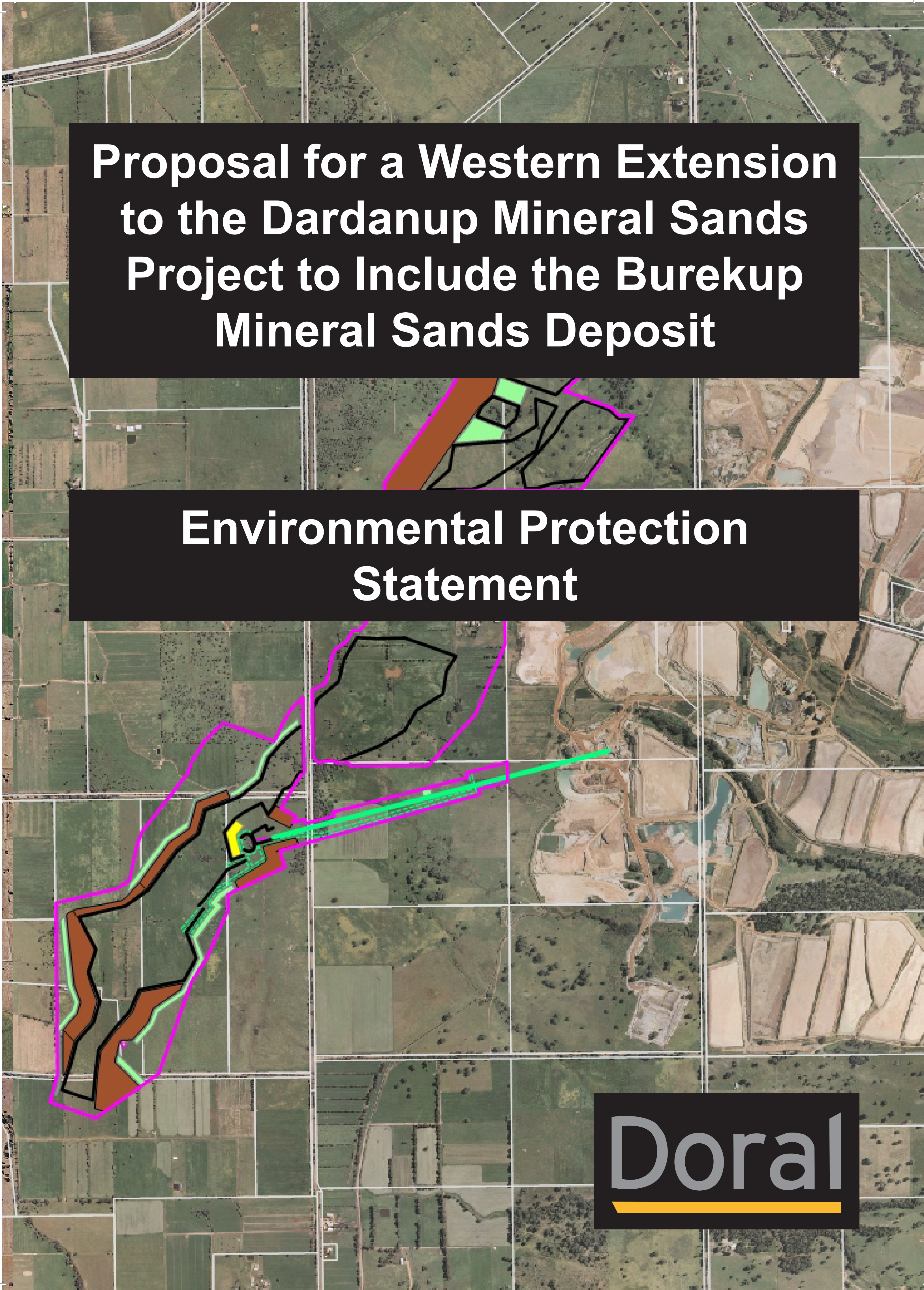
Proposal for a Western Extension to the Dardanup Mineral Sands Project to Include the Burekup Mineral Sands Deposit

Environmental Protection Statement



Doral

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Final Report: Preliminary Pre-Mine Soil Assessment for the Proposed Burekup Minesite (Soil and Water Consultants, 2007)

Water and Wetlands

Burekup Deposit Modelling of Groundwater Level Impacts (Parsons Brinckerhoff, 2007)

Final Report: Groundwater Dependant Ecosystem Assessment for the Proposed Burekup Minesite (Soil and Water Consultants, 2007)

Burekup Project Baseline Aquatic Biology and Water Quality Study (Wetland Research & Management, 2006)

Flora and Vegetation

Flora and Vegetation Assessment of the Burekup Area (Mattiske Consulting Pty Ltd, 2007)

Flora and Vegetation Assessment of the Burekup Area (Mattiske Consulting Pty Ltd, 2006)

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A Vertebrate Fauna Assessment of the Burekup Mineral Sands Project Area (Ninox Wildlife Consulting, 2006)

Noise

Point Modelling Results for the Proposed Western Extension Area to the Dardanup Mine (SVT Engineering Consultants, 2008)

Environmental Noise Impact Assessment of the Proposed Western Extension Area to the Dardanup Mine (SVT Engineering Consultants, 2008)

Aboriginal Heritage

Report of an Ethnographic Survey of the Proposed Dardanup Mine Western Extension Area (M70/0652, M70/0720) at Burekup, near Bunbury, Western Australia (Ethnosciences, 2008)

Report of an Ethnographic Survey of the Proposed Iluka Resources Limited Burekup Mineral Sands Mine (M70/0652, M70/0720) near Bunbury, Western Australia (Ethnosciences, 2007)

The Report of an Aboriginal Archaeology Survey of the Proposed Burekup Mineral Sands Mine (M70/0665, M70/0720) South West Region, Western Australia (Anthropos Australis Pty Ltd, 2007)

ABBREVIATIONS

AHD	Australian Height Datum
ASS	Acid Sulfate Soils
ASSMP	Acid Sulfate Soils Management Plan
BCM	Bank Cubic Metres
CAMBA	China-Australia Migratory Bird Agreement
CER	Consultative Environmental Review
CCW	Conservation Category Wetland
DEC	Department of Environment and Conservation
DIA	Department of Indigenous Affairs
DoIR	Department of Industry and Resources
DoW	Department of Water
DRF	Declared Rare Flora
EMP	Environmental Management Plan
EMS	Environmental Management System
EPA	Environmental Protection Authority
EPASU	Environmental Protection Authority Service Unit
EPS	Environmental Protection Statement
GDE	Groundwater Dependant Ecosystems
GDMA	Government Decision Making Authority
ha	Hectare
HMC	Heavy Mineral Concentrate
JAMBA	Japan-Australia Migratory Bird Agreement
kW and kV	Kilowatt and Kilovolt
LCDC	Land and Conservation District Committee
LOA	Level of Assessment
Mtpa	Mega tonnes per annum
REW	Resource Enhancement Wetland
PASS	Potential Acid Sulfate Soils
SEP	Solar Evaporation Ponds
SMU	Soil Mapping Unit
t	Tonnes
tpa	Tonnes per annum

EXECUTIVE SUMMARY

Introduction

The Dardanup Mine and the Picton Dry Separation Plant are known collectively as the Dardanup Mineral Sands Project, located principally on Mining Leases M70/675, M70/748, M70/643. The mine site and the dry separation plant are situated approximately 20km and 10km respectively east of the coastal city of Bunbury in the South West Region of Western Australia.

It is proposed to expand the Dardanup Mineral Sands Project Area in order to mine the adjoining Burekup Mineral Sands Deposit, using the existing infrastructure at the Dardanup Mine and Picton Dry Separation Plant. The Burekup Mineral Sands Deposit lies immediately to the west of the original approved boundaries of the Dardanup Mine. It is located between Henty Brook Road and Waterloo-Dardanup Road on M70/652 and M70/720.

It is therefore proposed to mine the Burekup Mineral Sands Deposit as a western extension to the Dardanup Mineral Sands Project. The proposed disturbance area, to allow mining of the Deposit, is referred to in this Environmental Protection Statement (EPS) as 'the western extension area'. The western extension to the Dardanup Mine is contained within the Iluka study area and within the Iluka proposed disturbance area, with the exception of an access corridor to connect an overland conveyor from the western extension area to the Dardanup Mine.

History of the Dardanup Mineral Sands Project

The Dardanup Mineral Sands Project Consultative Environmental Review (CER) (ISK Minerals Pty Ltd, 1991) was submitted to the Minister for the Environment in June 1991. The CER was approved by the Minister for Environment in April 1992 subject to the Conditions of Ministerial Statement No. 239. The timeframe for implementation of the proposal was then extended subject to the conditions of Ministerial Statement 484.

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 Mineral Sands Pty Ltd (Doral) produces (and exports) about 110,000 tonnes per annum (tpa) of ilmenite, 10,000tpa leucoxene and 10,000tpa zircon.

History of Approvals Sought to Mine the Burekup Mineral Sands Deposit

During 2006 and 2007, Iluka sought environmental approval to mine the Burekup Deposit. This included the preparation of a Draft EPS which was submitted to the EPA in November 2007 for assessment under Part IV of the *EP Act*. In February 2008, Government Decision Making Authorities' (GDMA) provided combined advice on the Iluka Draft EPS. This advice identified gaps in survey work, with significant deficiencies in information supplied on stakeholder consultation and the management of acid sulfate soils.

In March 2008, Iluka approached Doral in regards to taking on the project to mine the Burekup Mineral Sands Deposit. This has since been the subject of a due diligence investigation by Doral; the outcome being that Doral have signed agreements with Iluka to purchase the access rights to mine the Burekup Mineral Sands Deposit.

Iulka have formally withdrawn their proposal to mine the Burekup Mineral Sands Deposit in a letter addressed to the Chairman of the EPA dated 8 October 2007 (note: this should read 2008).

The Proposal

The proposal for a western extension to the Dardanup Mine is to allow mining of the Burekup Mineral Sands Deposit, a separate strand of heavy mineral deposit located between 100m to 2.1km from the Dardanup Mineral Sands Deposit. The western extension is anticipated to have a mine life of 3.5 to 5 years.

Mining of the western extension area will seek to increase the maximum Heavy Mineral Concentrate (HMC) production from 220,000tpa to 280,000tpa; using a similar ore mining rate but with additional HMC produced from the high grade of the Deposit. Dewatering requirements for the western extension will be an average of 2,200 cubic metres per day based on two pumps running for five hours each. Approximately 25% of HMC from the western extension area will be transported to the North Capel separation plant for further processing by Iluka. Other key characteristics of the proposal are summarised in Table ES-1.

Table ES-1
Key Characteristics Table for the Western Extension

Element	Proposed Western Extension to the Dardanup Mine to Include the Burekup Mineral Sands Deposit
Proponent	Doral Mineral Sands Pty Ltd, Lot 7 Harris Road, Picton Western Australia 6229
Life of Mine	The Life of Mine for the western extension will be 3.5 to 5 years (2009–2014)
Total Disturbance Area	The total disturbance area for the western extension will be 219.38ha
Mineable reserve	9.5 Million tonnes
Overburden Volume	5.8 Million BCM
Rates of Extraction (Overburden and Ore)	6.4 Million tonnes per year
Processing Rate/Mining Rate	390 tonnes per hour
Heavy Mineral Concentrate Production	900,000 tonnes
Extraction method	Dry mining
HMC Transport to Capel	5 round trips (10 movements) per day
HMC Transport to Picton	15 round trips (30 movements) per day
Water Supply Sources	No additional requirement
Employment	Estimated at 113 employees in summer, 93 employees in autumn and 83 employees in winter

Activities to be carried out in the western extension area include:

- Pre-mine establishment works, involving the stripping of topsoil and overburden and the installation of an overland conveyor;
- The excavation of ore (and associated dewatering);
- Transport of ore via overland conveyor to the Dardanup Mine;
- Backfill of mine voids with sand and clay tails and overburden; and
- Rehabilitation.

