variety of weed species which persist on the lease areas due to the long history of agricultural use substantially reduces the likelihood of successful direct seeding. As such, tubestock is utilised for all restoration sites.

9.6.6. SEED SOURCING AND COLLECTION; SEEDLING SOURCING

Seed are sourced locally wherever possible. An assessment of potential seed sources on neighbouring properties has been undertaken as part of the Willoughby and CCW restoration projects.

Private landholders are contacted in July and August preceding each summer collecting period in order to negotiate for supply of seed. Reconnaissance visits should be made to each site during August and September of the same year to determine the species diversity and seed quantity that can be sourced in time for orders to be placed with local nurseries for the coming planting season as required. It is Doral's intention to engage volunteer seed collectors associated with local community groups where possible in order to add value to the skills and experience of group members and support the local community. Seed collected will be given to the Leschenault Community Nursery where it will be grown specifically for this project. Any species not able to be supplied by this nursery will be sourced from other nearby suppliers.

9.7. SCHEDULE

Rehabilitation to the agreed final end land use was completed in 2018. Refer to Section 7.3.5 and Figure 9-7 for details of rehabilitation undertaken to date.

9.8. UNPLANNED CLOSURE

Mining ceased at the Dardanup Mine in December 2015. As such, rehabilitation and decommissioning works have been significantly progressed during 2017 and 2018. Doral's provisions for closure are expected to be able to provide adequate funds for planned and unplanned closure scenarios.

9.9. RELINQUISHMENT

Following the completion of the closure activities described above, Doral's intention is to relinquish the mining tenements that the Dardanup Mine operates on, return property to landowners and sell the remaining property that is owned by Doral. The proposed process to achieve this outcome is:

- Implement rehabilitation, deconstruction and infrastructure reinstatement;
- Document fulfilment of completion criteria;
- Obtain written acceptance from landowners that property meets the landowner's requirements, that Doral has fulfilled its obligations to rehabilitate the property and the landowner is willing to resume control of the property;
- Request relinquishment of the mining leases from the DMIRS.

This process is largely complete at the time of preparation of this MCP, pending receival of some landowner acceptance letters. It is anticipated that once received a relinquishment document will be submitted to DMIRS

10. CLOSURE MONITORING AND MAINTENANCE

Doral currently undertakes monitoring and maintenance of progressive rehabilitation, which will be maintained once operations cease.

10.1. CLOSURE MONITORING

Closure monitoring and measurement is targeted on demonstration of fulfilment of the completion criteria (see Section 6) and meeting all relevant obligations.

Doral will continue to undertake environmental monitoring as required by site specific licences (e.g. DoW and DER operational licence) until such time those licence instruments are removed. The methodology for those monitoring aspects are described within Doral's Annual Environmental Report.

10.1.1. COMPLIANCE

Doral has compiled a checklist of closure obligations (Appendix G). This checklist is populated and maintained as an ongoing demonstration that obligations are being met.

Where Doral has an access agreement with a landowner, at the completion of rehabilitation Doral will obtain written acceptance from the landowner that rehabilitation and reinstatement of infrastructure has been completed to the landowners satisfaction and that the landowner accepts transfer of the land from Doral.

10.1.2. LANDFORMS

Doral conducts post-mining final land surface elevation surveys. These are used to check that final surface topography is as designed, to identify maintenance work (if required as a result of subsidence).

Within agricultural land use areas Doral undertakes pasture productivity monitoring. Doral intends to use current pasture productivity methodology as developed and promoted within the agricultural industry by CSIRO and the Department of Agriculture and Food.

Within road reserves pit backfill is conducted under the technical direction and to the standards of the Shire of Dardanup. During road construction geotechnical assessments are undertaken and reports generated by the road building contractor. Doral obtains written acceptance from the Shire that the road construction meets the Shire's requirements prior to the road being opened for public use.

10.1.3. NATIVE VEGETATION

Doral is committed to implementing a range of revegetation works. A photo-monitoring programme has been developed and is being implemented to monitor the success of these works. This programme shall be continued during closure implementation. Furthermore a vegetation health monitoring programme is undertaken for the identified conservation significant wetlands and groundwater dependant vegetation.

Photopoints have been established at all of the native rehabilitation areas in order to allow visual monitoring of rehabilitation progress and success. The photopoints are visited quarterly. Monitoring quadrats have also been established at the Willoughby Offset Area, WHROA and Waterloo Offset to provide a more quantitative measure of change over time. Current quadrats have been set up in the portion of the rehabilitation areas where remnant vegetation is present. Quadrats will be established within the planted areas to allow monitoring of revegetation success. Characteristics such as species composition, soil type and ground cover are assessed and noted during the periodic visits to the quadrats.

Vegetation health monitoring transects and photo-points have been established at thirteen sites. Twelve are within the potential groundwater drawdown area of the project area, and one is a control site. The transects are located in areas of remnant vegetation in paddocks and within roadside vegetation.

Vegetation health monitoring at these transects has been undertaken since 2009 for sites 1 to 8 and from 2011 onwards for sites 9 to 13. The sites are relative to dewatering with some as control sites. Monitoring has historically been monthly for all sites however from year end 2014, sites 1-8 are not required to be monitored as two winters post dewatering has been achieved. Sites 9-13 continue to be monitored monthly. Each individual tree has been tagged for identification and the following tree characteristics are measured:

- Diameter at breast height (DBH) is measured with a tape measure at approximately 1.3m from ground level around the trunk. If numerous trunks are present, the largest trunk is measured;
- Canopy vigour is ranked from 1 (poor) to 5 (excellent) according to the proportion of canopy that is alive;
- Canopy density is recorded as the percentage of canopy observed compared to the 100% density possible;
- Height is measured by approximation from ground level;
- Presence of new growth is assessed by checking for the softer leaves at the apical ends of lower branches;
- Stress is ranked as D (dead), VS (very stressed), S (stressed) or NS (not stressed) according to a combination of defoliation and leaf health measures;
- Presence of leaf stress is usually obtained from lower branches which are able to be closely observed. Leaf stress is indicated by leaves showing signs of desiccation, chlorosis or dying at the tips;
- Trees are observed for signs of flowering.

10.1.4. RADIATION

Doral conducts post-mining ground level (1m from surface) gamma radiation surveys following the completion of mining and rehabilitation. This data is recorded to ensure that post-mining landforms are returned to acceptable background gamma radiation levels and similar to pre-mining levels.

Should returned post mining background gamma levels be unacceptable, then post rehabilitation earthworks may be required.

10.1.5. WATER

Doral currently undertakes a comprehensive surface and groundwater monitoring programme and results are published annually in the Doral Annual Environmental Report. In essence all the elements of this monitoring programme shall be maintained until such time that it has been demonstrated that water quality and water flow regimes have returned to a similar state to the surrounding areas.

10.1.5.1. SURFACE WATER

Sample collection will be conducted in accordance with DWER Licence requirements and AS5667.1:1998 (Water quality - Sampling - Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples). Monthly samples will be taken using the following collection methods:

- A calibrated Hanna HI 98130 hand held meter was used to take electrical conductivity (EC) and pH readings in situ;
- Total Suspended Solids (TSS) and sulfate levels were determined by collecting samples in clean plastic bottles and sending them to a NATA accredited laboratory for analysis.

Annual samples will be taken of:

- Appropriately treated and untreated sample bottles will be supplied by a NATA laboratory for the collection of the annual water sample from the Process Water Pond (Site 8); to be analysed for total petroleum hydrocarbons (TPH);
- Visual inspections will be undertaken of all surface water drainage lines, during flow events, to document the direction of flow and destination of flow (used to confirm the catchment of the drainage line).

10.1.5.2. GROUNDWATER

The following procedures will be carried out in accordance with DER and DoW licence requirements at each piezometer within and adjacent to the mine site:

- Static Water Levels – Piezometers dipped using a static water level indicator and depth below collar recorded. Readings are later converted to mAHD;
- pH and EC – Piezometers are purged prior to sampling. A calibrated Hanna HI98130 water quality meter is used to obtain pH and EC readings;
- Sulfate – Piezometers are sampled (after purging) and water was sent to a NATA accredited laboratory for sulfate analysis;
- Monthly sample sent to a NATA accredited laboratory and analysed for pH, EC, Total Dissolved Salts (TDS), Total Acidity, Total Alkalinity, chloride, sulfate, Al, Fe and Mn.

10.1.6. INFRASTRUCTURE

Photo-documented visual inspection shall be utilised to demonstrate that mining and processing equipment has been removed from site and agreed post-mining infrastructure has been installed.

Doral shall seek written acceptance from landowners that infrastructure has been installed to an acceptable working standard.

During deconstruction waste disposal records shall be retained to demonstrate that waste is disposed to appropriately licenced facilities.

As at 2018, all infrastructure has been decommissioned.

10.2. CLOSURE MAINTENANCE

Doral currently undertakes maintenance works on progressive rehabilitation areas. These activities will be continued into closure and will include:

- Reinstatement of designed surface levels where these are affected by subsidence (this method involves the stripping of topsoil, placement of subsoil or sand fill and reinstatement of topsoil);
- Where post mining background gamma radiation levels are found to be unacceptable, then earthworks will be undertaken to remove materials with elevated levels from near the soil surface;
- Weed control, where detected;
- Infill planting in native revegetation areas;

- Pest control;
- Pasture seeding and fertilising as relevant to the agricultural production system in place;
- Maintenance of fencing;
- Activities to correct erosion within drainage lines and stabilise the drainage line bed and banks;
- Maintenance of artificial fauna habitats.

11. FINANCIAL PROVISION FOR CLOSURE

11.1. FINANCIAL PROVISIONING PROCESS

Doral has a process established for estimating the cost for closing the Dardanup Mine site. This cost estimate is updated annually as part of the annual budgeting cycle. As at December 2018, the remaining costs are predominantly based on the residual rehabilitation cost estimate component only as the deconstruction and restoration has been completed.

The rehabilitation cost estimate is generated for each mining block utilising the following inputs:

- Cost unit rates ($/hr) are maintained for each type of earthmoving equipment as per the current earthmoving contract rates with an escalation factor for future provisioning;
- Equipment productivity rates (bulk cubic metres/hr) are based on average performance achieved at Dardanup Mine site for rehabilitation activities;
- Bulk earth moving volume is calculated for each mining block, based on surveyed mine pit volume, surveyed stockpile sizes and soil profile design, including:
    - Overburden;
    - Subsoil;
    - Extra tailings sand;
    - Topsoil (placement over entire disturbance area, not just mining block);
    - Sand tailings backfill, in pit overburden placement, tailings co-disposal and dry clay fines placement are treated as operating costs and are not included within the closure cost estimate.
- Cost unit rates are maintained for the following activities which are based on current costings:
    - Fencing ($/linear metre);
    - Drainage / Erosion Control;
    - Revegetation;
    - Service Re-establishment.

Closure Overheads including maintenance of equipment and infrastructure and environmental monitoring have been provisioned based on the organisation structure and implementation strategy described in Section 9.

The rehabilitation cost estimate is then generated by summing:

Calculating costs of bulk earthworks (volume x equipment productivity rate x cost unit rate);

- Revegetation costs;
- Drainage / erosion control costs;
- Fencing costs (length of fencings required x cost unit rate);
- Service re-establishment costs;
- Closure Overheads.

11.2. CLOSURE COST ESTIMATE AND PROVISION

The total closure cost estimate for the Dardanup Mine as at 31 December 2018 is $9.66M. Doral's audited and financially reported costs for rehabilitation are presented within Table 11-1.

12. MANAGEMENT OF INFORMATION AND DATA

Doral maintains an operational environmental management system (EMS) which provides for the storage and retrieval of environmental data. All environmental data collected and reports produced are stored in accordance with the requirements of the EMS.

This Mine Closure Plan document serves as a focal point for containing a summary of data relevant to closure planning and implementation and contains reference to source documentation that are maintained within the EMS.

Furthermore, Doral produces an Annual Environmental Report (AER) that reports on progress in operating the Mine and implementing progressive rehabilitation. Monitoring of progressive rehabilitation performance is described within the AER.

The Mine Closure Plan describes and documents the following information:

- History of regulatory approval of the Mine;
- History of development of the Mine;
- Summary of data relevant to planning and implementing closure of the Mine;
- Results of closure monitoring;
- History of progressive rehabilitation practices and materials placement.

As this plan is subject to ongoing revision and update the above information will be added to and updated as the Mine continues from closure into relinquishment.

13. REFERENCES

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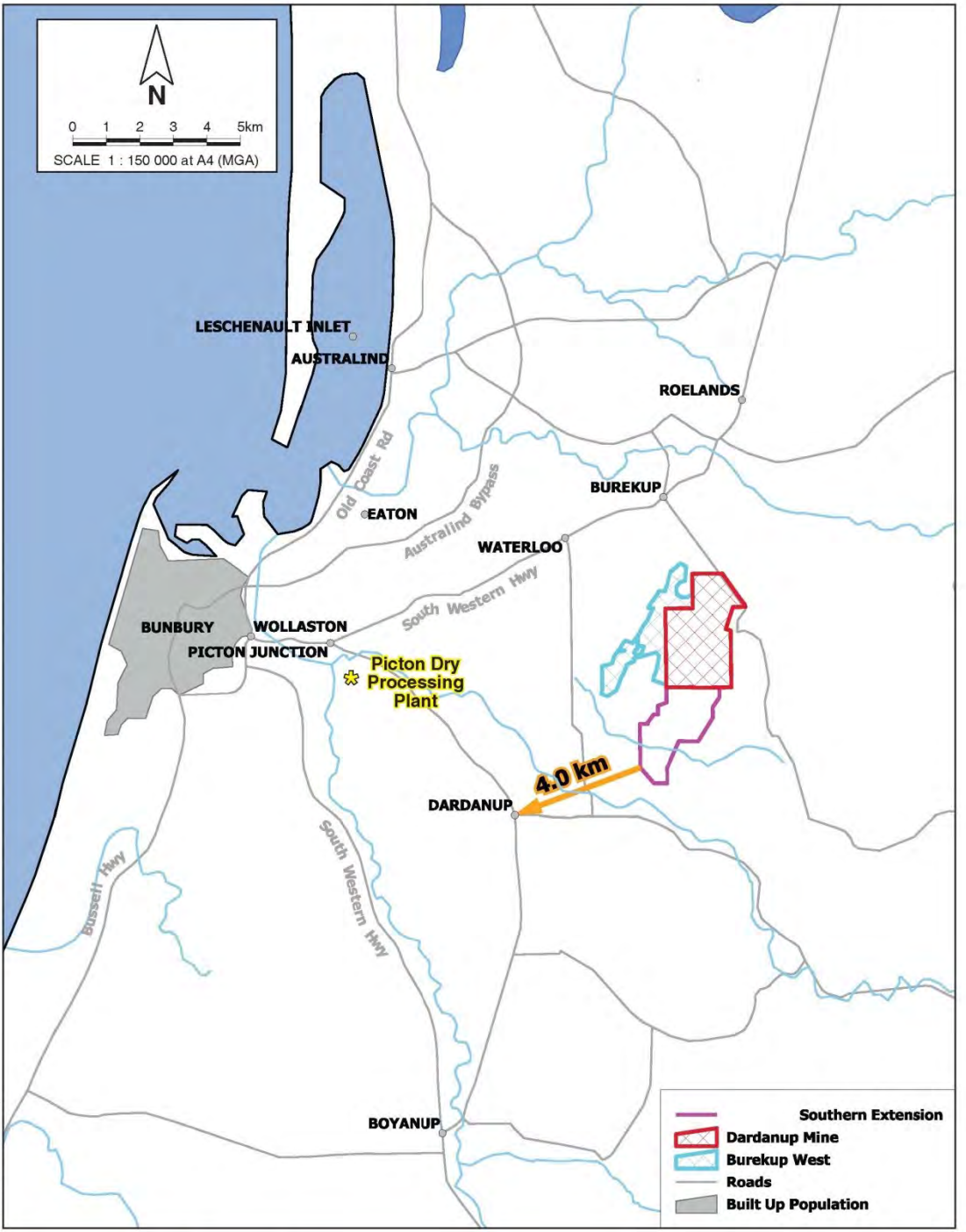
FIGURES

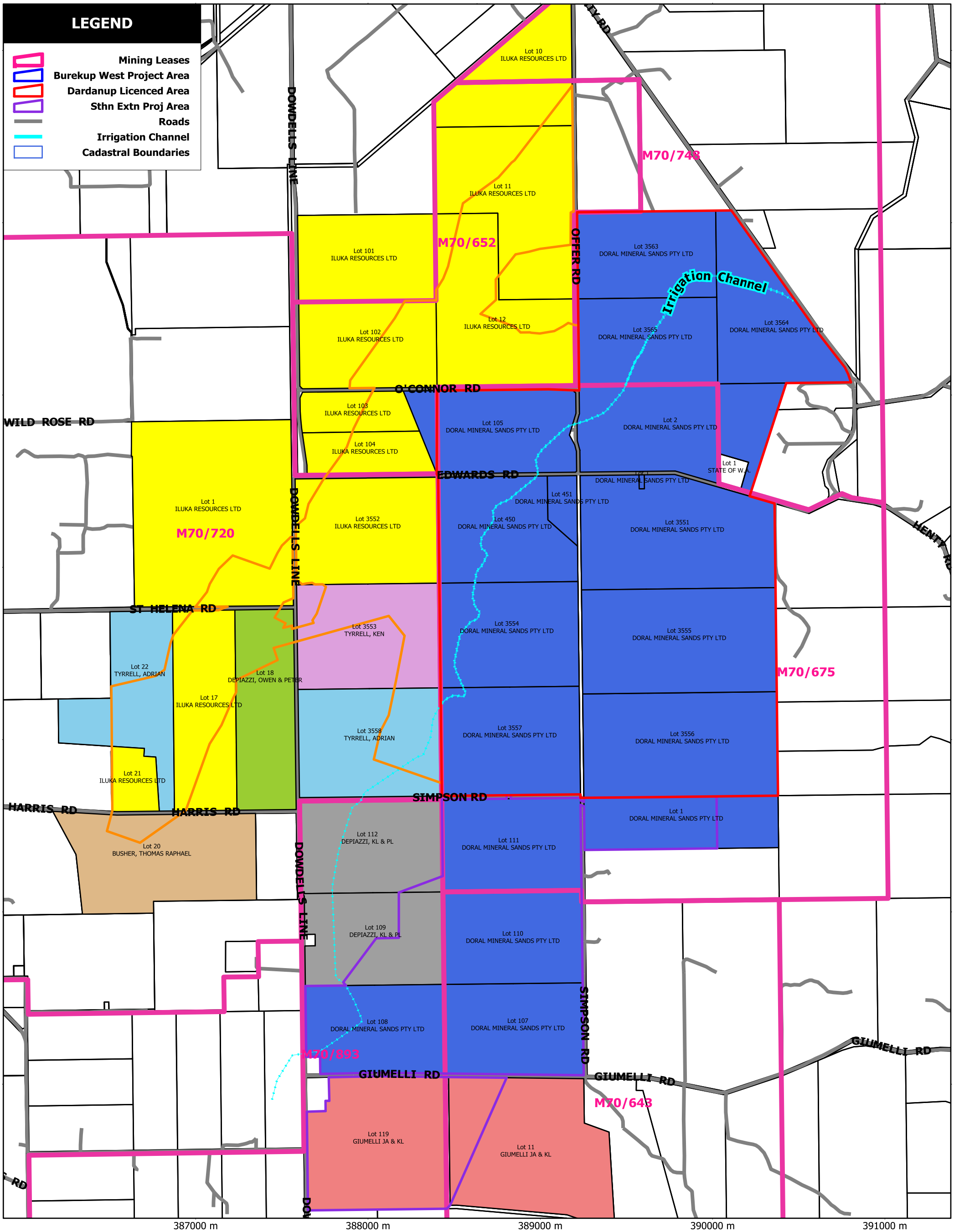


Doral

Figure 2.1

Locality Plan

Scale: 1:150000	Projection: Australia MGA94 (50)	Sheet Size: A4
File Name: DMS2011-002-closure plan-f2-01.dgn		Date: 29/10/2012



Date: 12/03/2014

Author: GMcD/ARM

Drawing: rehab2014.map

Scale: 1:20000

Projection: MGA Zone 50 (GDA 94)

Figure 2-2

Dardanup Minesite
Land Ownership
October 2012

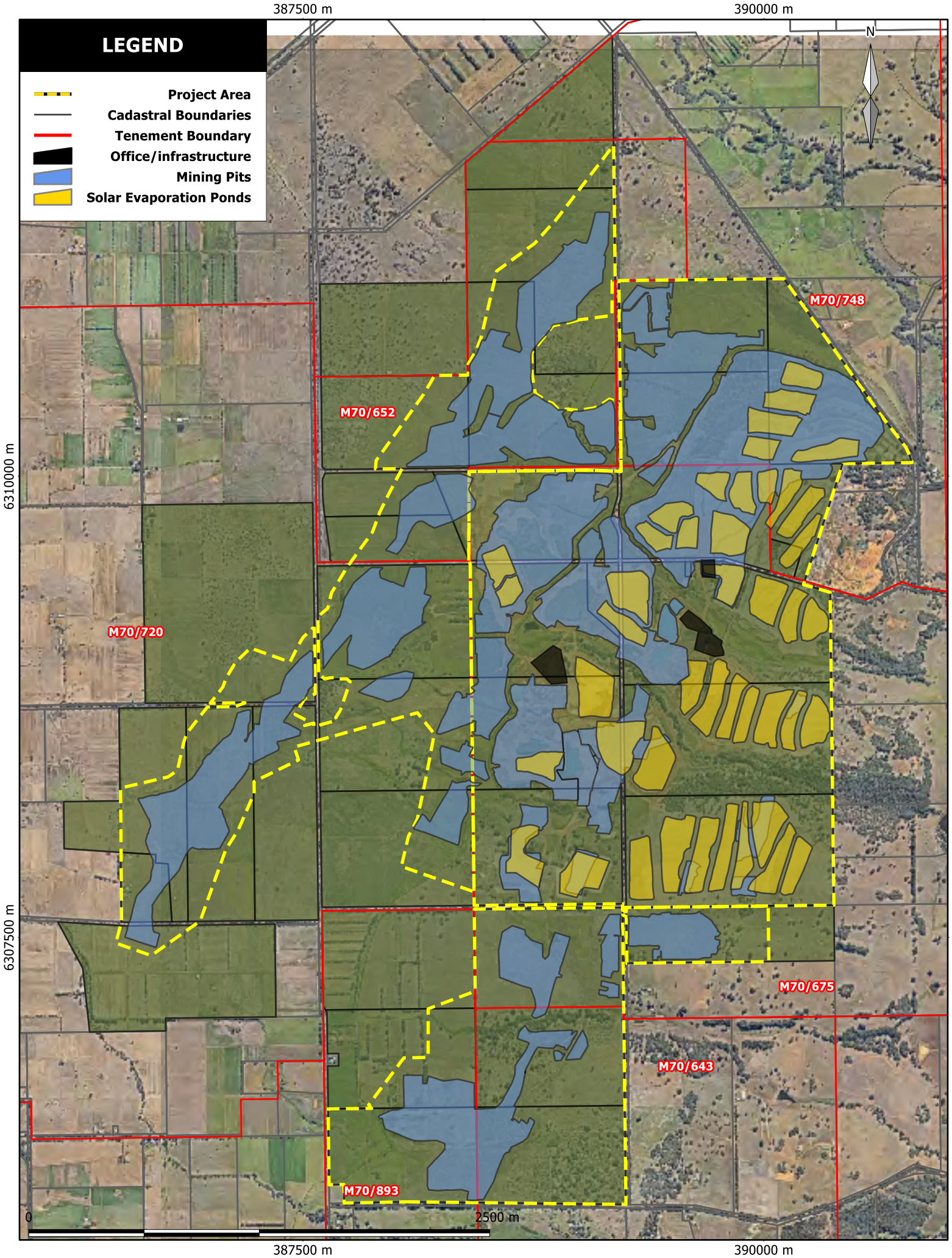


Figure 2-3

DORAL MINERAL SANDS - DARDANUP MINESITE
SITE LAYOUT

Australia MGA94 (50)
Scale : 1:25000 @ A4
File name : site plan mar2017.map
Printed at: 27/07/2017
Drawn by : ARM

387000 m 388000 m 389000 m 390000 m 391000 m

6311000 m 6310000 m 6309000 m 6308000 m 6307000 m 6306000 m

AILWAY RD
DOWDELLS LINE
RD
HENTY RD
OFFER RD
HENTY RD
O'CONNOR RD
E RD
EDWARDS RD
DOWDELLS LINE
ST HELENA RD
DOWDELLS LINE
D
HARRIS RD
SIMPSON RD
DOWDELLS LINE
SIMPSON RD

0 1000 m

LEGEND

- Completed Rehabilitation
- Lot Boundaries
- Environmental Offsets
- Doral Lots
- Roads

387000 m 388000 m 389000 m 390000 m 391000 m

Doral

Land Under Rehabilitation,
as per Schedule 1, MRF Regulations

FIGURE 2-4 Projection: Australia MGA94 (50) Drawn By: A.R.M

DORAL MINERAL SANDS PTY LTD

Scale: 1:17000 @A3 File Name: 2017 rehab schedule-Jan.map Date:23/01/2019

387000 m 388000 m 389000 m 390000 m

6311000 m 6310000 m 6309000 m 6308000 m 6307000 m 6306000 m

M 7000652
DORAL MINERAL SANDS PTY LTD

M 7000748
DORAL MINERAL SANDS PTY LTD

M 7000720
DORAL MINERAL SANDS PTY LTD

M 7000675
DORAL MINERAL SANDS PTY LTD

M 7000893
DORAL MINERAL SANDS PTY LTD

M 7000643
DORAL MINERAL SANDS PTY LTD

DOWDELLS LINE
WILD ROSE RD
O'CONNOR RD
EDWARDS RD
HENTY RD
HARRIS RD
SIMPSON RD
GIUMELLI RD

LEGEND

- PROPOSED REVEGETATION AREAS
- WILLOUGHBY'S OFFSET
- WHROA
- WATERLOO OFFSET
- St HELENA
- OFFER CREEK SOUTH
- OFFER CREEK NORTH
- NORTHERN REHAB CREEK
- HARRIS ROAD
- DOWDELL'S LINE
- CONSERVATION CATEGORY WETLAND OFFSET
- MINING LEASE BOUNDARIES
- LOT BOUNDARIES
- PUBLIC ROADS