The remainder of mining activities will all be carried out at the existing Dardanup Mine, or as per currently approved practices associated with Dardanup Mine activities. This includes communition (screening and grinding) of ore, processing of ore through a wet concentrator plant, the production of HMC and the management of sand and clay tails from processing activities. There will be no additional water supply sources required for the proposal.

Context of the Proposal

The loss of viable ore reserves due to the rising strength of the Australian dollar and rising fuel and labour costs over the past 18 months seems likely to result in an early closure of the Dardanup Mine by July 2009, compared to previous estimates of mining through to 2011/2012. Mining of the Burekup Mineral Sands Deposit is the only opportunity for the Dardanup Mine to remain an operating mine unless economic circumstances become more sustainable before July 2009. The Dardanup Mineral Sands Project is the only mining operation that Doral have in the South West Region of Western Australia.

Doral consulted with the DEC Environmental Impact Assessment Division, DoIR, DEC (SW Office) and the Dardanup Shire in order to scope out an approval pathway for an alternative proposal to Iluka's to mine the Burekup Mineral Sands Deposit. The alternative proposal was for Doral to mine the Burekup Deposit as an extension to their existing Dardanup Mineral Sands Project, using the infrastructure already established.

It was suggested during consultation, that in Dorals' opinion, the alternative proposal would deliver a reduced environmental impact (and footprint) for the region; compared to the scenario of Iluka proceeding with their proposal which could have resulted in two adjoining mineral sands mines with replicated infrastructure, extensive areas of solar evaporation ponds and the requirement to source additional groundwater supplies.

Structure of this EPS

The main text comprises Sections 1 to 8 as described below:

Section 1: This section introduces the location, proponent and land ownership/access arrangements for the western extension area. Evidence is provided of the Iluka formal withdrawal of their proposal to mine the Burekup Mineral Sands Deposit (as former proponents for the same mining leases). It deals with the development history and provides an overview of the proposal.

The purpose and scope of the EPS is identified and the context of the proposal discussed in relation to the continuation of the Dardanup Mineral Sands Project (by mining a new resource), and in relation to the regional impacts of mineral sands mining in the Burekup-Dardanup area.

Section 2: This section provides an overall description of the proposal, including the:

- Mineral resource;
- Overview of existing operations and a key characteristics table of the proposed western extension;
- Pre-mine establishment works that will be undertaken;
- Mining operation;
- Infrastructure required for the extension; and
- Workforce to service the extension.

Rehabilitation works carried out to date at the Dardanup Mine are also identified in this section. A discussion is provided on mine closure requirements and how to incorporate the western extension proposal into the relevant plans in regard to these factors.

Section 3: This section describes the biophysical factors that have the potential to be impacted by mining of the western extension. Proposed management strategies for each biophysical factor are discussed. Proposed monitoring programs are set out where relevant.

Section 4: A description of the various pollution issues in relation to dust, noise, greenhouse gases and waste is provided. Management strategies to prevent or minimise pollution are discussed in this section. Proposed monitoring programs are identified where relevant.

Section 5: This section identifies the social impacts of the western extension proposal. Doral has committed to measures to manage potential impacts in relation to Aboriginal cultural heritage issues.

Section 6: A summary of the EMS for the Dardanup Mineral Sands Project is provided including an overview on background, policy, planning, implementation and operation, checking and corrective action, and review and improvement. Discussion is provided in terms of updating the relevant sections of the EMS to include the western extension proposal. Doral's environmental performance to date has been audited and compliance demonstrated. Results of a risk assessment of the key environmental impacts for the western extension proposal are presented in table form in this section. A summary of Doral's proposed environmental management commitments for the western extension are presented. These commitments will be refined in consultation with the administering authority during the assessment and subsequent implementation of the proposal.

Section 7: A summary of the key stakeholders issues raised as a result of the comprehensive consultation program, undertaken as part of this EPS, are presented in table form in this section. Doral's response to the issues raised is provided in the table.

Section 8: Details of an environmental offset package for the western extension are set out in table form, as per the format requirements in EPA Guidance Statement No.9 (EPA, 2006b). Photographic Plates are included to show the offset areas.

All figures for the EPS are contained at the back of the main body of text for the document.

The Appendices are not numbered in the EPS but are referenced in the main text in terms of the aspect that they relate to, for example Appendix – Soil. A detailed table of contents is provided at the front of the Appendices to locate the specific report or item referred to.

Table ES-2
Assessment of (Post-Management) Risk for Key Environmental Impacts of the Western Extension Proposal

<table>
<tr><th rowspan="2">Aspect</th><th rowspan="2">Item</th><th rowspan="2">Description of Potential Impact</th><th rowspan="2">Actions to Mitigate Risk</th><th colspan="3">Post-Management Risk</th></tr>
<tr><th>Likelihood</th><th>Consequence</th><th>Risk</th></tr>
<tr><td colspan="7">Disturbance of Potential Acid Sulfate Soils (PASS) which could lead to groundwater acidification and contamination by heavy metals and radionuclides, alteration to soil structure and ‘acid scalds’. The risk of disturbing PASS material has been assessed at the following locations (see items 1 and 2 below). Note: oxidation of PASS located beyond the mine pit area as a result of drawdown is addressed in item 5 in ‘groundwater drawdown’.</td></tr>
<tr><td rowspan="2">Impacts to Soil</td><td>1</td><td>Within the mine pits</td><td>PASS (520 BCM) which was identified at only one location within the mine pits has been mapped and will be avoided (i.e. not disturbed) by mining.
If groundwater monitoring indicates oxidation of this PASS material from dewatering activities in the vicinity of this area, the groundwater contingency plan will be enacted (see item 2).</td><td>Rare</td><td>Moderate</td><td>Low</td></tr>
<tr><td>2</td><td>Below the mine pits</td><td>Groundwater drawdown from below the pit floor will be prevented by employing only suction pumps for dewatering activities (no submersible pumps will be used). Suction pumps will be installed at a designated height above the base of the pit (usually 0.5m) in order to maintain a saturated pit floor. Visual inspections will be conducted several times per day. If groundwater monitoring indicates oxidation of any PASS material the following groundwater contingency plan will be enacted:
• Continue daily field monitoring to confirm the presence or absence of ASS;
• Increase monitoring frequency for ASS parameters from monthly to fortnightly;
• If groundwater quality does not return to background/acceptable levels, notify DEC in accordance with the timeframes set out by the Contaminated Sites Act 2003 Part 2, Division 1, Section 11;
• Determine the most appropriate remediation techniques in consultation with the DEC. This may include the use of various neutralising agents and a variety of treatment methodologies for soil, dewatering effluent and groundwater remediation;
• Cease mining operations until groundwater quality returns to background/acceptable levels; and
• Supply downstream water users with an alternative source of suitable quality water, if required.</td><td>Unlikely</td><td>Moderate</td><td>Moderate</td></tr>
</table>

Aspect	Item	Description of Potential Impact	Actions to Mitigate Risk	Post-Management Risk		
				Likelihood	Consequence	Risk
Draw-down of groundwater levels in the vicinity of the western extension area due to dewatering. The risk of potential impact from groundwater drawdown on the following sensitive receptors has been assessed:						
Impact to Ground Water	3	Groundwater dependant vegetation	The Low Woodland of *C.obesa* has been excised from the mine plan (i.e. disturbance area), apart from where the overland conveyor and associated services traverses the southern area of the wetland. Visual monitoring of canopy health and cover will be undertaken monthly during dewatering activities and quarterly for the duration of mining. If monitoring data shows adverse findings, the following (one or more) contingencies will be enacted: • Minimise dewatering during susceptible months. • Artificial irrigation of (suitable quality) water to the affected areas (in keeping with the natural wetting and drying cycles of the local area). • Modification of mining activities. Adverse results may also trigger more detailed monitoring, including soil moisture testing.	Rare	Minor	Low
	4	Wetland sites, including CCW and REW	A buffer of 200m to the CCW from the proposed disturbance area will be established to minimise any risk of impact. See item 3 for contingency actions if monitoring data shows adverse findings.	Rare	Minor	Low
	5	Other land users	Only minor remnant drawdown is expected 8 months after mining operations have ceased. As a contingency, suitable quality water will be supplied to downstream users if required.	Moderate	Minor	Moderate
Alteration to the supply of surface water at sensitive receptors (*note surface water supply at receptors is already impacted due to agricultural drainage)						
Impact to Wetlands, Surface water and Flora and Vegetation	6	Sensitive receptors include: • Ephemeral creeks; • Wetland sites, including CCW and REW; and • The Low Woodland of *C.obesa* is located on the palusplain (Multiple Use Wetland).	• Any temporary disturbance to creek bed and banks will be undertaken as per the conditions of a permit to be obtained from DoW. • Rehabilitation works will reinstate the creeks to their previous natural state. Note: similar restoration works have been carried out successfully at the Dardanup Mine. • The Low Woodland of *C.obesa* has been excised from the mine plan (i.e. disturbance area), apart from where the overland conveyor and associated services traverses the southern area of the wetland. • As a contingency, suitable quality water will be supplied to wetlands and the Low Woodland of *C.obesa* if required, in keeping with the natural wetting and drying cycles. These cycles will be identified by the monitoring program.	Rare	Minor	Low

Aspect	Item	Description of Potential Impact	Actions to Mitigate Risk	Post-Management Risk		
				Likelihood	Consequence	Risk
Degradation of surface water quality at sensitive receptors						
Impact to Surface Waters and Wetlands	7	Sensitive receptors include: • Ephemeral creeks; and • Wetland sites, including CCW and REW.	• All mine pit water is re-circulated through the mine process and therefore not directly discharged to surface waters. • In the case of an extreme rainfall event and excess groundwater flooding the pits, water will be discharged from the emergency discharge point. Before excess groundwater is discharged off site it will be pumped into a catchment sump, where it will be tested before being discharged into either the Harvey Water Irrigation Channel or the Dowdells Line Drain., as agreed in consultation with DoW and Harvey Water. Water to be discharged will meet strict water quality criteria, as per requirements for emergency discharge water in the DEC Licence for the Dardanup Mine. • The closest watercourse (Henty Brook) is located 1000m upstream and will not be impacted. • A buffer of 200m to the CCW from the proposed disturbance area will be established to further minimise any risk of impact. Ecological values and attributes will be improved at this wetland by fencing and establishing an understorey. This CCW is currently grazed by cattle. • The REW is situated 350m from the boundary of the nearest mine pit.	Rare	Minor	Low
Impact to Vegetation of Conservation Significance						
Impact to Vegetation and Flora	8	Impact to one population (20 to 70 individual plants) of *Aponogeton hexatepalus* (Priority 4). Note: this population has not been found in recent surveys and it is unsure if it still exists.	• Conduct further field surveys to ascertain the presence of *A hexatepalus* in the western extension area. Field survey to be conducted in September 2009. • Quarantine and fence off areas where the species is likely to be present.	Unlikely	Minor	Low
	9	Loss of 0.15% (2.17ha) of the Guilford Vegetation Complex. There is 4.4% of this vegetation complex (pre European) remaining.	• Implement Environmental Offsets which includes rehabilitation of approximately 20ha of Guildford Vegetation Complex. • Doral commit to providing $250,000 over 5 years to manage the offset area. • The area will also be fenced and a weeding program put in place.	Unlikely	Minor	Low
	10	Clearing of *C. obesa* to establish the overland conyeyor and associated services in the southern portion of this vegetation stand.	• Minimise the requirement for access corridors by multiple use of easements and restrict vehicles and mining equipment to designated roads and mining areas. • Collect seed of local provenance for rehabilitation purposes. • Minimise the timeframe between disturbance and rehabilitation.	Rare	Minor	Low