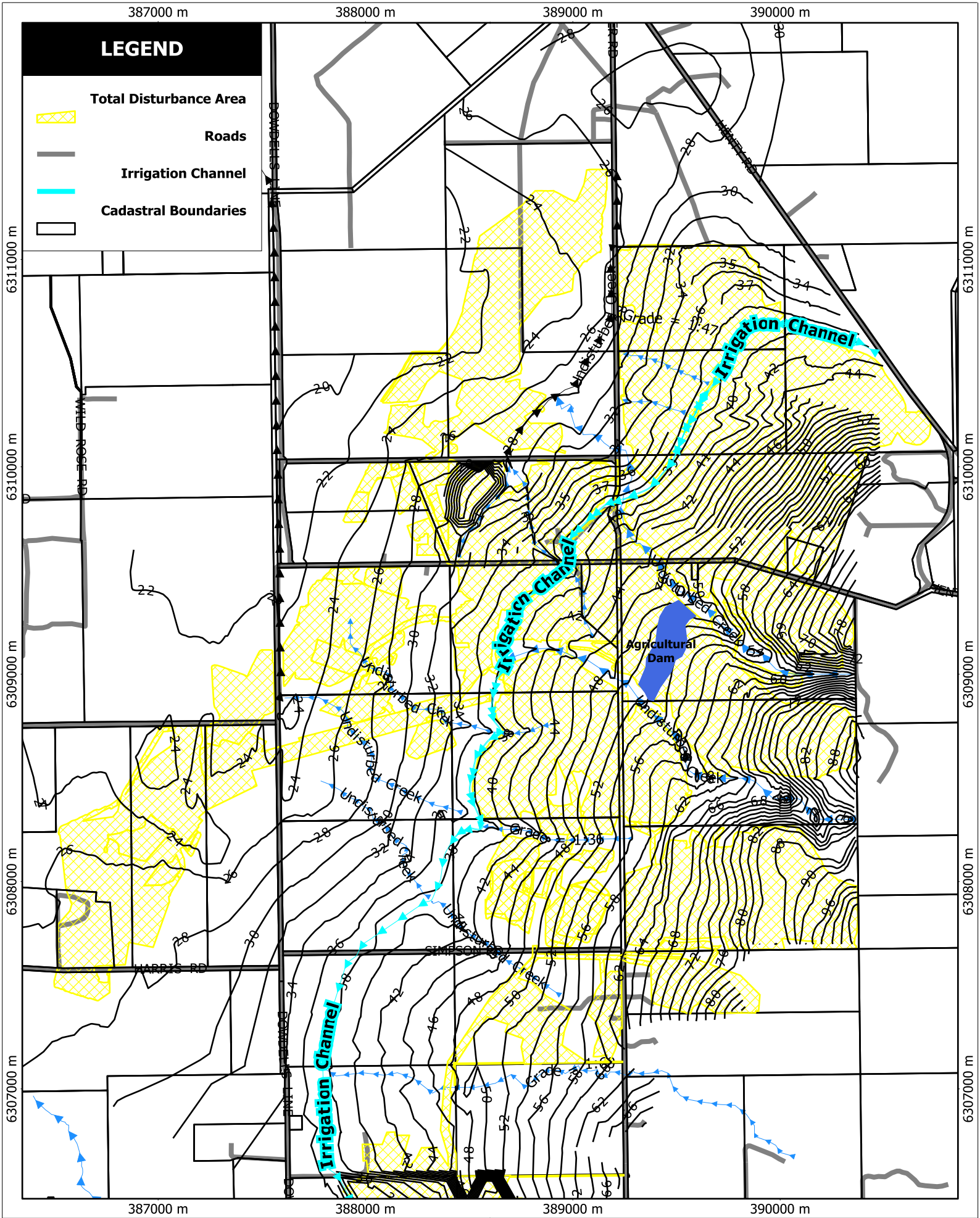
0 250 m

Doral

FIGURE 5-1
DARDANUP PROJECT REVEGETATION AREAS 2014

Projection: Australia MGA94 (50) | Drawn By: ARM

DORAL MINERAL SANDS PTY LTD | Scale: 1:15000 @A3 | File Name: south simpson.map | Date:21/08/2014



Doral

Date: 30/05/2012

Author: GMcD

Drawing: rehab2012.map

Scale: 1:23000

Projection: MGA Zone 50 (GDA 94)

FIGURE 5-2

Dardanup Minesite
Design Post-mining Landform Surface Levels
December 2011

FIGURE 7-1

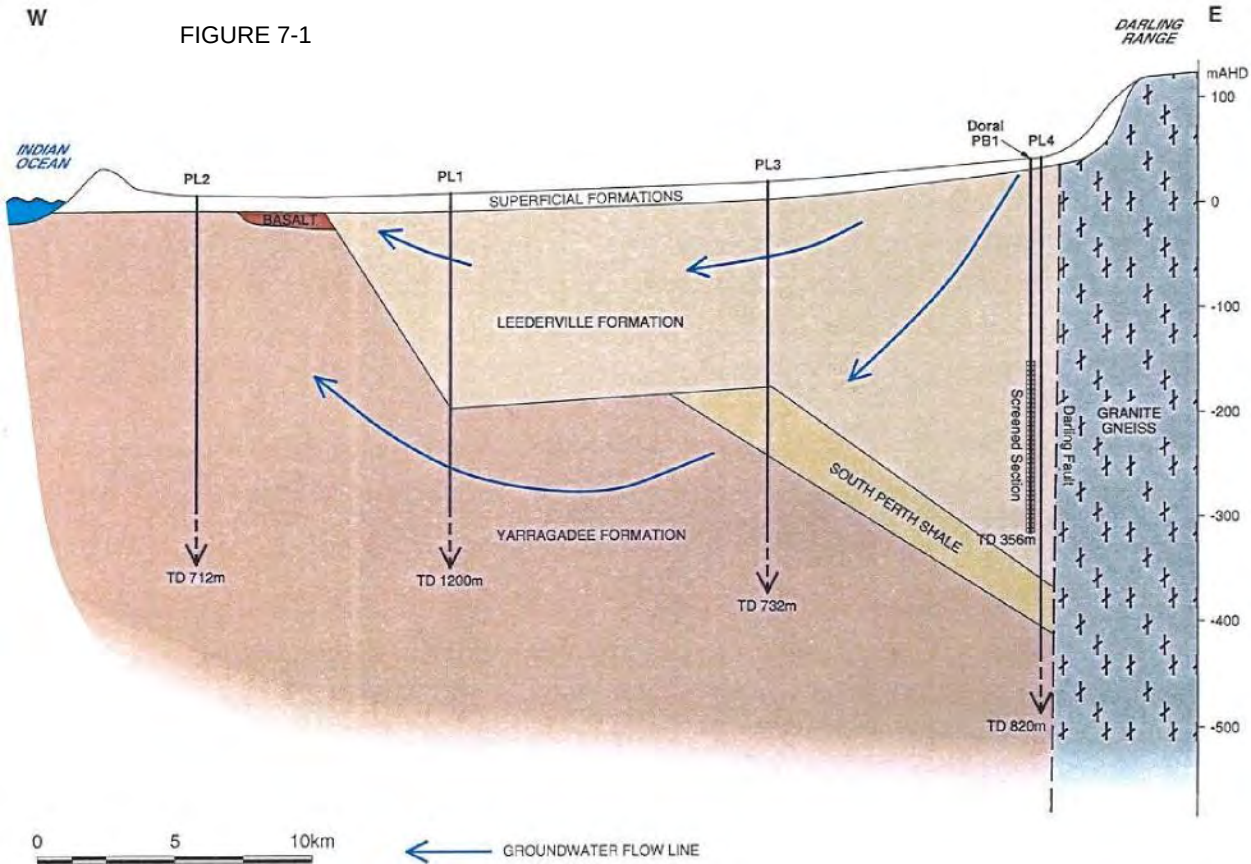

W
E
DARLING RANGE
INDIAN OCEAN
PL2
PL1
PL3
Doral PB1
PL4
SUPERFICIAL FORMATIONS
BASALT
LEEDERVILLE FORMATION
YARRAGADEE FORMATION
SOUTH PERTH SHALE
Screened Section
Darling Fault
GRANITE GNEISS
TD 712m
TD 1200m
TD 732m
TD 356m
TD 820m
mAHD
100
0
-100
-200
-300
-400
-500
0
5
10km
GROUNDWATER FLOW LINE

FIGURE 7-2

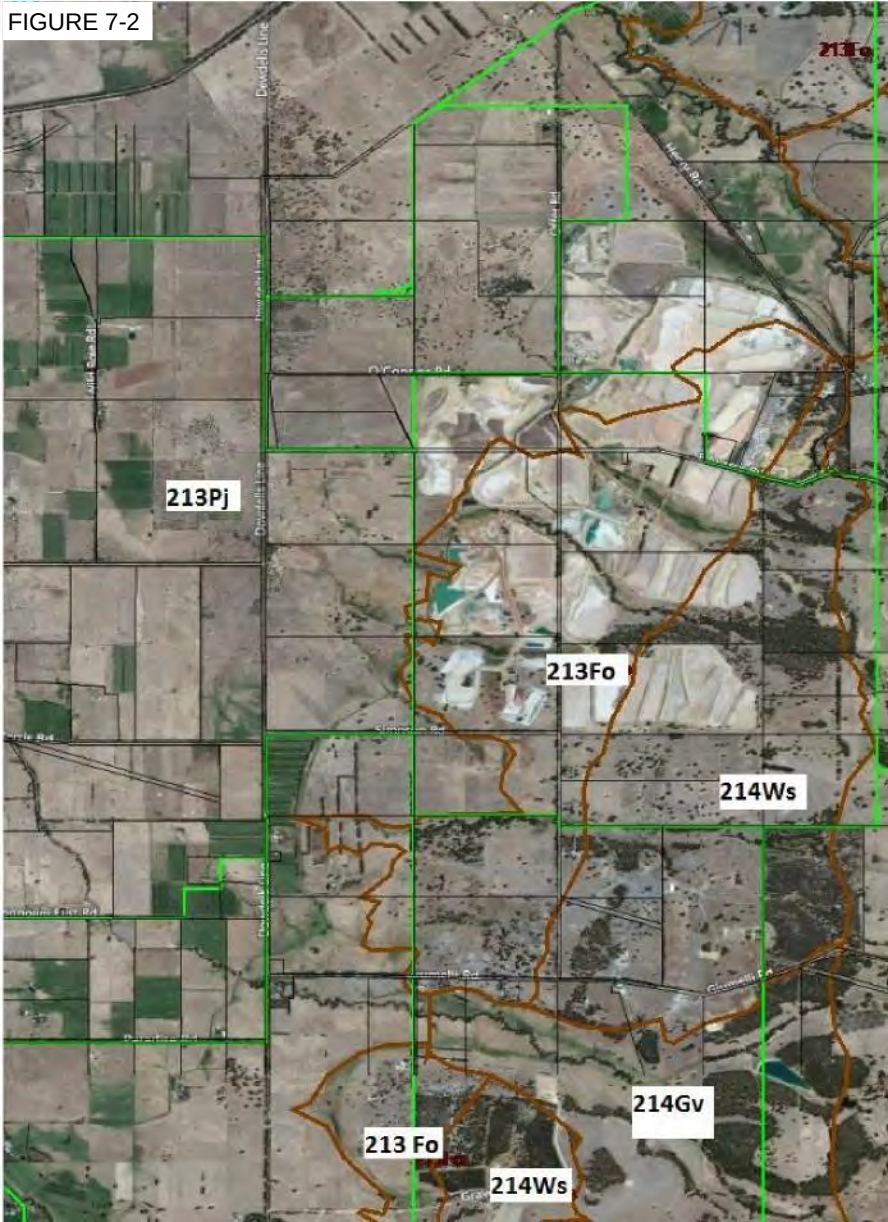
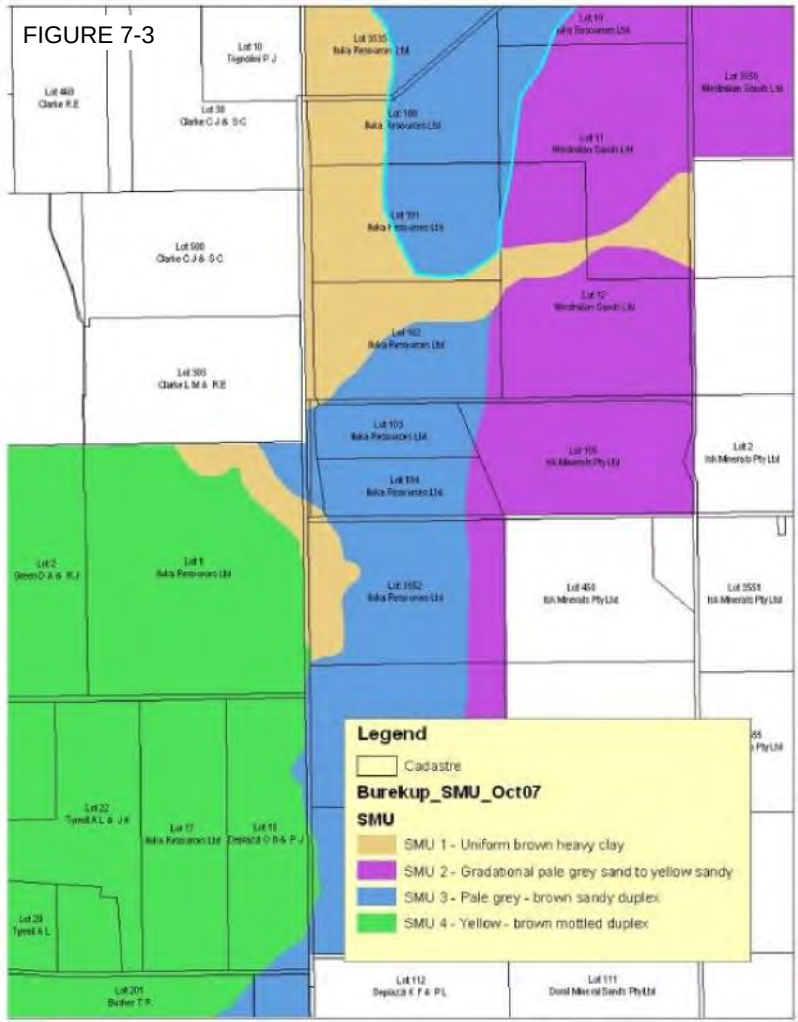


FIGURE 7-3


Legend
Cadastre
Burekup_SMU_Oct07
SMU
SMU 1 - Uniform brown heavy clay
SMU 2 - Gradational pale grey sand to yellow sandy
SMU 3 - Pale grey - brown sandy duplex
SMU 4 - Yellow - brown mottled duplex