Aspect	Item	Description of Potential Impact	Actions to Mitigate Risk	Post-Management Risk		
				Likelihood	Consequence	Risk
Impact to Fauna of Conservation Significance						
Impact to Fauna	11	Impact on Western Ringtail Possum foraging habitat in road reserves.	• A fauna management plan will be prepared with a specific recommendation that requires a suitably trained zoologist to be present to catch and translocate fauna. • Roadside vegetation will be retained when possible to provide a corridor for limited fauna movement and habitat. • Provision of additional habitat (20ha of Guilford Complex) provided as an Environment Offset.	Likely	Minor	Low
	12	Impact on Black Cockatoo's by a loss of foraging habitat (Marri's). There is evidence that the disturbance area has been used some time ago (historically) for foraging.	• A fauna management plan will be prepared with a specific recommendation that requires a suitably trained zoologist to be present to catch and translocate fauna. • Every effort will be made to avoid clearing trees with hollows that are suitable for nest sites for birds. • Roadside vegetation will be retained when possible to provide a corridor for limited fauna movement and habitat. • Provision of additional habitat (20ha of Guilford Complex) provided as an Environment Offset.	Likely	Minor	Low
Impact of Noise on Surrounding Residents						
Noise	13	There are 8 (occupied) residences located between 703m and 1675m from the boundary of the proposed disturbance area.	The following management measures will be implemented to reduce noise emissions from the western extension area: • Optimise the layout and schedules of mining activities. • Place topsoil/overburden stockpiles and/or build noise bunds along the pit edges to mitigate noise propagation, including the use of noise attenuating fencing where practicable. • Build a noise bund along the south side of the access road and overland conveyor. • Place an ore stockpile or build a noise bund in the west and south sides of the road hopper. • Restrict mining activities during night/evening time. • Use quieter equipment where practicable. • Reduce the number of equipment items operating where practicable. • Set-up noise monitoring stations to monitor noise impacts at the closest residential locations. • Optimise the mobile equipment operations in different modes for different wind conditions.	Moderate	Minor	Moderate

Aspect	Item	Description of Potential Impact	Actions to Mitigate Risk	Post-Management Risk		
				Likelihood	Consequence	Risk
			Contingency actions if noise levels are exceeded include: • Attenuation of machinery and equipment; • Amenities agreements will be sought with affected residents; and • Temporary shutdown of relevant (noise generating) operations to ensure compliance during certain persistent wind conditions.			
Disturbance of sites of Aboriginal cultural significance						
Impacts to Aboriginal Sites	14	Disturbance to sites identified as having cultural significance. These have been identified as the CCW and the Low Woodland of *C.obesa*.	• A buffer of 200m to the CCW from the proposed disturbance area will be established to further minimise any risk of impact. • Ecological values and attributes will be improved at this wetland by fencing and establishing an understorey. • The Low Woodland of *C.obesa* has been excised from the mine plan (i.e. disturbance area), apart from where the overland conveyor and associated services traverses the southern area of the wetland. • Implement an Aboriginal Heritage Management Plan in order to ensure that any cultural material, including skeletal material, unearthed in the course of the development is treated in accordance with the provisions of the *Aboriginal Heritage Act 1972*. • Doral will consult with the Gnaarla Karla Booja claimant group throughout the life of mine.	Rare	Moderate	Low

This following table provides a summary of Proposed Management Commitments made by Doral in order to manage potential impacts to environmental aspects of the proposal.

Table ES-3
Proposed Environmental Management Commitments

Number	Topic	Commitment	Actions to Achieve Commitment	Timing	Advice
1	Soil Resources	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.	March 2009	DoIR
2		Doral will implement an approved ASSMP.	Adhere to the ASSMP (see Appendix – Soil) during the mining operation.	Duration of the operation	DEC
3	Groundwater	Doral will apply for a dewatering licence and provide the DoW with a Dewatering Management Plan.	Prepare and submit a Dewatering Management Plan and an application for a Dewatering Licence. Implement the Dewatering Management Plan.	March 2009	DoW
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.	March 2009	DoIR/DoW
5		Doral will comply with relevant legislation and guidelines for groundwater management.	Doral will licence all bores and other water management facilities, as required.	Duration of the operation	DoW
6		Doral will install an additional seven piezometers, including sites between the mine pits and the CCW and REW.	• The western extension proposal will be incorporated into the existing Dardanup Mineral Sands Project Groundwater Management Plan. Implement the Plan; • Adhere to groundwater monitoring requirements from the ASSMP; and • Update the water monitoring requirements of the Existing Dardanup Project Radiation Management Plan to include the western extension area. Enact the Plan.	March 2009	DoW
7		Groundwater monitoring will be conducted for the western extension area.		Duration of the operation	DoW

Number	Topic	Commitment	Actions to Achieve Commitment	Timing	Advice
8	Surface Water	Doral will comply with Harvey Water's requirements including their approval letter, to: • Not impact on downstream users; • Consult with Harvey Water; and • Gain land owner approval to cut off irrigation water to their property.	• Liaise with Harvey Water and provide a plan to use the irrigation channel as a discharge point; • Continually liaise with Harvey Water and downstream land owners; and • Notify DEC of the emergency discharge point to be included in operation licence.	March 2009 and duration of the operation	Harvey Water/DEC
9		Doral will obtain all necessary permits for the temporary diversion of seasonal waterways.	• Apply for Bed & Banks Permit from DoW. • Site specific plans for each waterway will be developed to enable restoration works to pre-mine contours. These plans will be implemented when diversion of the waterways are completed.	Before mining waterways and post mining	DoW
10		Doral will supply suitable quality water to sensitive receptors and land users in the vicinity of the mine should adverse impacts resulting from mining be detected.	• Liaise with landowners to ensure that bore yields are not significantly impacted. • Doral will assist in the maintenance of landowner bores and pumps for the continuation of bore yields. • Surface water supply will be monitored and maintained as per natural ecosystem processes at CCW, REW, and the Low Woodland of *C.obesa*.	Duration of the operation	DoIR/DoW/DEC
11		Doral will monitor surface water locations (including all wetlands) in the immediate vicinity of the western extension.	• The western extension proposal will be incorporated into the existing Dardanup Project Surface Water Management Plan and the Plan will be enacted.	Duration of the operation	DoIR/DoW/DEC
12	Wetlands	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.	March 2009; maintenance prior to and post rehabilitation and for 3 years post mining	DEC
13	Vegetation and Flora	Doral will use seed of local provenance for revegetation.	Collect seed at the appropriate time of year and store to preserve seed viability.	Duration of the operation and post mining.	DEC

Number	Topic	Commitment	Actions to Achieve Commitment	Timing	Advice
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.	Duration of the operation and post mining	DEC
15		Doral commit to conducting further survey work to determine the presence or absence of a population of *A. hexatepalus* that has previously been recorded in the western extension proposal area.	• Quarantine and fence the area where the population was previously recorded; • Conduct survey work in Spring 2009; and • Consult with the DEC on potential management strategies, based on the results of the survey.	Spring 2009	DEC
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.	March 2009; maintenance prior to and post rehabilitation and for 3 years post mining	DEC
17		Doral will develop criteria for triggering infill planting.	Triggers will be determined in consultation with DEC using the following assessment tools and mitigation measures: • Quarterly visual assessment of vegetation health, including weed assessment. • Monitor vegetation health on a monthly basis in GDE areas at risk, when dewatering activity is occurring. • Periodic review of the site species list to determine that the priority status of any particular species has not changed. • Appropriate remedial works including infill planting. • Recovery of the vegetation will be monitored against the baseline.	Duration of the operation	DEC

Number	Topic	Commitment	Actions to Achieve Commitment	Timing	Advice
18	Fauna and Rehabilitation	Doral will prepare a fauna management plan.	A qualified zoologist will prepare a fauna management plan which will include the following: • A trained zoologist will be present to manage fauna when large trees are being cleared. • Where possible, clearing trees with hollows that are a suitable habitat for fauna will be avoided.	January/February 2009	DEC
19		Doral will retain roadside vegetation wherever possible as a corridor for limited fauna movement and habitat.	Instruction will be given to earthworks contractors in order to ensure minimal disturbance.	Duration of operation	DEC
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.	Duration of operation	DEC
21	Air Quality (Dust)	Doral will actively implement dust controls to minimise the creation of airborne dust, and therefore its potential release across the boundaries of the mine site.	• Include the western extension proposal into the existing Dardanup Mineral Sands Project Dust Management Plan and enact the Plan. • Implement the use of two water carts for dust suppression on unsealed roads and in new areas of ground disturbance.	Duration of the operation	DEC
22	Noise	Doral will actively implement noise controls to minimise the generation of noise, and therefore its potential to impact on surrounding residences.	• Include the western extension into the existing Dardanup Mineral Sands Project Noise Management Plan. Enact the Plan. • Implement findings from the acoustic modelling study (October 2008) and the additional modelling study (November 2008). If management strategies are exceeded the following contingencies will be enacted: i. Attenuation of machinery; ii. Where possible, reach amenities agreements with affected residences; and failing the above iii. A temporary shutdown of relevant (noise generating) operations to ensure compliance during certain wind conditions.	Duration of the operation	DEC

Number	Topic	Commitment	Actions to Achieve Commitment	Timing	Advice
23	Greenhouse Gas Emissions	Doral will minimise greenhouse gas emissions.	• Restricting to a practical minimum the area of native vegetation to be cleared. • Progressively rehabilitating mine landforms and disturbed areas as they became available. • Synergistic linking of process steps where possible to reduce net greenhouse gas outputs. • Replacement of fossil fuels where possible with renewable. • Identification of energy efficient opportunities, conservation measures, and reduction in fugitive emissions when and where practical. • Doral will use the methodology developed by the National Greenhouse Gas Inventory Committee to record and estimate emissions from mining activities. • Consideration will be given to carbon sequestration options.	Duration of the operation	DEC
24	Waste Management	Doral will dispose of wastes generated by the western extension in an appropriate manner.	Update the relevant Operating Procedures in the existing Dardanup Mineral Sands Project EMS (e.g. Hydrocarbon Management Procedure) to incorporate the western extension proposal. Implement the Operating Procedures.	Duration of the operation	DEC
25	Aboriginal Cultural Heritage	Doral will consult with the Gnaala Karla Booja claimant group on a regular basis; including for the developing and implementing an Aboriginal Heritage Management Plan and training program to assist in the identification and handling of any archaeological material.	• Prepare and implement an Aboriginal Heritage Management Plan. • Consult the Gnaala Karla Booja claimant group on a regular basis for the life of mine.	March 2009 Duration of the operation	DIA
26	Rehabilitation	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.	Annually	DEC

Number	Topic	Commitment	Actions to Achieve Commitment	Timing	Advice
			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	Environmental Offsets	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.	Within one year from the commencement of mining	DEC
28	Reporting	• Doral will produce an Annual Environmental Report. • Doral will prepare an ASSMP Closure Report. • Doral will report annually on the Environmental Offset.	• Prepare an Annual Environmental Report; • Prepare an ASSMP Closure Report; and • Prepare an Annual Report for Environmental Offsets that includes evidence of expenditure.	Annually Prior to Mine Closure Annually	DEC
29	EMS	Doral will continue to implement the existing Dardanup EMS to ensure continual environmental improvement.	• Continually improve the Doral Dardanup Mineral Sands Project EMS; and • Update all relevant areas of the EMS to incorporate the western extension.	Monthly initially Yearly review	DEC

1 INTRODUCTION

1.1 Location

The Dardanup Mine and the Picton Dry Separation Plant are known collectively as the Dardanup Mineral Sands Project. Figure 1.1-1 shows the location of the mine site and the dry separation plant; situated approximately 20km and 10km respectively east of the coastal city of Bunbury in the South West Region of Western Australia.