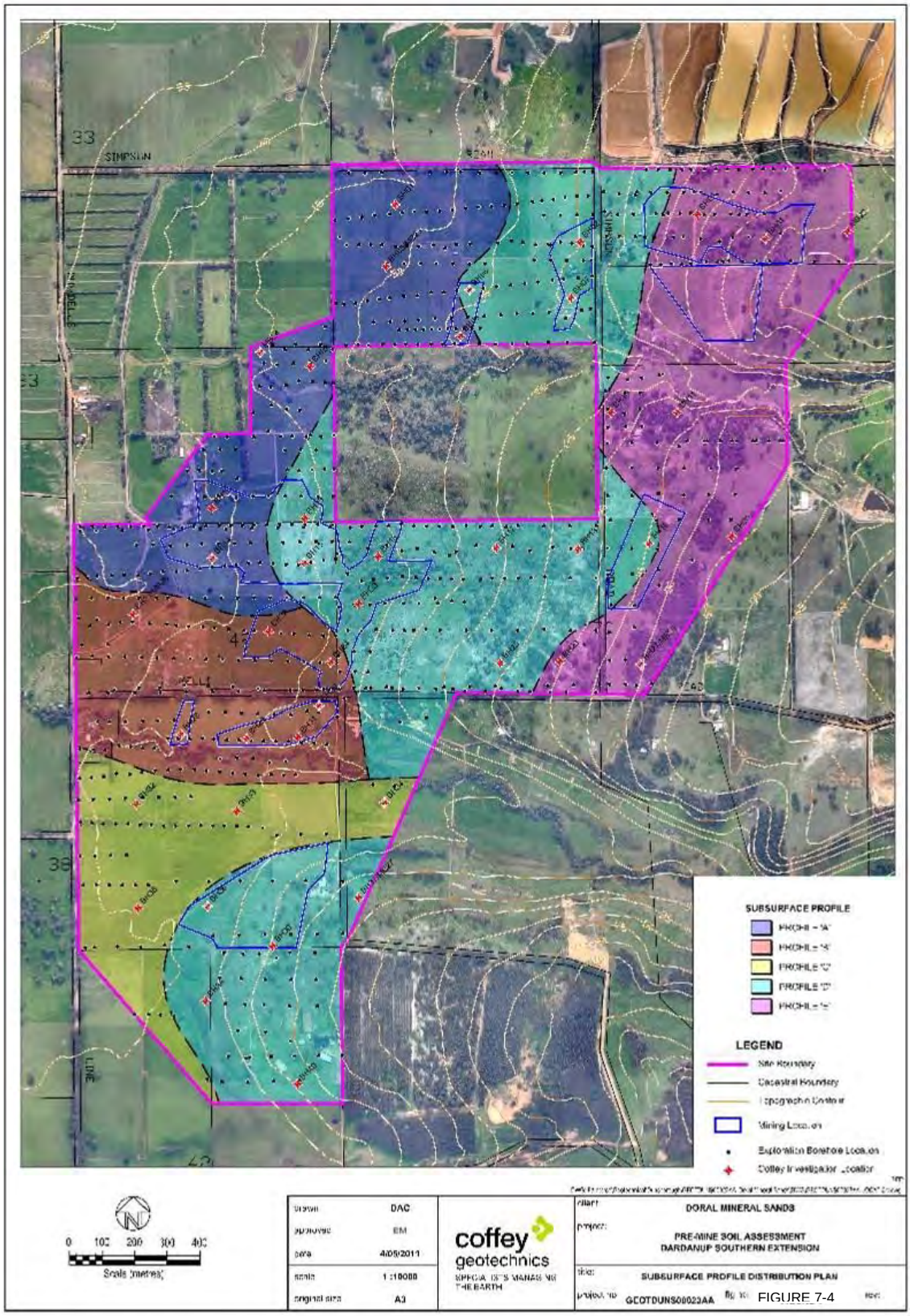

SUBSURFACE PROFILE
LEGEND
Site Boundary
Cadastral Boundary
Mining Location
0 100 200 300 400
Scale (metres)
drawn DAC
date 4/05/2011
scale 1:10000
original size A3
coffey geotechnics
client DORAL MINERAL SANDS
project PRE-MINE SOIL ASSESSMENT
DARDANUP SOUTHERN EXTENSION
title SUBSURFACE PROFILE DISTRIBUTION PLAN
project no GCOTDUNS00023AA

FIGURE 7-4

388000 m

390000 m

6310000 m

6308000 m

DOWDELLS LINE

OFFER RD

HENTY RD

O'CONNOR RD

WILD ROSE RD

EDWARDS RD

ST HELENA RD

HARRIS RD

SIMPSON RD

GIUMELLI RD

BN01
BN02
BN03
BN04
O1
O2
O3
C1
C2
O4
O5
WP4
S01
S02
S03
S04
S05
WP3
WP1
TN1
TN2
ED06
ED07
ED04
ED05
TN4
TN3
WW1
ED09
ED08
ED03
ED01
ED02
G01
TS4
TS1
TS2
TS3
TS05
TS29
TS28
W1
W2
W3
W4
W5
SD6
BW09
BW10
BW11
R02
BW12
BW08
BW07
BW02
BW06
BW05
BW04
BWO1
R01
BW03
S3
S2
S4
S18
S19
D8
S7

0 1000 m

LEGEND

- CLAY OVERBURDEN OR DRY CLAY
- HIGH CLAY OVERSIZE
- OVERSIZE
- ROADFILL
- CO DISPOSED TAILS
- SAND TAILS
- text — BACKFILL LABELS

Doral

FIGURE 7-5 MINE PIT BACKFILL DISTRIBUTION 2017

Projection: Australia MGA94 (50) | Drawn By: A.R. Morgan

DORAL MINERAL SANDS PTY LTD | Scale: 1:15000 @A3 | File Name: Mine Pit Backfill Material Distribution A3.map | Date:24/03/2017

FIGURE 7-6

LEGEND

- Irrigation Channels
- Catchment Borders
- Dardanup Licenced Area
- Burekup West Project Area
- Sthn Extention Proj Area

Unnamed Catchment

Paradise Creek Catchment

Ferguson River Catchment

Public Works Drain

Irrigation Channel

Minor Water Course

Spray

Cffer Creek

Willoughby Creek

Paradise Creek

DOWDELLS LINE

WILD ROSE RD

ROSE RD

Swan B

Swan Main

Swan A

ST HELENA RD

HARRIS RD

O'CONNOR RD

HENTY RD

SIMPSON RD

GIUMELLI RD

OGNOLINI EAST RD

PARADISE RD

IS RD

Doral

Date: 12/03/2014

Author: GMcD / ARM

Drawing: rehab2014.map

Scale: 1:18000

Projection: Australia MGA94 (50)

FIGURE 7-7

Surface Water Systems

FIGURE 7-8

FIGURE 7-9


FIGURE 7-10


FIGURE 7-11

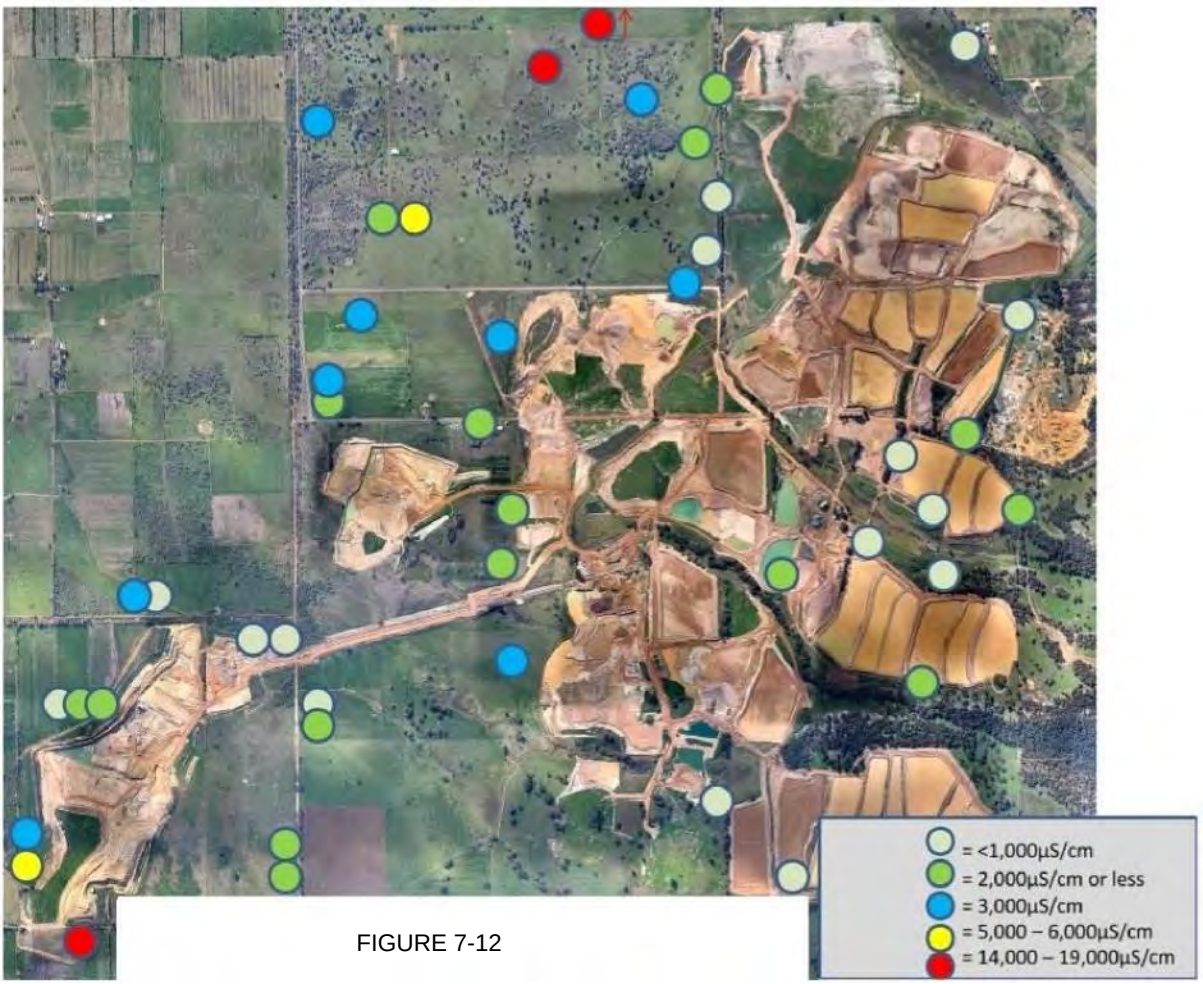
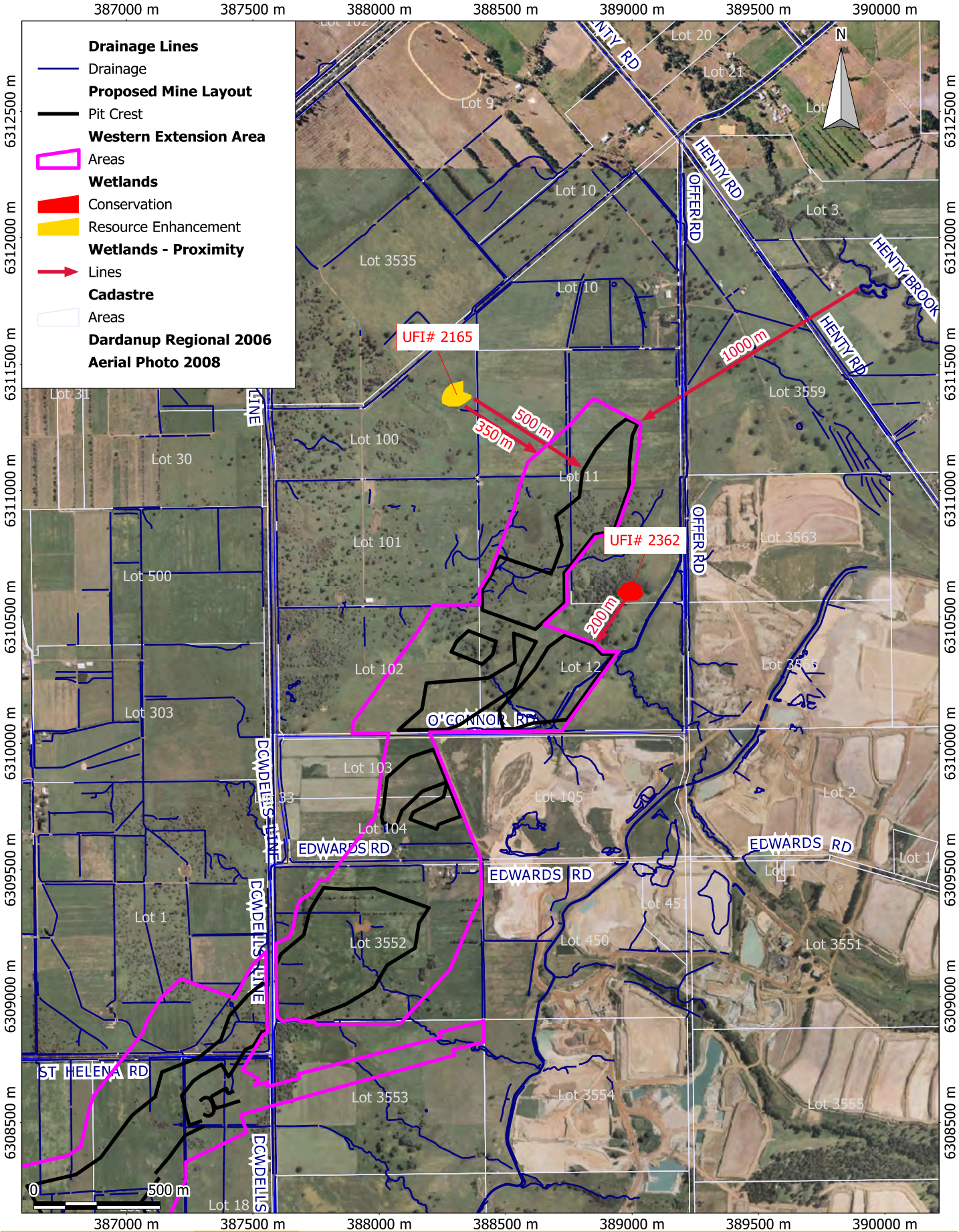

= <1,000µS/cm
= 2,000µS/cm or less
= 3,000µS/cm
= 5,000 – 6,000µS/cm
= 14,000 – 19,000µS/cm

FIGURE 7-12

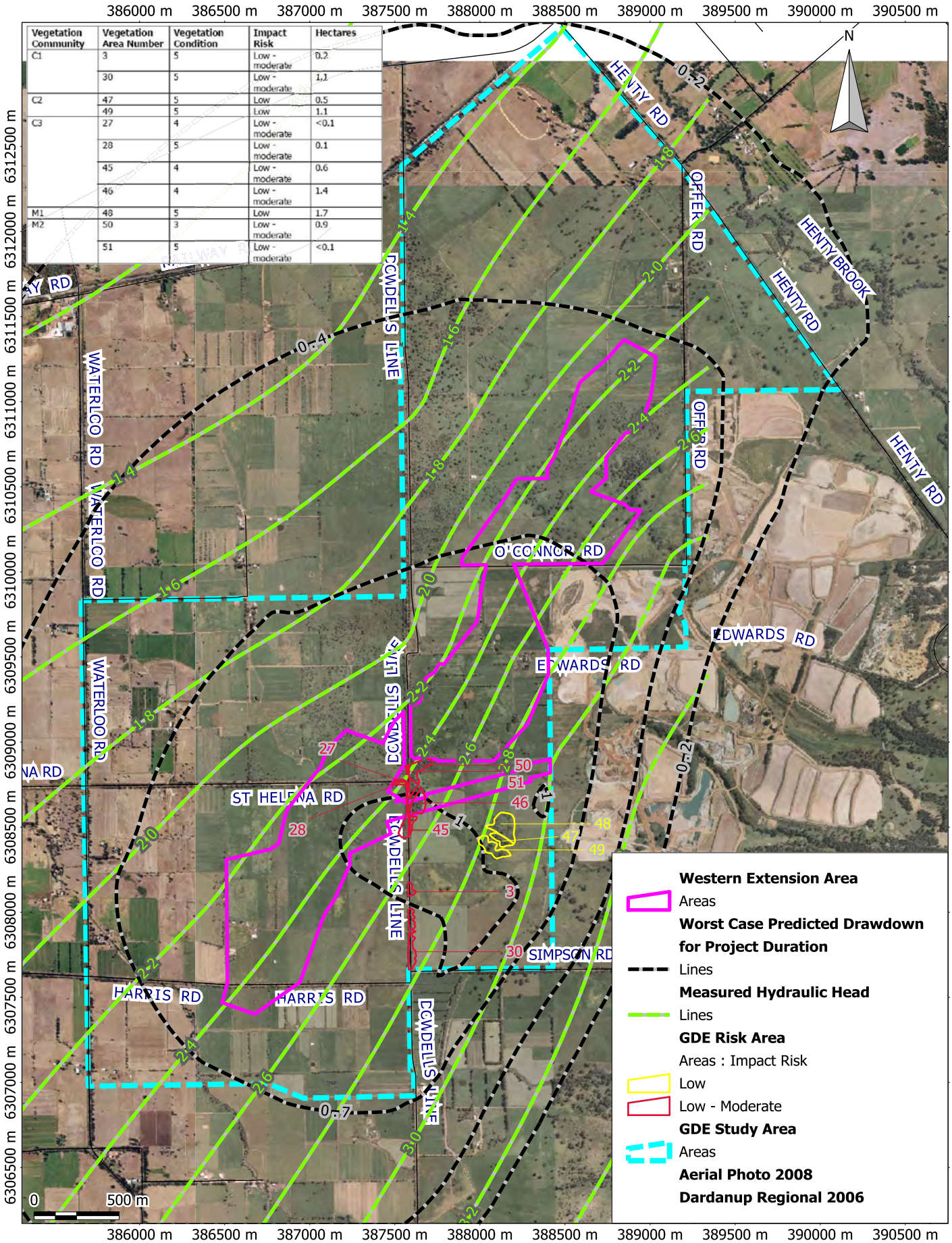


Doral

Dardanup Mine Closure Plan

Conservation Significant Wetlands

Scale: 1:20000	Projection: Australia MGA94 (50)	Sheet Size: A4
FIGURE 7-13		Date:25/11/2008



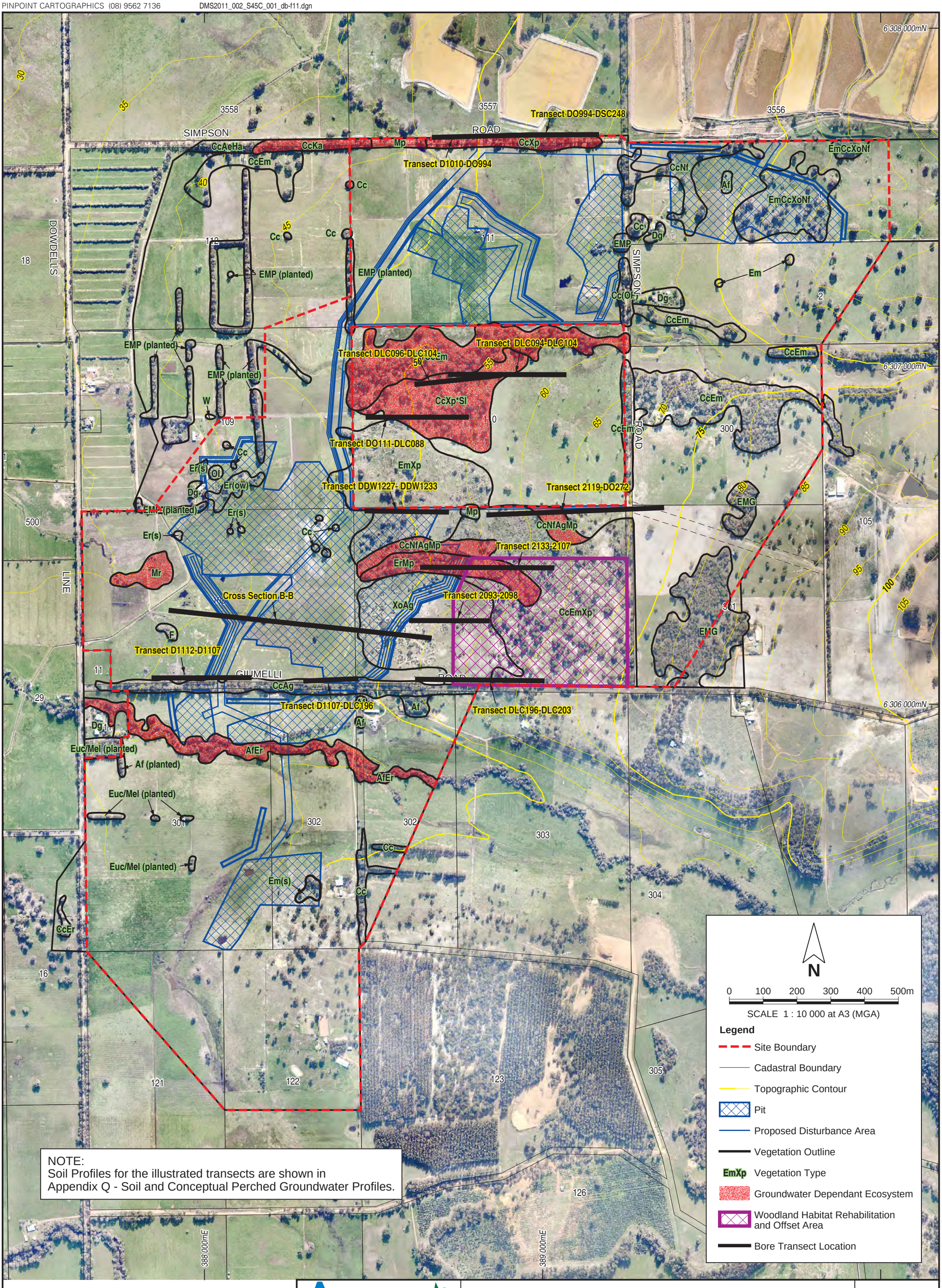
Vegetation Community	Vegetation Area Number	Vegetation Condition	Impact Risk	Hectares
C1	3	5	Low - moderate	0.2
	30	5	Low - moderate	1.1
C2	47	5	Low	0.5
	49	5	Low	1.1
C3	27	4	Low - moderate	<0.1
	28	5	Low - moderate	0.1
	45	4	Low - moderate	0.6
	46	4	Low - moderate	1.4
M1	48	5	Low	1.7
M2	50	3	Low - moderate	0.9
	51	5	Low - moderate	<0.1

Doral

Dardanup Mine Closure Plan

Ground Water Dependant Ecosystems
Western Extension

Scale:	Projection:	Sheet Size:
1:30000	Australia MGA94 (50)	A4
FIGURE 7-14		Date:12/16/2008



NOTE:
Soil Profiles for the illustrated transects are shown in Appendix Q - Soil and Conceptual Perched Groundwater Profiles.

CADASTRAL SOURCE: Landgate, January 2012.
VEGETATION SOURCE: Mattiske Consulting, 2011.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown July 2011.