1.2 History of Environmental Approvals

The Dardanup Mineral Sands Project Consultative Environmental Review (CER) (ISK Minerals Pty Ltd, 1991) was submitted to the Minister for the Environment in June 1991. The CER was approved by the Minister for Environment in April 1992 subject to the Conditions of Ministerial Statement No. 239. The timeframe for implementation of the proposal was extended subject to the conditions of Ministerial Statement 484.

The CER defined the Project boundaries of the Dardanup Mine by:

- Showing the Mining Leases M70/675, M70/748, M70/643 and E70/776. It is noted that M70/748 was previously P70/951, P70/952, E70/156 and that E70/776 now comprises M70/1004, M70/1005 M70/1006, E70/1634.
- Illustrating a preliminary Principal Mineralised Area. The CER stated that the full mineral potential within these tenements was yet to be determined and was the subject of ongoing exploration and it was possible that ore bodies outside the preliminary Principal Mineralised Area could be identified.
- Circling broad areas for potential water storage and the location of a wet concentrator plant. There was no mine plan in the CER to designate where associated mine infrastructure and activity areas would be located. It was inferred that the 80ha of tailings ponds storage (identified in Schedule 1 of Ministerial Statement 484) would be located to the east of the orebody within the boundary of the Mining Leases. The following extract from Bulletin 605 (Section 2, The Proposal) states:

  "*Ponds used to solar dry the clay tailings would occupy an estimated 80 hectares, again to the east of the orebody*".

Figure 1.1-2 shows the location of the Principal Mineralised Area within the Mining Leases listed above, as reproduced from the CER. The original figure from the CER is provided in Appendix – Land.

It is proposed to expand the Dardanup Mineral Sands Project Area in order to mine the adjoining Burekup Mineral Sands Deposit, using the existing infrastructure at the Dardanup Mine and Picton Dry Separation Plant. The Burekup Mineral Sands Deposit lies immediately to the west of the original CER approved boundaries of the Dardanup Mine as shown on Figure 1.1-3. It is located between Henty Brook Road and Waterloo-Dardanup Road on M70/652 and M70/720 as shown on Figure 1.2-1.

It is therefore proposed to mine the Burekup Mineral Sands Deposit as a western extension to the Dardanup Mine. The proposed disturbance area, to allow mining of the Deposit, is referred to in this EPS as 'the western extension area'.

Figure 1.1-4 illustrates the western extension to the Dardanup Mine, which is contained within the Iluka study area and within the Iluka proposed disturbance area, with the exception of an access corridor to connect an overland conveyor from the western extension area to the Dardanup Mine.

1.3 Proponent, Land Ownership and Access

1.3.1 Doral Mineral Sands Pty Ltd

Doral is a wholly owned subsidiary of Perth-based Doral Mineral Industries Limited, which itself is an unlisted public company owned by Iwatani International Corporation of Japan. In June 2001, Doral committed over $A30 million to the Dardanup Mineral Sands Project in an agreement between ISK Minerals Pty Ltd (the former proponent) and Doral. This involved the acquisition of the mineral rights, mine site, exploration and mining land; refurbishment of the Picton Dry Separation Plant; and construction of the Dardanup Mine Wet Concentrator Plant, support and administration facilities. This is the only mineral sand mining operation that Doral own in the South West Region of Western Australia.

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 110,000 tonnes per annum (tpa) of ilmenite, 10,000tpa leucoxene and 10,000tpa zircon.

Environmental factors for the Dardanup Mineral Sands Project are managed in accordance with the conditions of Ministerial Statement 484. The Dardanup Mine (Licence 7789/6) and the Picton Dry Separation Plant (Licence 7789/6) operate under separate licences as issued by the DEC.

The registered office for Doral is:

Doral Mineral Sands Pty Ltd
Lot 7 Harris Road
PICTON WA 6229

The contact for the proposal is:

Mike Ferraro - General Manager Doral Mineral Sands Pty Ltd
Phone: (08) 9725 5414
Fax: (08) 9725 4757

1.3.2 Withdrawal of Iluka as Proponent to Mine the Burekup Mineral Sands Deposit

Iluka have formally withdrawn their proposal to mine the Burekup Mineral Sands Deposit from assessment under Part IV of the *Environmental Protection Act 1986* (EP Act). This notification of withdrawal was provided in a letter addressed to the Chairman of the EPA dated 8 October 2007 (note: this should read 8 October 2008). A copy of this letter is contained in Appendix – Land.

History of Approvals Sought for the Iluka Proposal

During 2006 and 2007, Iluka sought environmental approval to mine the Burekup Deposit. This included the submission of written documentation and correspondence with the EPA as well as the preparation of baseline studies, surveys and specific technical investigations to support these submissions. A summary of this correspondence is compiled on the following page.

15 Feb 2007: The Burekup Mineral Sands Project was referred to the EPA by Iluka, in accordance with Section 38 of the *EP Act* to allow the EPA to set the level of assessment for this Project.

9 July 2007: The EPA – Environmental Impact Assessment Division, in consideration of all the documentation submitted by Iluka, determined that the likely environmental impacts are sufficient to warrant formal assessment of the proposal. A level of assessment was set at PER.

20 July 2007: Iluka appealed the level of assessment set by the EPA in a letter on 9 July 2007. Iluka requested that the Minister remit the referral to the EPA for reconsideration based on the outcomes of acid sulphate soils and groundwater drawdown investigations and changes to the vegetation clearing boundary.

24 Sept 2007: The Minister allowed the appeal by remitting the proposal to the EPA for the making of a fresh decision as to the level of assessment.

30 Nov 2007: A Draft EPS for the Burekup Mineral Sands Project was submitted to the EPA by Iluka.

7 Feb 2008: Comments by the various government agencies from a review of the Draft EPS were provided back to Iluka. In summary, it was noted by the EPA that some of the issues have been raised before but not adequately addressed.

In March 2008, Iluka approached Doral about taking on the project to mine the Burekup Mineral Sands Deposit.

1.3.3 Land Ownership and Access Arrangements

Details of land ownership and access arrangements for the proposed western extension area are shown in Figure 1.2-1.

The majority of the land is owned by Iluka. Doral have a purchase agreement in place with Iluka to gain access to the rights to these mining leases and land that pertains to the western extension area. The execution of a formal agreement between Doral and Iluka was completed on 16 September 2008; and settlement took place on 4 November 2008.

There are four other private landowners with property partially within the proposed disturbance area (Figure 1.2-1). ISK Minerals Pty Ltd also has property in the proposed disturbance area (Figure 1.2-1). Individual land access agreements have been negotiated with ISK and the other property owners to allow access for mining the western extension area. Appendix – Land contains evidence of the Iluka purchase and land access agreements.

The proposal to mine the western extension area involves the disturbance of road reserves vested in the Shire of Dardanup. Proposed changes to local roads are discussed in Section 2.5.3 and were the subject of a public meeting on 13 October 2008. There is no vacant crown land in the proposed disturbance area.

1.4 Approval and Development History of the Dardanup Mineral Sands Project

Regulatory approvals for the Dardanup Mineral Sands Project, reflecting the development history of the Project, are summarised below and shown graphically in Figure 1.1-2:

- The CER was submitted to the Minister for the Environment in June 1991;
- The CER was approved by the Minister for Environment in April 1992 subject to the Conditions of Ministerial Statement No. 239. This Statement included a Schedule 1 – Key Characteristics of the Project and a Summary of Environmental Commitments;
- The timeframe for implementation of the proposal was extended subject to the conditions of Ministerial Statement 484;
- The EPA was notified of the agreement between Doral and ISK Minerals in June 2001 whereby Doral were formally nominated as the Proponent for the Project;
- The Dardanup Mineral Sands Project, Pre-Construction Approvals – Supporting Documentation (GHD, 2001) was prepared to allow site construction and ground disturbance works to commence;
- Mining commenced in June 2002. Current works are managed under DEC Licence 7789/6;
- The EPA and the Department of Environment approved a southern extension to the project in January 2004. The approval was for:

    i. The inclusion of a 70ha area of land (Wellington Location 3556) for the purpose of constructing an additional 50ha of solar evaporation ponds. This extension area is located on mining lease M70/675, which is held by Doral, and was part of the study area originally approved in the CER 1991.

    ii. Updating Schedule 1 of Ministerial Statement 484 to increase the total area of disturbance for solar evaporation ponds from 80ha to 130ha.

    This extension was deemed by the Department of Environment (Environmental Audit Section) to be a non-substantial change to the Dardanup Mineral Sands Project. Approval was granted under Works Approval 3890 and Notice of Intent 4503; and
- Approval to mine the northern continuation of the Dardanup Mineral Sands Deposit within tenements M70/748 and M70/675 was granted under Section 45C of the *EP Act* by the Minister for the Environment on 28 June 2004 (and by DoIR under Notice of Intent 4732). This extension incorporated Wellington Lots 3563, 3564 and 3565 and included a land purchase from Iluka Resources Ltd (within M70/748).

It should be noted that both the southern and northern extensions to the Dardanup Mine are located within the original CER Project area. These extensions were referred to the EPA to provide detailed site specific survey information on the environmental attributes of these areas, determine management strategies for the proposed works, and scope out specific monitoring requirements.

1.5 Timeline to Prevent Impending (Early) Closure of the Dardanup Mine

The economic climate over the past 18 months has seen significant rises in fuel and labour costs and an increased strength of the Australian dollar. The interplay of these factors has resulted in a contracted life of mine for the Dardanup Mineral Sands Deposit, whereby some of the ore that was economical to mine (within current approval areas) is no longer viable in the current climate. This includes approximately 300ha of resource (or 2 years mine life) to the south of Simpson Road (i.e. the southern continuation of the Dardanup Mineral Sands Deposit). This loss of viable ore reserves is anticipated to result in the early closure of the Dardanup Mine by July 2009, compared to previous estimates of mining through to 2011/2012.

Mining of the Burekup Mineral Sands Deposit, situated on the western boundary of the Dardanup Mine, is the only opportunity for the Dardanup Mine to remain an operating mine unless economic circumstances change (and the change is sustainable) before July 2009. The Dardanup Mine is the only Mineral Sands Project that Doral have in the South West Region of Western Australia.

Timely assessment under Part IV of the *EP Act* is sought in order to allow pre-mine establishment works to commence by early March 2009 (in order to expose ore before the rainy season) and mining of the orebody by July 2009.