Aurora environmental

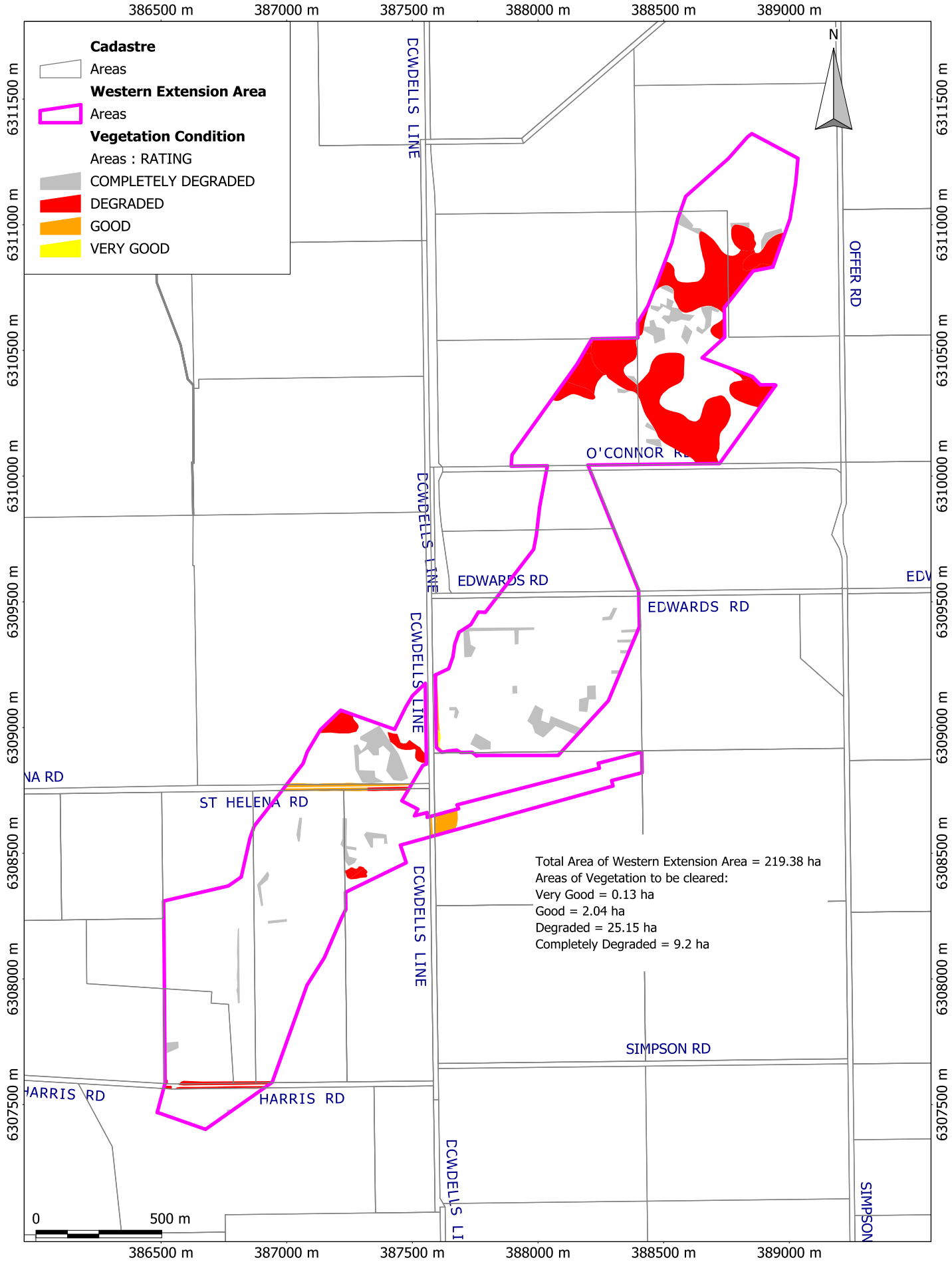
Drawn: D. Bourke | Date: 11 May 2012

Dardanup Mine Closure Plan

GROUNDWATER DEPENDANT ECOSYSTEMS
SOUTHERN EXTENSION

FIGURE 7-15

Job: DMS2011-002

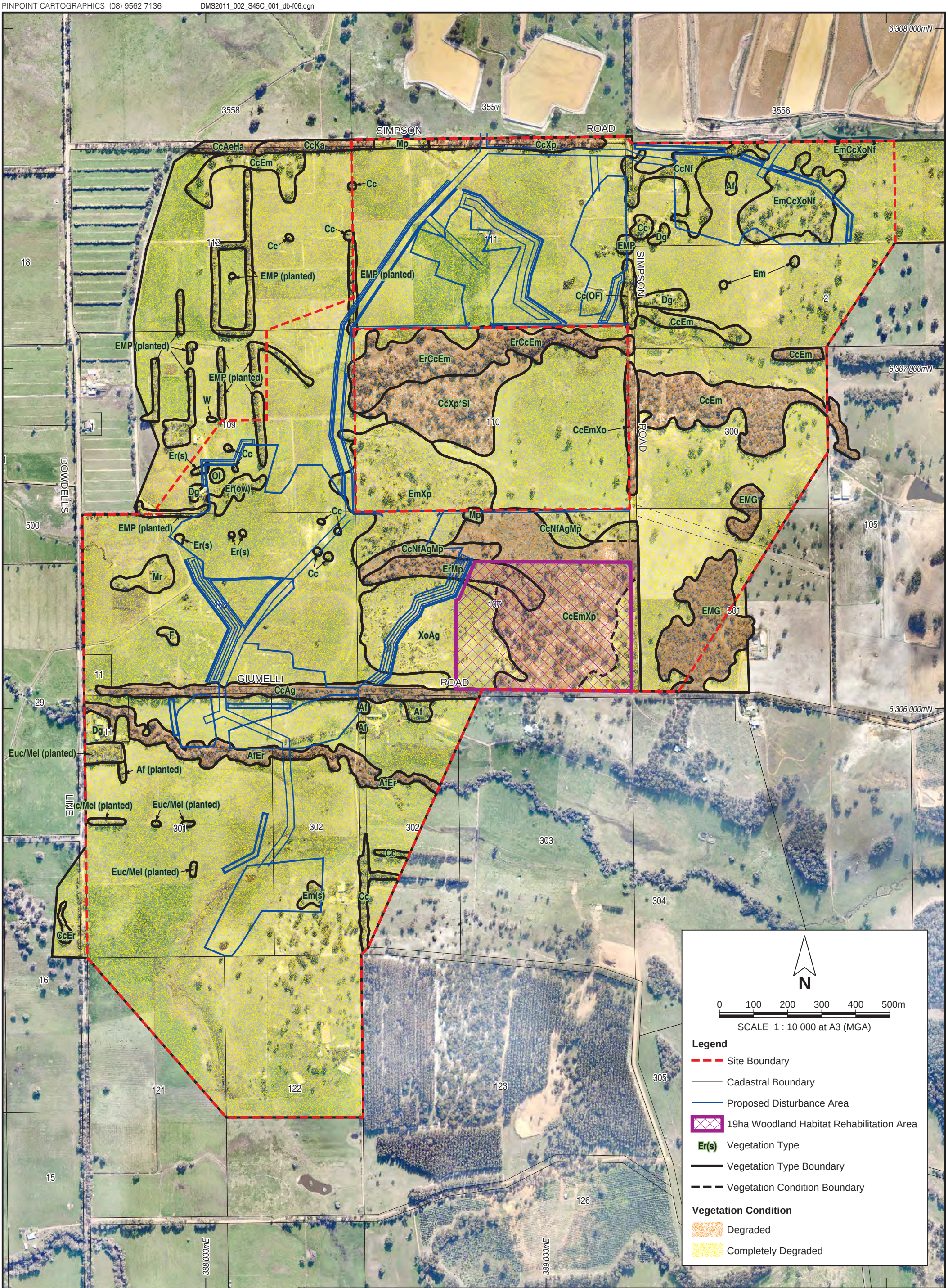


Doral

Dardanup Mine Closure Plan

Vegetation Condition - Western Extension

Scale: 1:20000	Projection: Australia MGA94 (50)	Sheet Size: A4
FIGURE 7-16		Date:25/11/2008



CADASTRAL SOURCE: Landgate, January 2012.
VEGETATION SOURCE: Mattiske Consulting, 2011.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown July 2011.

Aurora environmental

Drawn: D. Bourke | Date: 10 May 2012

Dardanup Mine Closure Plan

Vegetation Condition - Southern Extension

FIGURE 7-17

Job: DMS2011-002

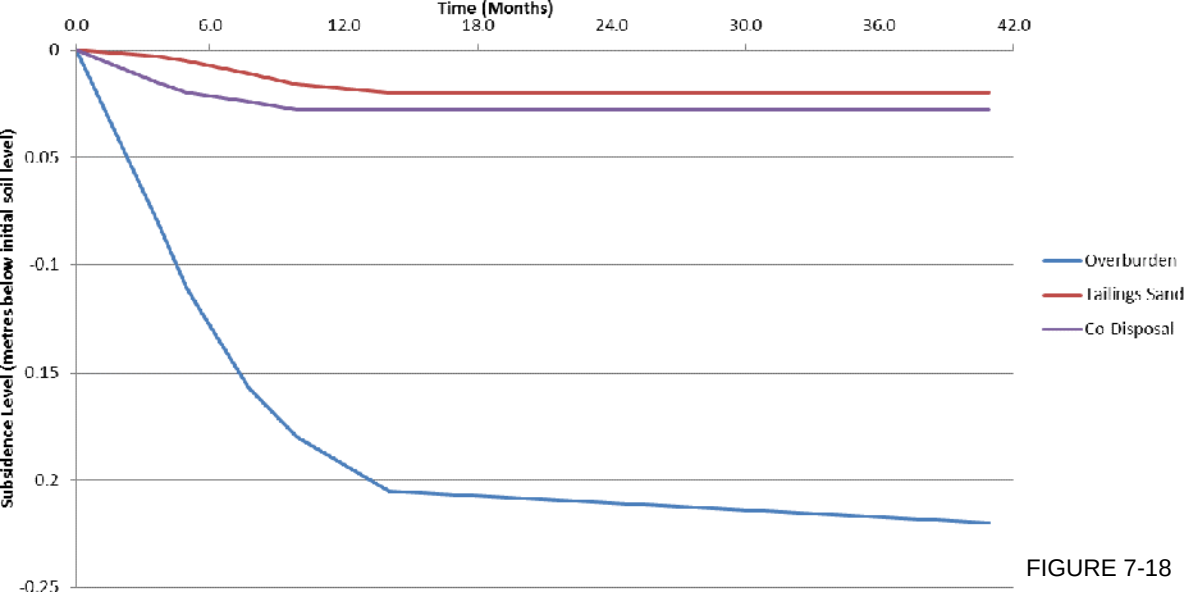
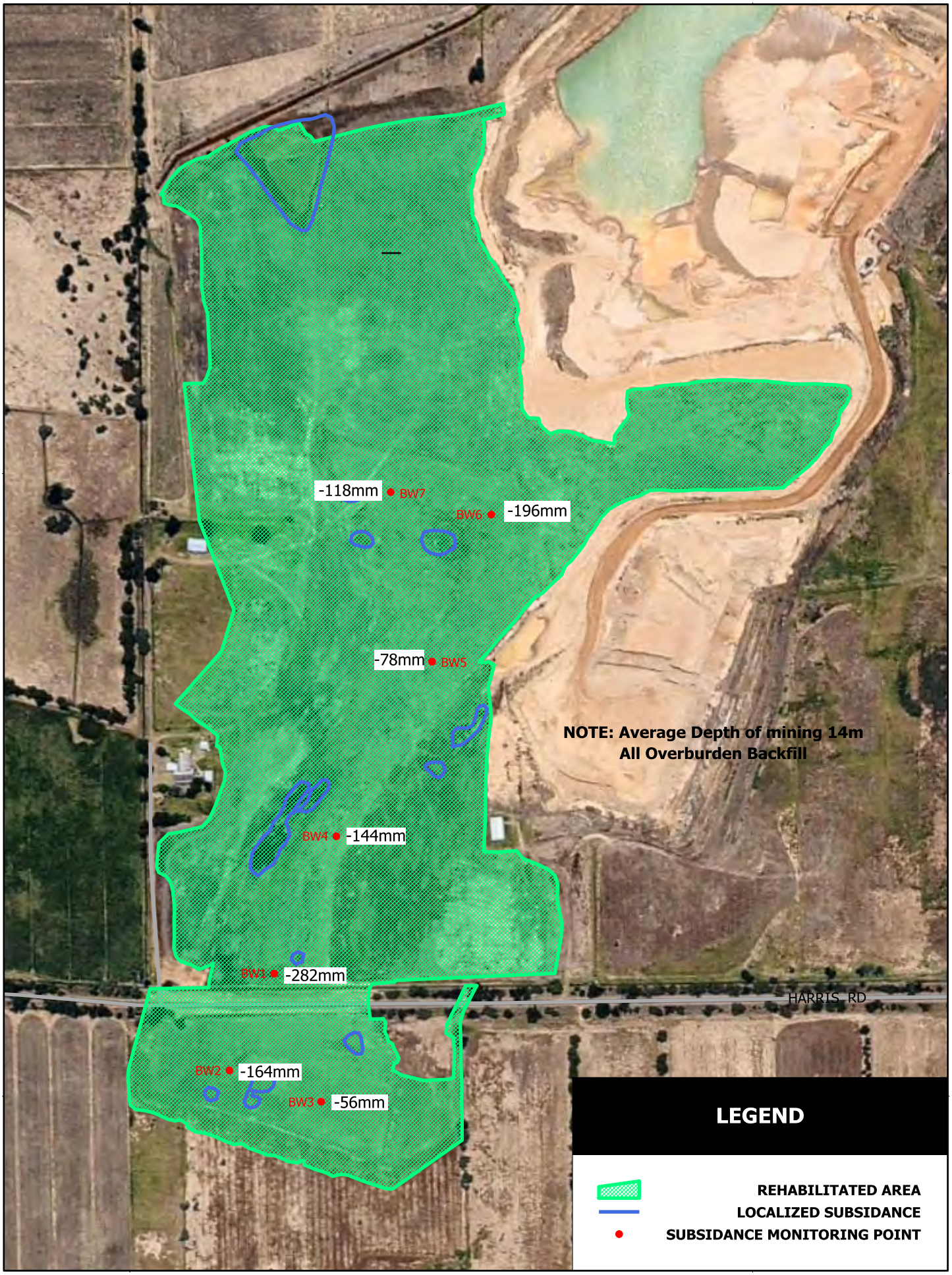

Time (Months)
0.0
6.0
12.0
18.0
24.0
30.0
36.0
42.0
0
0.05
-0.1
0.15
0.2
-0.25
Subsidence Level (metres below initial soil level)
Overburden
Tailings Sand
Co Disposal

FIGURE 7-18



Doral

Example of Annual Rehabilitation Subsidence Maintenance

Dardanup Mine Closure Plan	FIGURE 7-19	MGA94 Zone 50	Drawn By: ARM
	File Name: Survey Default2.map		Date:3/04/2012

Doral

Example Pre and Post Mining Radiation Survey Results

Dardanup Mine Closure Plan	FIGURE 7-20	MGA94 Zone 50	Drawn By: ARM
	File Name: radiation survey.map		Date:4/05/2012

Doral

RETURNED DRY PLANT TAILS FROM PICTON MINERAL SEPERATION PLANT - FIGURE 7-21

Projection: Australia MGA94 (50) | Drawn By: ARM

DORAL MINERAL SANDS PTY LTD | Scale: 5000 @A3 | File Name: south simpson.map | Date:13/03/2015

387000 m 388000 m 389000 m 390000 m 391000 m

6311000 m
6310000 m
6309000 m
6308000 m
6307000 m
6306000 m

M 7000652
DORAL MINERAL SANDS PTY LTD

M 7000748
DORAL MINERAL SANDS PTY LTD

M 7000720
DORAL MINERAL SANDS PTY LTD

M 7000675
DORAL MINERAL SANDS PTY LTD

M 7000893
DORAL MINERAL SANDS PTY LTD

M 7000643
DORAL MINERAL SANDS PTY LTD

LEGEND

TENEMENT BDY

Amended (2018) DWER License Area
DWER License Area (Previous)

REHABILITATION (by year)
2005
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018

Aerial Image, August 2017

0 1000 m

387000 m 388000 m 389000 m 390000 m 391000 m

Doral

DORAL MINERAL SANDS PTY LTD

FIGURE 7-22 REHABILITATION AREAS

Projection: Australia MGA94 (50) | Drawn By: A.R.M

Scale: 1:17000 @A3 | File Name: 2017 rehab_areas v disturb.map | Date:5/02/2019

FIGURE 8-1

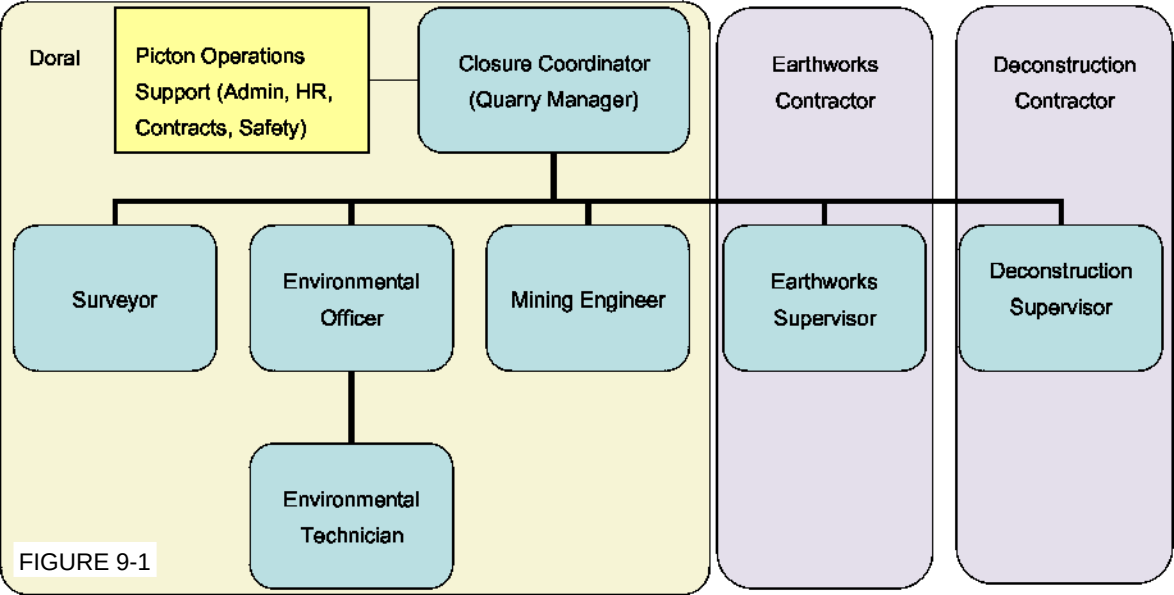

Doral
Picton Operations Support (Admin, HR, Contracts, Safety)
Closure Coordinator (Quarry Manager)
Earthworks Contractor
Deconstruction Contractor
Surveyor
Environmental Officer
Mining Engineer
Earthworks Supervisor
Deconstruction Supervisor
Environmental Technician

FIGURE 9-1

FIGURE 9-2

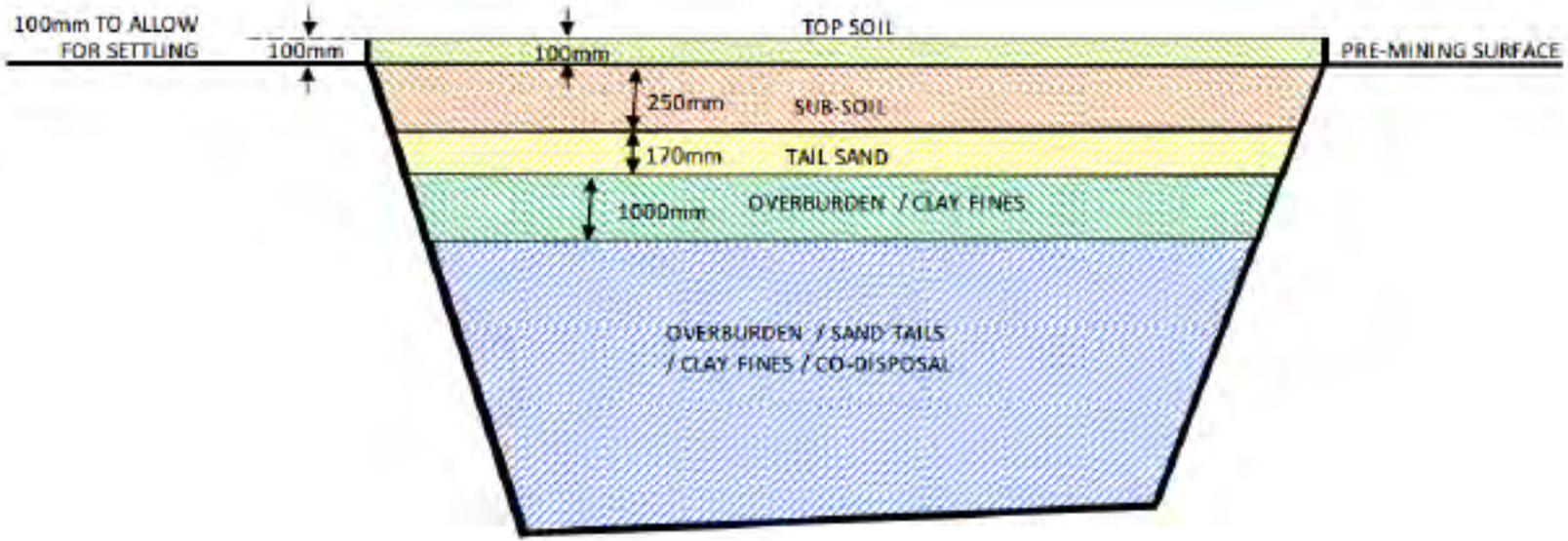
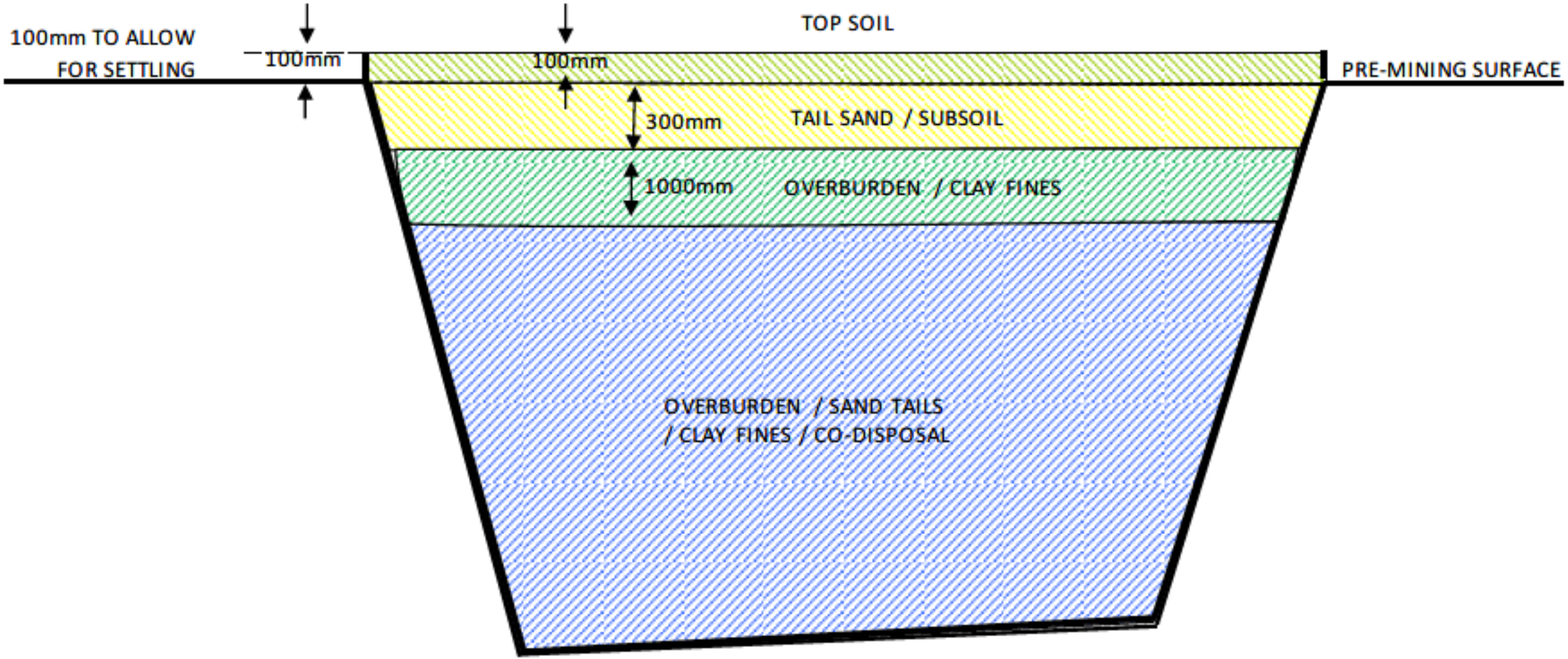
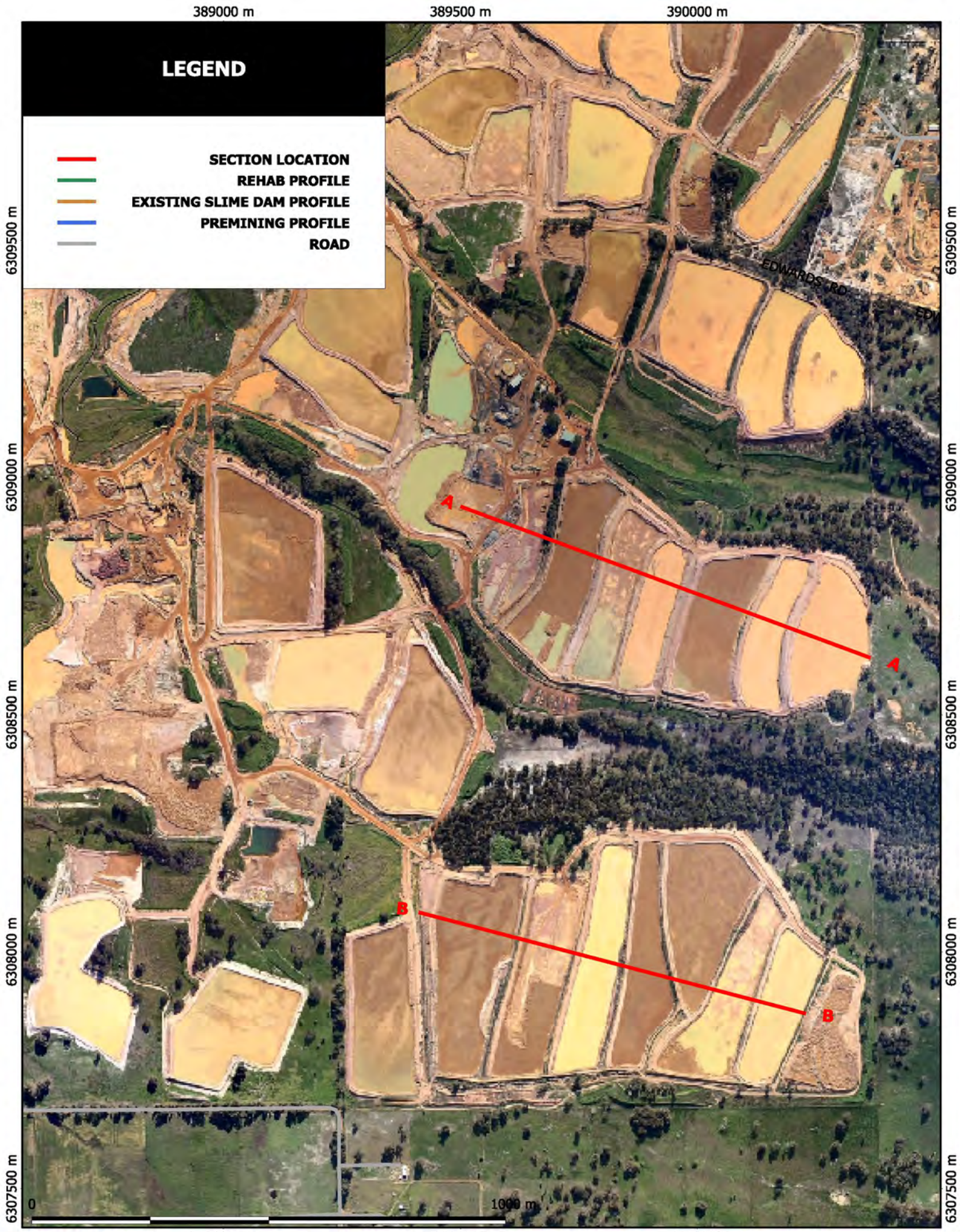
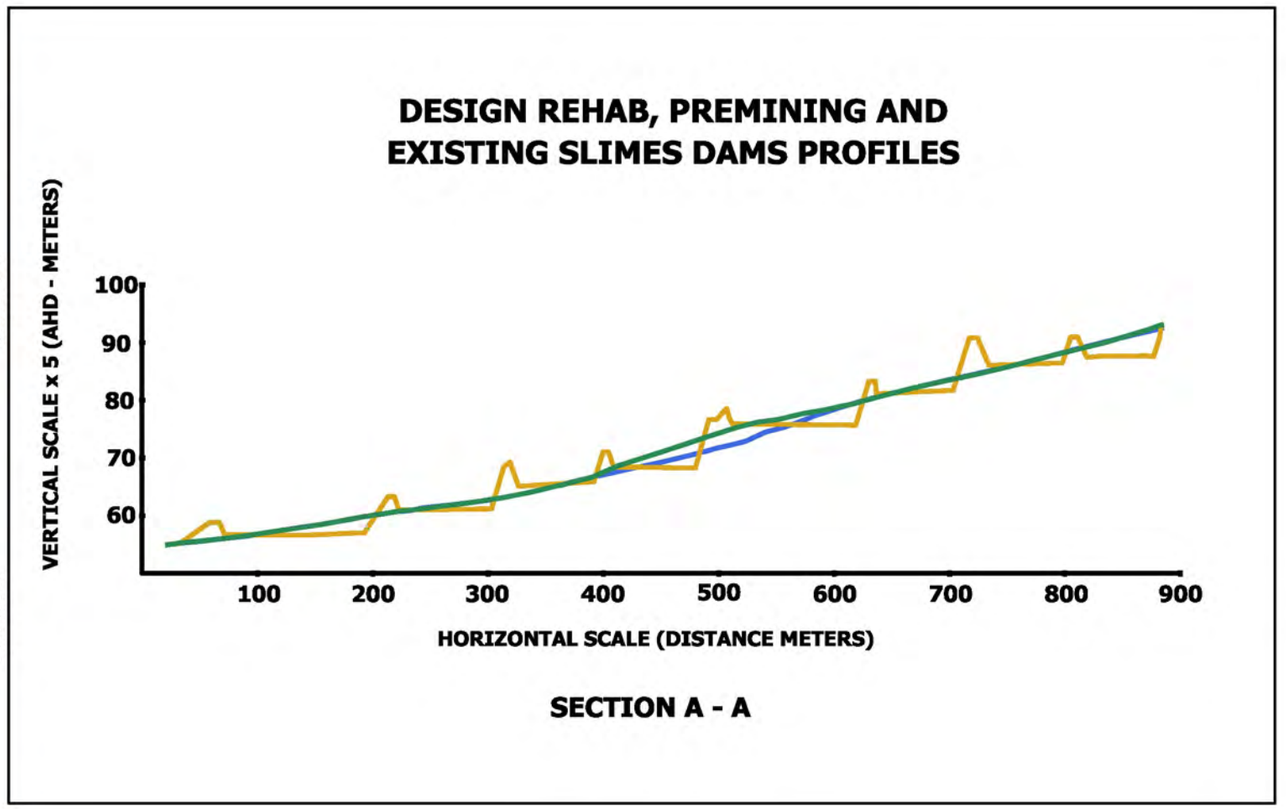
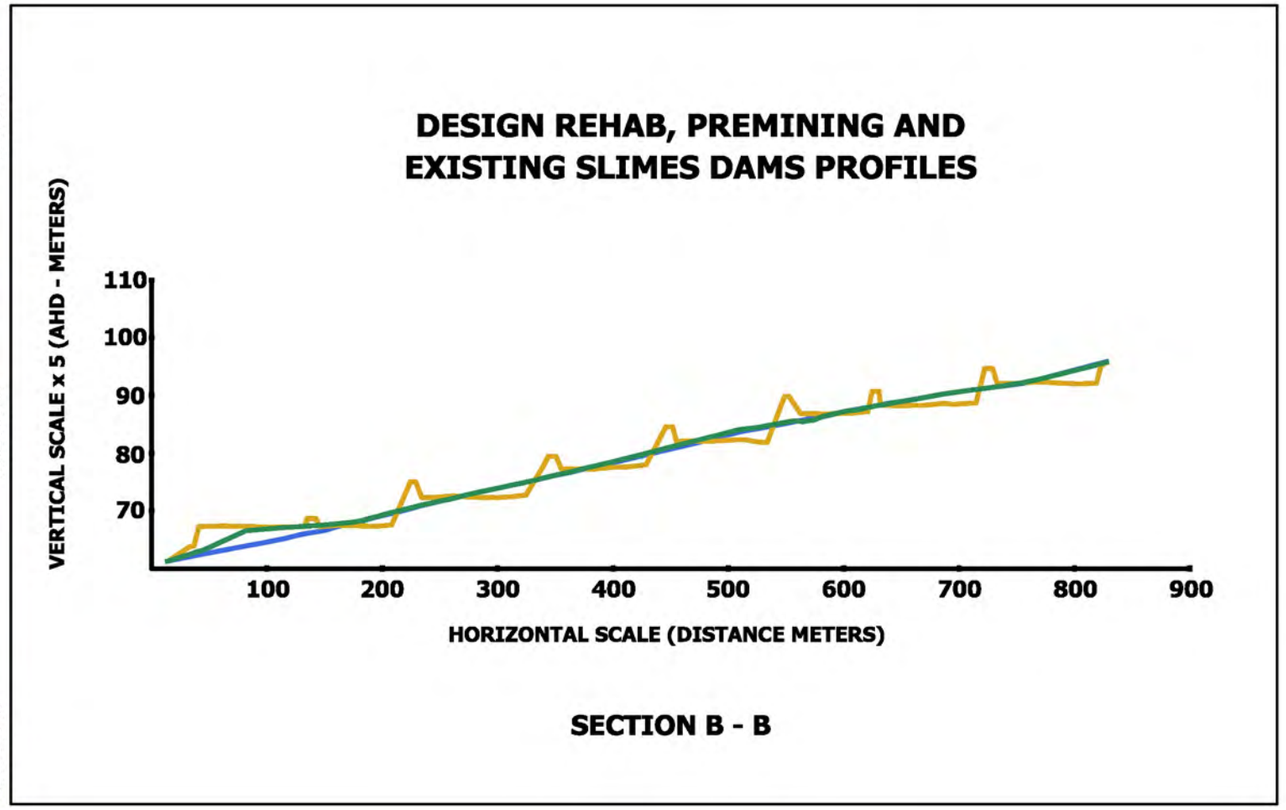