1.6 Overview of the Proposal in Relation to Schedule 1 for the Dardanup Mineral Sands Project

A description of the proposal to mine the western extension area, including a table of key characteristics, is provided in Section 2 of this EPS. Changes to the elements for Schedule 1 of the Dardanup Mineral Sands Project (as a result of the proposal for a western extension) are set out in Table 1-1, along with the original items approved in Ministerial Statement 484 and any subsequent revisions during the life of the Project. It should be noted that these changes are inclusive of (i.e. not additional to) the quantities and areas stated for the Project to date, unless specified. For example the total area required for water storage dams will be 8ha and not 13ha.

Table 1-1
Overview of the Proposal in Relation to Schedule 1 to include the Western Extension Area

Element	Description as Shown in Schedule 1 of Ministerial Statement 484	Approved Revisions	Changes to Include the Western Extension Area
Life of Project	15 years (2002–2017)		
Area of Disturbance			
- Size of Orebody	5km long by 0.5–1.5km wide		Additional 5km long by 0.15-1.2km wide
- Mining of Orebody	40ha per annum		65ha per annum
- Water Storage Dams	5ha		8ha
- Tailing Ponds	80ha (to December 2003)	130ha (approved January 2004)	
Mining Method	Dry or Sluice Mining		
Processing	Wet separation on site, dry separation at Picton Plant		
Ore Mining Rate (Maximum)	200,000tpa HMC production	220,000tpa HMC production (approved 28 June 2004)	280,000tpa HMC production
Overburden (Maximum)	2.5Mtpa	3.25Mtpa (approved June 2004)	4.2Mtpa

Element	Description as Shown in Schedule 1 of Ministerial Statement 484	Approved Revisions	Changes to Include the Western Extension Area
Rehabilitation			
- Topsoil	Re-spread direct from stockpiles		
- Hydrology	Adopt mechanism to reinstate acceptable hydrological regimes		
- End Use	Restore agricultural production at least to current level, and to plant trees to replace and augment existing trees		
Area of Influence on Groundwater	500m radius around mining		
Water Supply	Dewatering (up to 1,700 cubic metres per day)		Dewatering (average of 2,200 cubic metres per day)
Energy	Upgrade and extend existing 22kV line west of site		Additional 22kV line to existing line. Will run parallel to overland conveyor
Transport	Operating Supplies by different roads, depending on source. HMC Product to Picton Plant via Dowells Road extension to South West Highway.	Two new roads constructed as part of the project are O'Conner Road and the extension to Dowdell's Line Road. This change in transport route was approved as a non-substantial change 19 October 2001.	As the mine progresses the mine access will change. It is likely that Edwards Road will replace O'Conner Road to access Dowdells Line.

1.7 Purpose and Scope of the EPS

The purpose of this EPS is to communicate the proposal for a western extension to the public and government agencies. Environmental management strategies, requirements for monitoring and provisions for reporting have been committed to in this EPS to mitigate any potential impacts.

Doral consulted with the DEC Environmental Impact Assessment Division, DoIR, DEC (SW Office) and the Dardanup Shire in order to scope out an approval pathway (and timelines) for an alternative proposal to Iluka's to mine the Burekup Mineral Sands Deposit. The alternative proposal was to mine the Burekup Deposit as an extension to their existing Dardanup Mine, using the infrastructure already established at the operating mine such as a feed preparation plant, wet concentrator plant, solar evaporation ponds and an approved water supply source. HMC from the Burekup Deposit would be hauled by truck for processing at the Picton Dry Separation Plant, as per current approved practises, with an additional 25% of HMC to be hauled to the North Capel Separation Plant for further processing by Iluka.

It was suggested during consultation that, in Dorals' opinion, the alternative proposal would deliver a reduced environmental impact (and footprint) for the region; compared to the scenario of Iluka proceeding with their proposal which would have resulted in two adjoining mineral sands mines with replicated infrastructure, the need for extensive areas of solar evaporation cells and for additional groundwater supplies. The western extension to the Dardanup Mine is contained within the Iluka study area and within the Iluka proposed disturbance area, with the exception of an access corridor to connect an overland conveyor (and associated infrastructure) from the western extension area to the Dardanup Mine.

The scope of the EPS is to:

i. Provide evidence of the stakeholder consultation process that has been undertaken to communicate the proposal to the public and government agencies;

ii. Demonstrate that responses from the consultation process have been incorporated (wherever relevant) into the environmental strategies and commitments for the management of biophysical, pollution and social factors relating to the proposal;

iii. Utilise previous studies, surveys and technical reports commissioned by Iluka for the Draft EPS, November 2007 to characterise the existing environment and provide the necessary detail on the biophysical factors in the proposal area; and

iv. Provide responses to the gaps in the survey work (in item iii above) from the Draft Iluka EPS (November 2007). In February 2008, the GDMA provided combined advice, via email, on the Iluka Draft EPS. This advice identified gaps in survey work and potential constraints to the Iluka proposal, with significant deficiencies in information identified on stakeholder consultation and the management of acid sulfate soils. Doral has sought consultation with the relevant GDMA in the development of these responses as part of the EPS document preparation. Agreed management strategies determined as a result of this consultation process with the GDMA have been included in the EPS document.

This EPS document acknowledges the core principles of environmental protection set out in the *EPA's Position Statement No.7 Principles of Environmental Protection* (EPA, 2004a). These principles have been considered in the preparation of the EPS where relevant.

Core principles are:

1) The Precautionary Principle

Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

In the application of the precautionary principle, decisions should be guided by –

(a) Careful evaluation to avoid, where practicable, serious or irreversible damages to he environment: and

(b) An assessment of the risk-weighted consequences to various options.

2) The Principle of Intergeneration Equity

The present generation should ensure that the healthy, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

3) The Principle of the Conservation of Biological Diversity and Ecological Integrity

Conservation of biological diversity and ecological integrity should be a fundamental consideration.

4) Principles in relation to Improved Valuation, Pricing and Incentive Mechanisms

(1) Environmental factors should be included in the valuation of assets and services.

(2) The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement.

(3) The users of goods and services should pay prices based on the full life cycles costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes.

(4) Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.

5) The Principle of Waste Minimisation

All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.

1.8 Structure of the EPS

The EPS is presented as two components, the first being the main text and the second being the supporting appendices.

The main text comprises Sections 1 to 8 as described below:

Section 1: This section introduces the location, proponent and land ownership/access arrangements for the western extension area. Evidence is provided of the Iluka formal withdrawal of their proposal to mine the Burekup Mineral Sands Deposit (as former proponents for the same mining leases).

An approval and development history of the Dardanup Mineral Sands Project is provided, along with the timeline required to prevent the anticipated (early) closure of the Dardanup Mine due to the economic climate over the last 18 months.

An overview of the proposal to mine the western extension is provided in terms of changes to Schedule 1 (Ministerial Statement 484) of the Dardanup Mineral Sands Project.

The purpose and scope of the EPS has been identified and the context of the proposal discussed in relation to the continuation of the Dardanup Mineral Sands Project (by mining a new resource), and in relation to the regional impacts of mineral sands mining in the Burekup-Dardanup area.

Section 2: This section provides an overall description of the proposal, including the:

- Mineral resource;
- Overview of existing operations and a key characteristics table of the proposed western extension;
- Pre-mine establishment works that will be undertaken;
- Mining operation;

- Infrastructure required for the extension; and
- Workforce to service the extension.

Rehabilitation works carried out to date at the Dardanup Mine are also identified in this section. A discussion is provided on mine closure requirements and how to incorporate the western extension proposal into the relevant plans in regard to these factors.

Section 3: This section describes the biophysical factors that have the potential to be impacted by mining of the western extension. Proposed management strategies for each biophysical factor are discussed. Proposed monitoring programs are set out where relevant.

Section 4: A description of the various pollution issues in relation to dust, noise, greenhouse gases and waste is provided. Management strategies to prevent or minimise pollution are discussed in this section. Proposed monitoring programs are identified where relevant.

Section 5: This section identifies the social impacts of the western extension proposal. Doral has committed to measures to manage potential impacts in relation to Aboriginal cultural heritage issues.

Section 6: A summary of the EMS for the Dardanup Mineral Sands Project is provided including an overview on background, policy, planning, implementation and operation, checking and corrective action, and review and improvement. Discussion is provided in terms of updating the relevant sections of the EMS to include the western extension proposal. Doral's environmental performance to date has been audited and compliance demonstrated. Results of a risk assessment of the key environmental impacts for the western extension proposal are presented in table form in this section. A summary of Doral's proposed environmental management commitments for the western extension are presented. These commitments will be refined in consultation with the administering authority during the assessment and subsequent implementation of the proposal.

Section 7: A summary of the key stakeholders issues raised as a result of the comprehensive consultation program, undertaken as part of this EPS, are presented in table form in this section. Doral's response to the issues raised is provided in the table.

Section 8: Details of an environmental offset package for the western extension are set out in table form, as per the format requirements in EPA Guidance Statement No.9 (EPA 2006b). Photographic Plates are included to show the offset areas.

All figures for the EPS are contained at the back of the main body of text for the document.

The Appendices are not numbered in the EPS but are referenced in the main text in terms of the aspect that they relate to, for example Appendix – Soil. A detailed table of contents is provided at the front of the Appendices to locate the specific report or item referred to.

2 DESCRIPTION OF THE PROPOSAL

2.1 Mineral Resource

Current estimates suggest that 900,000t of HMC is located within the Burekup Mineral Sands Deposit. Heavy mineral product to be generated from mining the Deposit includes zircon, ilmenite, rutile and leucoxene. A description of the site geology and mineralisation is provided in Section 3.2.

2.2 Overview and Key Characteristics of the Proposal

2.2.1 Overview of Existing Operations

Mining of the Dardanup Mineral Sands Deposit commenced in June 2002 on M70/675 and M70/748. A total of 2.36 million tonnes of ore was extracted in the first year of mining to produce 176,000t of HMC.

HMC from the Dardanup Mine 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 250,000t 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.

A southern extension to the Dardanup Mine was approved in January 2004 to increase the area of solar evaporation ponds from 80ha to 130ha, located on M70/675. A northern extension to the Dardanup Mine was approved in July 2004 which allowed mining of the Dardanup Mineral Sands Deposit to continue between Henty Brook Rd and Offer Rd on M70/748.

In 2007, approximately 167,000t of HMC was produced at the Dardanup Mine which resulted in 140,000t of heavy mineral product for export.

2.2.2 Overview of the Proposal

The proposal for a western extension to the Dardanup Mine is to allow mining of the Burekup Mineral Sands Deposit, a separate strand of heavy mineral deposit located between 100m to 2.1km from the Dardanup Mineral Sands Deposit. The western extension is anticipated to have a mine life of 3.5 to 5 years which is within the timeframe of 15 years for the Dardanup Mineral Sands Project, as outlined in Schedule 1 for the Project (see Section 1.6). Mining of the western extension area will seek to increase the current approved HMC production rate of 220,000tpa to 280,000tpa. Dewatering requirements for the western extension will be an average of 2,200 cubic metres per day based on two pumps running for five hours each. Other key characteristics of the western extension proposal are summarised in Table 2-1. Approximately 25% of HMC from the western extension area will be transported to the North Capel separation plant for further processing by Iluka.