100mm TO ALLOW
FOR SETTLING
100mm
TOP SOIL
100mm
PRE-MINING SURFACE
250mm
SUB-SOIL
170mm
TAIL SAND
1000mm
OVERBURDEN / CLAY FINES
OVERBURDEN / SAND TAILS
/ CLAY FINES / CO-DISPOSAL

FIGURE 9-3


100mm TO ALLOW
FOR SETTLING
100mm
TOP SOIL
100mm
PRE-MINING SURFACE
300mm
TAIL SAND / SUBSOIL
1000mm
OVERBURDEN / CLAY FINES
OVERBURDEN / SAND TAILS
/ CLAY FINES / CO-DISPOSAL







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DARDANUP MINERAL SANDS PROJECT

Typical Post-mining Landform SEP Areas

FIGURE 9-4

MGA94 Zone 50

Drawn By: ARM

File Name: slime dam sections.map

Date:11/05/2012

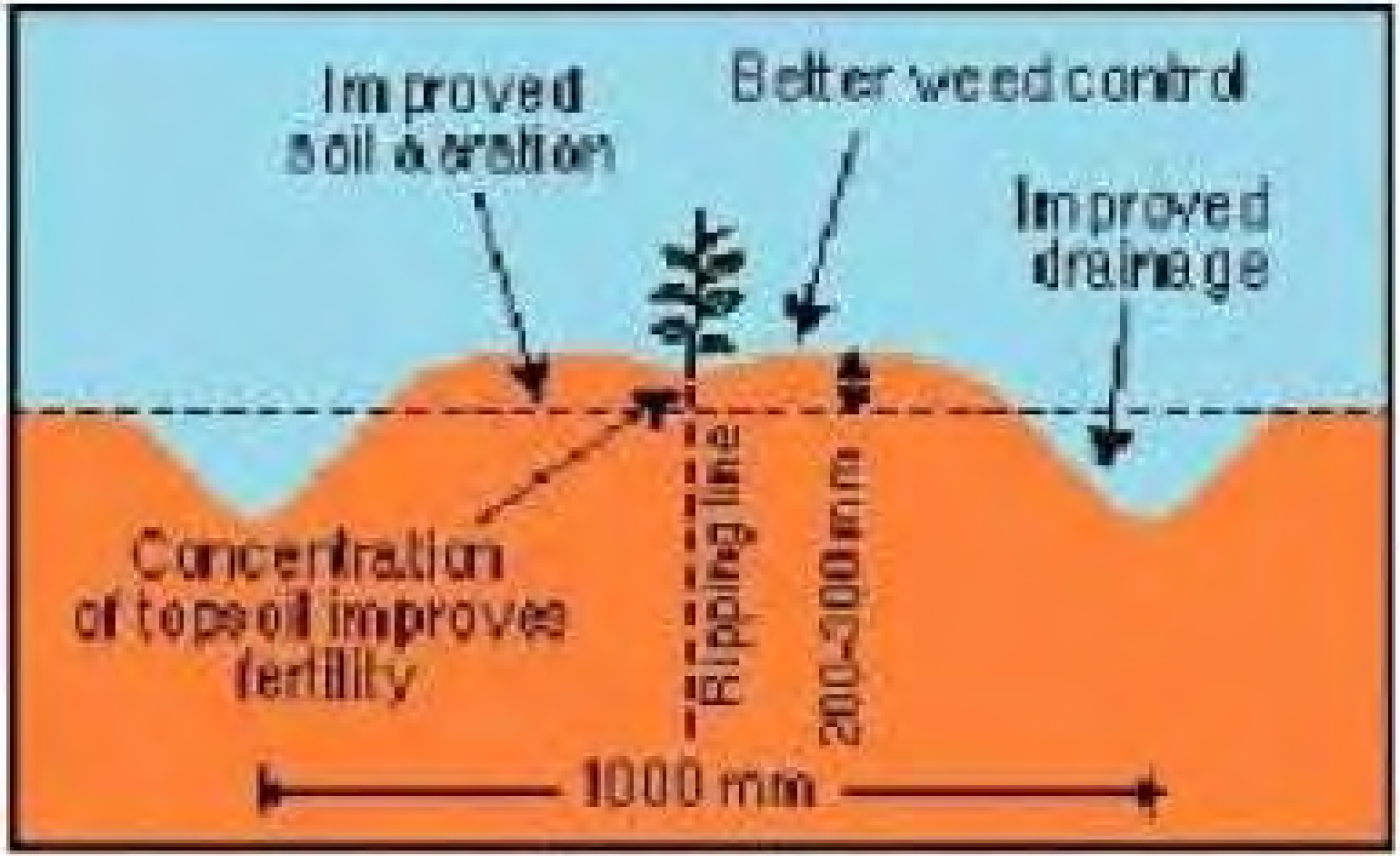

FIGURE 9-5 *Mounding*

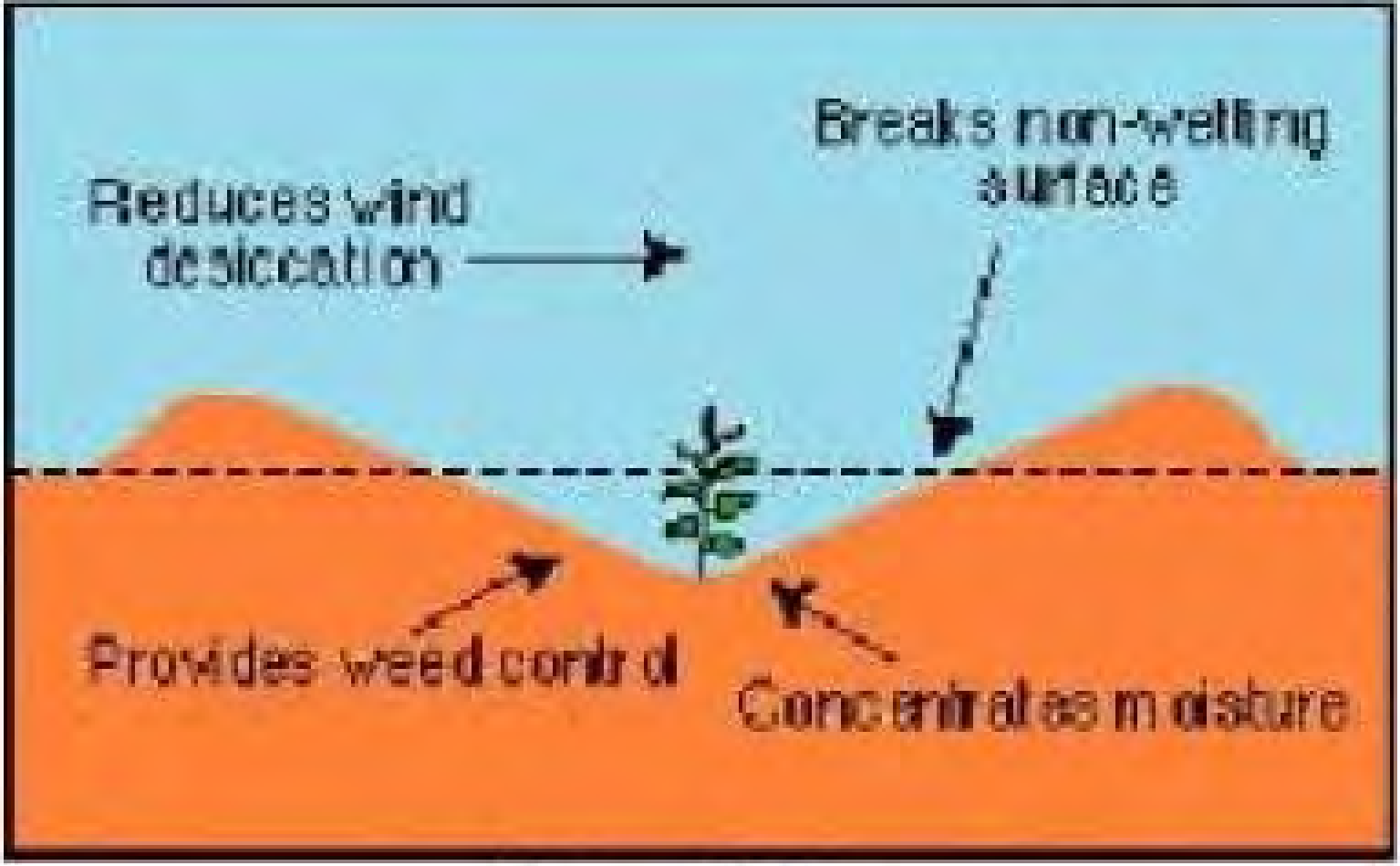

FIGURE 9-6 *Furrowlining.*

387000 m 388000 m 389000 m 390000 m 391000 m

6311000 m 6310000 m 6309000 m 6308000 m 6307000 m 6306000 m

AILWAY RD
DOWDELLS LINE
RD
HENTY RD
OFFER RD
HENTY RD
O'CONNOR RD
E RD
EDWARDS RD
DOWDELLS LINE
ST HELENA RD
DOWDELLS LINE
D
HARRIS RD
SIMPSON RD
DOWDELLS LINE
SIMPSON RD

0 1000 m

LEGEND

- Completed Rehabilitation
- Lot Boundaries
- Environmental Offsets
- Doral Lots
- Roads

387000 m 388000 m 389000 m 390000 m 391000 m

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DORAL MINERAL SANDS PTY LTD

FIGURE 9-7 REHABILITATION COMPLETED

Projection: Australia MGA94 (50)		Drawn By: A.R.M
Scale: 1:17000 @A3	File Name: 2017 rehab schedule-Jan.map	Date:23/01/2019