Table 2-1
Key Characteristics Table for the Western Extension

Element	Proposed Western Extension to the Dardanup Mine to include the Burekup Deposit
Proponent	Doral Mineral Sands Pty Ltd, Lot 7 Harris Road, Picton Western Australia 6229
Life of Mine	The Life of Mine for the western extension will be 3.5 to 5 years (2009–2014)
Total Disturbance Area	The total disturbance area for the western extension will be 219.38ha
Mineable reserve	9.5 Million tonnes
Overburden Volume	5.8 Million BCM
Rates of Extraction (Overburden and Ore)	6.4 Million tonnes per year
Processing Rate/Mining Rate	390 tonnes per hour
Heavy Mineral Concentrate Production	900,000 tonnes
Extraction method	Dry mining
HMC Transport to Capel	5 round trips (10 movements) per day
HMC Transport to Picton	15 round trips (30 movements) per day
Water Supply Sources	No additional requirement
Employment	Estimated at 113 employees in summer, 93 employees in autumn and 83 employees in winter

Activities to be carried out in the western extension area include: pre-mine establishment works; the excavation of ore (and associated dewatering); transport of ore via overland conveyor to the Dardanup Mine; backfill of mine voids with sand and clay tails and overburden; and rehabilitation. The remainder of mining activities (listed in Section 2.4) will all be carried out at the existing Dardanup Mine, or as per currently approved practices associated with Dardanup Mine activities.

2.3 Pre-Mine Establishment Works

Pre-mine establishment works will include topsoil stripping, overburden removal, drainage works and the establishment of noise bunds, internal haul roads and some infrastructure. It is proposed to strip overburden using scrapers, excavators and trucks. Overburden stripping will be carried out on day shift only, to minimise noise impacts from the mining equipment on local residences.

Infrastructure required for mining of the western extension area will be limited to the installation of an in-pit hopper (to receive ore), an overland conveyor (pre-fabricated and to be installed on-site) and an associated access/maintenance road. Pre-mine establishment works will need to be undertaken in the dry months, prior to the onset of rains.

2.4 Mining Operations

Ore from the Burekup Mineral Sands Deposit will be mined progressively (from south to north) via a series of open-cut pits using dry mining techniques. Dewatering of groundwater inflows into the pit will be required to enable dry mining to occur. Mining will be staged in order to minimise the area of disturbance (at any one time) with the aim of achieving focussed and effective management of the environmental factors at each pit location, prior to moving onto the next pit location. It is proposed to mine the southern area of the deposit within the first 2 to 2.5 years and then mine the northern extent of the deposit in the final 1 to 1.5 years of the mine life. The life of mine could extend to 5 years based on more accurate (predictive) data becoming available as the resource is mined and also if economic circumstances improve (and these improvements are sustained).

The remainder of mining activities (listed below) will be carried out at the existing Dardanup Mine, or as per currently approved practices associated with Dardanup Mine activities. The only other activities to occur in the western extension area are backfill of mine voids with overburden, sand and clay tails. Following backfill, the area will be rehabilitated to a landform and land use similar to the surroundings.

Ore will be fed from the overland conveyor to the existing feed preparation plant at the Dardanup Mine consisting of a double deck screen and scrubber. Oversize material greater than 3.0 millimetres (mm) will be removed through the feed preparation plant.

From the feed preparation plant, the ore will be transported via pumps and pipelines to the existing Dardanup wet concentrator, where the process requires all particles >2.4mm to be removed from the ore. It is anticipated the wet concentrator will operate at a nominal throughput rate of 300t per hour to produce 900,000t of HMC over the life of mining the Burekup Mineral Sands Deposit.

Clay tails will be piped to established solar evaporation ponds located at the Dardanup Mine to allow settlement and drying. Dried clay tails will then be removed from the ponds (during the dry months) and placed in-pit with sand tails. There will be no new solar evaporation ponds required to be established in the western extension area for the management of clay tails from mining of the Burekup Mineral Sands Deposit. The co-disposal of clay tails with the sand tails into pit voids will also be carried where possible, as has been done successfully at the Dardanup Mine.

Established process water supplies for the Dardanup Mine will satisfy the requirements for mining of the western extension area. Process water will continue to be sourced from the Harvey Water Irrigation System and also captured from the drainage of groundwater in operational pits. The Dardanup Mine and processing plants will continue to be operated as a closed water system.

Drainage water from the western extension area will (similarly) be captured and pumped back to the process water pond at the Dardanup Mine for re-use.

The majority of HMC will be transported to the Picton Dry Separation Plant by haul truck (using established transport routes) for further treatment and the generation of zircon and ilmenite products.

The proposal to mine the Burekup Mineral Sands Deposit will result in approximately 25% of HMC to be transported to the North Capel separation plant for further processing by Iluka. This does not typically occur as part of the current Dardanup Mine operations, and is discussed further in Section 2.5.3.

2.5 Ancillary Infrastructure

Support infrastructure to be located in the western extension area will be limited to internal haul roads, an amenities facility and an overland conveyor. The conveyor route corridor will include the establishment of an access road, the installation of power lines and the laying of pipeline infrastructure. All office and maintenance infrastructure will continue to operate from the existing Dardanup Mine. The site will be established and operated in a manner to reflect the existing operations at the Dardanup Mine.

2.5.1 Power and Water Supplies

No additional water source supplies will be required to mine the western extension.

An increase of power usage of 806kW is likely to be required to mine the western extension. Additional power requirements are as follows:

- 0.37kW: Overland conveyor brake system;
- 1.5kW: Overland conveyor cleaning belt pump;
- 2.2kW: Overland conveyor lube system air compressor, Overland conveyor, discharge sump pump and air compressor;
- 11kW: Supplementary scalping screen; Supplementary feeder screen feed conveyor; Scalping screen discharge conveyor;
- 45kW: Supplementary feeder discharge conveyor;
- 55kW: Supplementary feed hopper discharge conveyor;
- 110kW: Tails booster pump;
- 150kW: Water return booster pump;
- 185kW: Overland conveyor; and
- 220kW: Water return pump.

An additional 30 lights will be required for mining (70W each) with some located on the conveyor and the supplementary feeder. Lighting will contribute an additional energy usage of 2.1kW.

2.5.2 Amenities

One amenities building, likely to be a transportable, will be situated on the western extension area. This will consist of a lunch room and toilets. A local government approved septic tank and leach drain system will be established for effluent disposal.

2.5.3 Transport and Road Closures

HMC is trucked from the Dardanup Mine to the Picton Dry Separation Plant via the approved transport route. The transport route (see Figure 2.5-1) runs west along O'Connor Rd, north along Dowdells Line and then west along South West Highway. This transport route for HMC to the Picton Dry Separation Plant will not change for mining the western extension, but more trucks will frequent the route due to the increased tonnage of HMC to be produced from the Burekup Deposit. Currently there are 11 round trips by trucks per day which will increase to 20 round trips per day.

Approximately 25% of HMC will be transported to the North Capel separation plant for further processing by Iluka. The five round trips per day to Capel will occur along the designated truck route on main roads. The route will encompass part of the pre-existing Shire approved truck haulage and part of the existing Iluka truck route on Network 2/3 category main roads (as per the *Road Traffic (Standard Vehicles) Rules 2002)*.

Some road closures will be required for mining the western extension. Proposed road closures have been presented to the Shire of Dardanup at their “Ordinary Meeting” on 24 September 2008, and have subsequently been approved. The closures will impact on transport through the area but sufficient alternative access is available and traffic volumes are generally low enough to not be a concern. The roads to be closed and length of closure are outlined below:

- Dowdell's Line (March 2009–April 2009). The temporary closure of this road will be for the installation of a culvert to run the overland conveyor beneath the road;
- Harris Road (March 2009–May 2010);
- St Helena Road (October 2010–April 2013); and
- O'Connor Road (February 2011–April 2014).

2.6 Workforce

Based on the current workforce for the Dardanup Mine, the following workforce is expected for mining the western extension:

- Summer 113 people;
- Autumn 93 people; and
- Winter 83 people.

This includes a: mine coordinator, mine manager, mine engineer, geologist, surveyor, environmental officer, operators, maintenance staff and contractors. Specific workforce induction and training commitments will be implemented for the western extension, as outlined in the EMS and the Safety Manual. Mining of this mineral resource will provide direct and indirect employment opportunities for the community.

2.7 Rehabilitation and Mine Closure

2.7.1 Western Extension

Overview

The Rehabilitation and Decommissioning Plan for the Dardanup Mineral Sands Project (see Section 6.1.3) will be updated to include all relevant details for the western extension. The same control measures will be implemented for the western extension as are used at the Dardanup Mine (see Section 2.7.2).

Two key objectives will guide the rehabilitation of the western extension. These are:

- To provide for the restoration of the agricultural productivity of the mined land to at least its current level; and
- To maintain a hydrological regime to ensure the post-mining land use can be achieved.

For the purpose of this document, rehabilitation in regards to the western extension has been dealt with on a site specific basis, including the:

- Mined land;
- Wetlands and riparian zones (including the CCW Proposed Covenant Area);
- Low Woodland of *C. obesa*;
- Bed and banks of creeks; and
- Environmental Offset Site (Willoughby's Area).

Rehabilitation of Mined Land

A summary of proposed mine rehabilitation works is provided below:

<u>Top Soil and Subsoil Harvesting</u>

- Prior to removal of topsoil, any millable timber will be recovered.
- Cleared vegetation will be chipped and used as mulch for soil stabilization.
- The replacement of topsoil and subsoil in order to promote the establishment and survival of pasture or native vegetation.
- After replacement of subsoils, the surface will be contoured to provide drainage.
- Following topsoil replacement, the surface will be harrowed in areas of pasture establishment.

<u>Pit Backfilling and Soil Profile Construction</u>

- The pit volume will progressively be filled with a heterogeneous mixture of sand tailings, dried clay tailings and oversize. The return of clay fines material and subsoil (silty sand) will emulate the pre-mining hydraulic properties of the region.
- Backfilling will be such that, once the subsoil and topsoil have been replaced, slight mounding (100-200mm) of the overall profile should be evident to allow for some settlement.
- There will be no overall change in topography.

Soil Amendments

- Soil amendments, such as gypsum, will be incorporated where required on the basis of soil tests.
- Fertilizer application will be made in consultation with the Department of Agriculture and specialist agricultural consultants.

Pasture Re-establishment

- Pasture re-establishment will be undertaken by seeding areas with subterranean clover/ryegrass mix.
- Rates of seeding will be approximately 20kg/ha each of clover and ryegrass.
- Advice on the most suitable varieties and seeding rates will be obtained from the Department of Agriculture.

Establishment of Native Vegetation

Native vegetation will be established for:

- Areas where screening of plant operations is desirable;
- Amenity plantings;
- Roadside plantings and enrichment of existing roadside vegetation;
- Establishment or enhancement of wildlife corridors and key ephemeral creeks. This will include the planting of trees within strategic corridors such as adjacent to road reserves and fence lines to link, strengthen or improve corridors for native fauna. The areas for replanting will be determined in consultation with DEC; and
- Areas where pasture is not desirable or unlikely to be sustainable.

Species used will be drawn from those recorded in the vegetation and flora surveys. Advice will be obtained from DEC in regards to practical steps to prevent or restrict dieback disease from areas to be revegetated with native vegetation.

Weed Control

- Weed control measures including herbicide application or topsoil skimming (turning over the top few centimetres after weed germination) will be carried out when necessary.
- Maximum level of weeds will not be more than that typical of the region.

Rehabilitation of Wetlands and Riparian Zones

CCW Wetland

A rehabilitation plan and program will be designed in consultation with the DEC for the CCW with the following key commitments:

- Fencing will be constructed and maintained around the CCW and buffer zone to prevent disturbance and grazing by cattle.
- A two hundred (200) metre buffer from the wetland will be maintained and rehabilitated.

- A conservation covenant will be established for the CCW. A proposed CCW Covenant Area has been agreed in principal in preliminary discussions with the land owner and the DEC (See Figure 8-1).
- The details of the conservation covenant and associated management strategies will be finalised within 1 year of the commencement of mining.
- Where possible, local provenance species will be included in the rehabilitation of the understorey.
- Weed control will be undertaken for the CCW and buffer zone, for 3 years post mining. Further details will be determined with DEC and the Department of Agriculture.

<u>REW Wetland</u>

A rehabilitation plan of the REW wetland will be developed in consultation with the DEC. The Plan will include the following implementation commitments:

- Fencing will be constructed and maintained around the REW to prevent disturbance and cattle grazing.

<u>Low Woodland of C. *obesa*</u>

- Fencing of the Low Woodland of the C. *obesa* will occur at the intersection of Dowdell's Line and St Helena Road to manage disturbance and cattle grazing.
- The disturbance corridors (for the purpose of services and the conveyor) in the southern section of the Low Woodland of C. *obesa* will be rehabilitated post mining using seed of local provenance.

<u>Beds and Banks of Ephemeral Creeks</u>

- Site specific plans for the rehabilitation of ephemeral creeklines (to be impacted on) will be developed as part of the beds and banks permit.
- Restoration works to beds and banks will restore riparian areas to pre-mining contours and vegetation cover.

Rehabilitation of Willoughby Offset Area

Detailed information in regards to the proposed Environmental Offset can be found in Section 8. A summary of the key rehabilitation commitments for the Willoughby Offset Area are as follows:

- Secure and rehabilitate approximately 20ha of Guildford Vegetation Complex.
- Provide $250,000 over 5 years to manage the area.
- Offset the (approximate) 450 trees to be cleared with the planting of 5,000 trees within the offset site.
- Doral will submit an annual report to the DEC outlining the status of the commitments for rehabilitation works undertaken. The annual report will be for the 12 months following Ministerial approval. Annual reports will be submitted within 3 months of the end of each 12 month period. The Annual report will provide summary evidence of expenditure by Doral for the maintenance of the Offset to the agreed amount of $250,000 over a 5 year period.

Implementation of the rehabilitation program for the offset site will include:

- Rehabilitation of the degraded and parkland cleared areas with trees;
- Rehabilitation of understorey where possible, consistent with the soil type and surrounding vegetation;
- The area will also be fenced and a weeding program put in place; and
- Species selected for the revegetation of canopy cover will be predominantly Marri, Jarrah and Banksia. Species selection for the development of an understorey will focus on the re-creation of fauna habitat and will be local provenance and representative of the Guildford Vegetation Complex.

2.7.2 Dardanup Mine

To date, a total of 461.63ha has been disturbed at the Dardanup Mine (since mining commenced in 2002) with 24.11ha of land rehabilitated. A summary is provided below:

- 2002-2005: a total of 349.65ha was disturbed with 1.1ha rehabilitated;
- 2006: a total of 59.64ha was disturbed;
- 2007: a total of 36ha was disturbed with 2.30ha rehabilitated; and
- 2008: a total of 16.34ha was disturbed with 20.71ha rehabilitated.

Further detail is provided in Table 2-2 and shown graphically in Figure 2.7-1.

Management objectives and strategies have been developed for the following activities at the Dardanup Mine, as contained in The Rehabilitation and Decommissioning Plan for the Project (see Section 6.1.3) which include:

- Topsoil and subsoil harvesting and storage;
- Overburden recovery and storage;
- Pit backfilling and soil profile construction;
- Stockpile and tailings pond areas;
- Soil amendments;
- Pasture re-establishment;
- Establishment of native vegetation using local provenance species where possible;
- Enrich roadside vegetation to ensure that native vegetation is represented in the post mining landscape; to an extent at least comparable with that which currently exists;
- Establishment of native vegetation; and
- Weed control.

Control measures in the Rehabilitation and Decommissioning Plan have been successfully implemented at the Dardanup Mine to mitigate potential environmental impacts.

Compliance with the management objectives and strategies in this Plan was demonstrated to the DEC in a Performance Compliance Report (see Section 6.1.5). Doral conduct an annual in-house study into the rehabilitation and mine closure requirements as part of their planning for the next years' budget and life of mine plan. Items reviewed each year include:

i. Final land use: which identifies the likely final land use/s and any alternatives being considered.

ii. Design Criteria: such as rehabilitation elevations, soil profiles and creek line restoration works.

iii. Radiation/Dry Separation Plant Tails Disposal Sites: such as burial requirements and potential caveats to ensure minimal disturbance of the burial sites in the future.

Table 2-2
Areas Disturbed and Rehabilitated at the Dardanup Mine

Tenement & Area Disturbed/ Rehabilitated	2002 to 2005		2006		2007		2008		*Cumulative As at Oct 08*	
	Disturbed (ha)	Rehabilitated (ha)	Disturbed (ha)	Rehabilitated (ha)	Disturbed (ha)	Rehabilitated (ha)	Disturbed (ha)	Rehabilitated (ha)	Disturbed (ha)	Rehabilitated (ha)
M70/748										
Pit	60.85		30.53		5.10	0.50		8.75	96.48	9.25
Permanent SEP	20.62	0.70	10.52						31.14	0.70
Mine Infrastructure	7.25		1.32						8.57	0.00
Temporary SEP/Backfill	20.01								20.01	0.00
M70/748 TOTAL	**108.73**	**0.70**	**42.37**		**5.10**	**0.50**		**8.75**	**156.20**	**9.95**
M70/675										
Pit	23.38		7.85		28.70	1.80	14.34	11.96	74.27	13.76
Permanent SEP	107.86		1.15						109.01	0.00
Mine Infrastructure	51.92	0.40	8.27		2.20		2.00		64.39	0.40
Temporary SEP/Backfill	57.76								57.76	0.00
M70/675 TOTAL	**240.92**	**0.40**	**17.27**		**30.90**	**1.80**	**16.34**	**11.96**	**305.43**	**14.16**
TOTAL	**349.65**	**1.10**	**59.64**		**36.00**	**2.30**	**16.34**	**20.71**	**461.63**	**24.11**

SEP = Solar Evaporation Ponds

3 BIOPHYSICAL FACTORS – IMPACT ASSESSMENT, MANAGEMENT AND MONITORING

3.1 Climate

3.1.1 Existing Environment

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 (Bureau of Meteorology, 2008).

3.1.2 Objectives

EPA Objective

To minimise emissions to levels as low as practicable on an on-going basis and consider offsets to further reduce cumulative emissions.

3.1.3 Potential Impacts and Management Strategies

The western extension proposal will result in increased greenhouse gas emissions from the consumption of additional electricity to power the overland conveyor (and associated equipment) and pumps at the mine. There will also be an increase in emissions due to additional haulage of HMC, based on the increased tonnage of HMC produced. Section 4.3 discusses the potential impacts of these additional greenhouse gas emissions.

3.2 Geology

3.2.1 Existing Environment

The following description of the geology of the western extension area has been taken from Soil Water Consultants (2007a) *Final Report: Preliminary Pre-Mine Soil Assessment for the Proposed Burekup Minesite*. This report is referred to in the remainder of the EPS as SWC, 2007a. A copy of this report is contained in Appendix – Soil.

Regionally the Burekup Mineral Sands Deposit occurs in the southern Perth Basin and is composed of up to 8km of Permian and Quaternary sediments. Of particular importance to the Burekup Mineral Sands Deposit are the Quaternary – Late Tertiary Guildford and Yoganup Formations, and the Mesozoic Leederville Formation. 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).

The Leederville Formation provides the base material on which the Burekup Mineral Sands Deposit 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 which comprise the Burekup Deposit that Doral are proposing to mine. 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 western extension area.

3.2.2 Objectives

EPA Objective

To maintain the integrity, ecological functions and environmental values of the soil and landform.

3.2.3 Potential Impacts and Management Strategies

The western extension will involve mining approximately 2.8 million tonnes per annum of additional ore over a 3.5 to 5 year mine life.

3.3 Soil Resources

3.3.1 Existing Environment

The following description of the soil resources of the western extension area has been taken from SWC (2007a). A copy of this report is contained in Appendix – Soil.

The Burekup Mineral Sands Deposit occurs on the Pinjarra Plain with the soils consisting primarily of poorly drained clayey soils of the Guildford Formation. The dominant soil type in the area consists of acidic yellow, grey and brown gradational soils and mottled duplex soils subject to seasonal inundation and water logging. These soils correspond to the Coolup System of McArthur and Bettenay (1974) and represent the oldest soil types on the Swan Coastal Plain.

Clayey soils of the Guildford Formation are present on the eastern side of the site and are overlain by shallow, pale grey sand and sandy loam, forming a well defined duplex soil profile, facilitating perching and water logging near the surface.

A baseline soil survey was conducted over the site, with shallow (maximum depth of 4m) and deep (maximum depth of 11m) trench excavation to investigate soils across the site. 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.

SMU1: Uniform Brown Heavy Clay

The SMU1 horizon occurs in two isolated areas within the site and likely represents the basal portion of remnant stream channels through the area. The 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.

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, likely due to the presence of smectite.

SMU2: Gradational Pale Grey Sand – Yellow Sandy Loam

The SMU2 horizon is restricted to areas of higher elevation in the northeast. The surface soils consist of 10-40cm of pale grey sand grading into a bright yellow to mottled yellow sandy loam at depth. These soils are not structurally degraded like those of SMU1. The surface soils exhibit a sandy texture with little clay and therefore are well drained and friable. There is a clear boundary between the surface sandy soils and the underlying blue-grey sandy clay soils of the Guildford Formation.

SMU3: Pale Grey – Brown Sandy Duplex

The SMU3 horizon is isolated to the middle section of the Burekup Deposit. It consists of pale grey – brown sand overlying the blue-grey sandy clay soils of the Guildford Formation with an abrupt textural boundary. The sandy surface soils have a very low water holding capacity and subsequently they become saturated in winter months with water perching on the clayey soil below, and drying rapidly in spring. The defined duplex boundary facilitates perching and subsequent lateral flow of water, which has implications for the formation of surrounding areas of inundation. It is likely that these soils have formed in depressions on the upper surface of the underlying Guildford Formation.

SMU4: Yellow – Brown Mottled Duplex

The SMU4 horizon is the most common soil type across in the site. The bright yellow to brownish orange surface soils overlying the Guildford Formation are coarser than those in SMU1 and therefore better drained. Again, the boundary between the surface soils and the Guildford Formation is abrupt, indicating a depositional, rather than pedogenic, mode of formation.

The topsoil has a sandy clay texture which is structurally sensitive. These soils slake rapidly when rewet and show moderate dispersion resulting in hardsetting. Cultivation of these soils is also likely to enhance hardsetting, and considerable shrink-swell properties are observed.

The subsoil consists of bright yellow sandy clay with a very good structure, with firm crumb peds. The SMU is less dispersive than the other SMU's on site (due to iron oxides) with relatively high plant available water content.

Guildford Clay

The clayey Guildford Formation underlies all surface soils across the site, with the exception of a few isolated areas to the north 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 does occur through isolated coarse sandy lenses.

Acid Sulfate Soils Survey

The site of the proposed Burekup Mineral Sands Deposit is mapped as having Moderate to Low risk that ASS are likely to occur at depths within 3m of natural soil surface (WAPC, 2007). Based on the results of desktop and field studies (SWC drilled 146 drill holes across the study area from depths of 7–20m and analysed every metre of the drill holes for pH_F and pH_{FOX}. A total of 2,054 soil samples were tested and 100 soil samples were analysed for S_{CR}), SWC identify that potential ASS material associated is largely confined to pyritic sediments associated with the upper Leederville Formation, which occur beneath the Burekup Mineral Sands Deposit. Accordingly, the requirements of the ASSMP for the proposal will be to provide 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.

3.3.2 Objectives

EPA Objective

To maintain the integrity, ecological functions and environmental values of the soil and landform.

Relevant Standards and Legislation

- *Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils in Queensland (Ahern, Ahern & Powell, 1998)*;
- *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines (Dear et al, 2002)*;
- *Preparation of Acid Sulfate Soil Management Plan (ASSMP) (DoE, 2003)*;
- *Treatment and management of disturbed acid sulfate soils (DoE, 2004a)*;
- *Guidance for groundwater management in urban areas on acid sulfate soils (DoE, 2004b)*;
- *Draft Identification and Investigation of Acid Sulfate Soils (DoE, 2006a)*; and
- *Dewatering Effluent and Groundwater Monitoring Guidance for Acid Sulfate Soil Areas (DoE, 2006b).*

3.3.3 Potential Impacts and Management Strategies

The potential impacts on soil resources are expected to be similar to the existing Dardanup Mine, with the added possibility of disturbing ASS. Potential impacts on soil resources would be associated with the following:

- Clearing of vegetation would increase the likelihood of soil erosion by both wind and water;
- Alteration of soil structure by excavation, stockpiling and returning soil material to mine voids;
- Loss of optimum soil chemical properties such as: nutrients (mineralised N, plant available P and K, and KCl extractable S); organic carbon; exchangeable cations and cation exchange capacity, pH and electrical conductivity; and
- Oxidising ASS present below the mine pits and disturbing potential ASS in the mine pits which could lead to groundwater acidification and contamination by heavy metals and radionuclides, alteration to soil structure and 'acid scalds'.

Management Strategies

<u>Overview</u>

In order to mitigate the potential impacts outlined above, Doral commit to:

i. Implementing the same control measures in the western extension area as outlined in the Rehabilitation and Decommissioning Plan for the Dardanup Mine (GHD, 2001). These control measures were developed to mitigate the potential impacts of:

    - Stripping, handling, storage and placement of topsoil;
    - Clearing of vegetation resulting in increased soil erosion;
    - Alteration of soil structure by excavation, stockpiling and returning soil material to mine voids; and
    - Loss of optimum soil chemical properties.

Control measures in this Plan have been successfully implemented at the Dardanup Mine to mitigate potential environmental impacts. Compliance with the management objectives and strategies in this Plan was demonstrated to the DEC in a Performance Compliance Report (see Section 6.1.5). The Plan will be updated to include all relevant details for the proposal for a western extension.

ii. Implementing an ASSMP to appropriately manage ASS material identified in the western extension area. An overview of management strategies from the ASSMP is provided below.

An investigation of the western extension area was conducted by Soil Water Consultants in May 2007 (SWC, 2007b). The distribution of potential ASS, as a result of the findings of the investigation, is shown in Figure 3.3-1.

Coffey Environments, on behalf of Doral, has developed an ASSMP in consultation with the DEC (Steve Appleyard) based on the findings of the SWC (2007b) report.

Copies of both the ASSMP (Coffey Environments, 2008a) and SWC (2007b) report are contained see Appendix - Soil.

An overview of strategies for the detection, management and reporting of ASS developed in the ASSMP for mining the western extension is provided below:

- Groundwater monitoring for specific ASS parameters on piezometers located around the Burekup Deposit;
- Daily groundwater monitoring for pH, electrical conductivity, Total Titratable Acidity and depth to groundwater;
- Dewatering effluent monitoring, with monitoring frequency and analytes to be determined based on the pH and Total Titratable Acidity;
- Soil analysis on ore and overburden for the first three months of mine operation to ground-truth the ASS model developed by SWC (2007b);
- A commitment to reporting on the results of the above monitoring programs in the Annual Environmental Report; and
- A commitment to preparing an ASSMP Closure Report as part of the mine closure and rehabilitation plan for the Dardanup Mine.

Additional detail on management measures, should ASS be detected by monitoring in the western extension, is set out under the headings below.

<u>Soil Monitoring for the First Three Months of Operation</u>

As a precautionary measure, soil testing of ore and overburden material will occur for the first three months of mine operation. Based on the volume guidelines presented in Table 1 of the ASSMP, approximately 690 soil samples of orebody material will be collected and approximately 1,320 soil samples of overburden will be collected (from a mined volume of 100,500m^3 total or ore/overburden). All soil samples will be field tested for pH_F and pH_{FOX}. Samples with a pH_{FOX} >4 will be considered non-ASS and no further analysis will be required.

If any sample from the batch has a pH_{FOX} <4 then 25% of the samples from the batch will require further analysis to quantify their net acidity via the S_{CR} suite method. This may be undertaken in the field if equipment is sufficient for analysis; otherwise samples will be despatched to a NATA accredited laboratory for the analysis. Acid-Base Accounting will be performed on the results to determine if net acidity in any samples exceeds the DEC's texture-based Action Criteria for management.

If the Action Criteria are exceeded, neutralisation and verification of the material will be undertaken, as described below (Section 5.1.2.3 of the ASSMP). If the net acidity Action Criteria are not exceeded, the material may continue to the feed preparation plant.

A fixed pH monitoring point will be located at the feed preparation plant to monitor the pH of the incoming ore/process water slurry. The purpose of this monitoring point is for the early detection of acidification in order to assess the need for, and potentially trigger, management strategies at the source of mining.

This additional data will be used to ground-truth the SWC data and will provide another means of monitoring potential acidification of mined material from the Burekup Deposit. Data from the first three months will be reviewed and the ASSMP updated (where necessary) to reflect the findings of the first three months of monitoring.

If identified ASS material cannot be avoided, it must be segregated for neutralisation following excavation. In order to appropriately neutralise the material, it must be analysed (via SPOCAS or S_{CR} suite analyses) to determine its net acidity. Analyses and neutralisation will be conducted before the ore is transported to the feed preparation plant.

The excavated ASS material will be stockpiled on a bunded pad constructed from alkaline material of not less than 300mm thickness. The pad will be graded to ensure good drainage and the side will be bunded with limestone or a similar alkaline material to a minimum height of approximately 300mm to prevent lateral migration of any acid drainage and to divert storm water.

The minimum number of samples to be tested will be determined by the total volume of the ore material in the batch as per Table 1 of the ASSMP. Initially, samples will be analysed for pH_F and pH_{FOX}. Samples with a pH_{FOX} >4 will be considered non-ASS and no further analysis will be required.

Neutralisation & Verification

If the Action Criteria are exceeded, the stockpile will be treated with lime to neutralise the acidity present.

Liming rates

The liming rate will be calculated by determining the mean, standard deviation, and standard deviation plus one of the laboratory-calculated liming rates (excluding any ANC) which will be given with the SPOCAS or S_{CR} Suite methods.

The liming rate then needs to be multiplied by 2 (safety factor), plus corrected for the $CaCO_3$ content and particle size distribution of the neutralising agent chosen. A suitable blending method should be implemented to ensure efficient mixing of the neutralising agent with the ASS material.

The liming rate calculations should be reviewed by a qualified environmental scientist before the rates are exercised on ASS material.

Neutralisation

Following neutralisation, the material requires re-sampling to ascertain if the stockpile has been adequately neutralised. The number of samples shall be in accordance with Table 1 of the ASSMP.

The criteria to determine adequate neutralisation are:

- A mean pH_{KCL} of 6.5 or greater for the batch; and
- No detectable net acidity (including acid neutralising capacity, divided by an appropriate fineness factor).

Once the stockpile has been verified and net acidity meets the verification criteria the ore may be transported to the feed preparation plant.

3.4 Groundwater Resources

3.4.1 Existing Environment

The following description of the groundwater resources of the western extension area has been taken from the study *Burekup Deposit Modelling of Groundwater Level Impacts* by Parsons Brinckerhoff (PB, 2007). A copy of this report is contained in Appendix – Water and Wetlands.

Hydrology

Limited groundwater resources occur within the superficial aquifer which overlies the regionally extensive Leederville aquifer.

Groundwater monitoring results show the hydraulic head in the superficial aquifer is between 0.1m BGL and 6m BGL, with some surface areas becoming inundated during the winter months. Hydraulic heads range between 34m AHD in the south-east to 15m AHD in the north-west of the site. Groundwater flow is generally in a north-west direction from the scarp to the coast, with the hydraulic gradient mimicking the topography.

Aquifer test results indicate the transmissivity of the superficial formations ranges between $0.5m^2$/day and $79.1m^2$/day, with the highest transmissivity values representing the sand dominated Yoganup Formation.

Aquifer test results indicate the transmissivity of the Leederville Formation ranges between $4.9m^2$/day and $46m^2$/day. Hydraulic heads are similar to those of the superficial aquifer and indicate a north-west flow.

A marker horizon of grey clay and silts separates the Leederville and superficial aquifers. Localised upward leakage occurs between the Leederville and superficial aquifers where this marker horizon is thin or absent, due to the difference in piezometric head.

The superficial aquifer is recharged by rainfall infiltration and by localised upward hydraulic head from the underlying confined Leederville and Yarragadee aquifers. Discharge occurs as baseflow to surface drainage features, coastal wetlands, rivers, evapotranspiration, and downward leakage. Groundwater quality ranges from fresh to brackish in the superficial formations.

The Leederville aquifer is regionally recharged through the infiltration of rainfall on the Blackwood Plateau to the south, the localised downward leakage from the superficial aquifer and by upward leakage from the Yarragadee aquifer. Discharges are by upward and downward leakage to the superficial and Yarragadee aquifers and the ocean.

Groundwater Management Area

The Burekup Mineral Sands Deposit is partly located within the proclaimed Dardanup Groundwater Management Sub-Area of the Bunbury Groundwater Area, with Dowdells Line being the eastern boundary to the Sub-Area. The area of the Burekup Deposit to the east of Dowdells Line is situated in an unproclaimed Groundwater Area as shown in Figure 3.4-1.

Groundwater Modelling

Groundwater modelling has been conducted to determine the impact of dewatering and groundwater draw-down in the vicinity of the western extension area (PB, 2007, see Appendix - Water and Wetlands). The model predicts the lowering of hydraulic head associated with Burekup mining operations will be centred on active blocks and relatively rapid recovery will occur in mined and back-filled areas. Only minor remnant drawdown is expected eight months after mining operations have ceased.

The proposed mining operations will result in localised lowering of hydraulic head. A draw-down of hydraulic head of approximately 8m is expected in the Guildford Formation adjacent to active block margins, decreasing to 1m at a distance of approximately 950m from the block at the widest point.

A shallow hydraulic gradient is expected within the more conductive Leederville aquifer, where the hydraulic head is only expected to be drawn down by 3m adjacent to the block margins, with drawdown decreasing to 1m approximately 980m from mine blocks.

The impact of dewatering on supply from landowner bores will depend on the pump setting within the bores. Given the high clay content of the Guildford Formation and the distance of these bores from the mine site, hydraulic head in landowner bores are unlikely to be significantly influenced by dewatering activities.

It is estimated that only minor (less than 0.5m) to negligible drawdown may occur at the eastern boundary of the extension area as a result of mining activities at the adjoining Dardanup Mine.

3.4.2 Objectives

EPA Objective

To maintain the quantity of water so that existing and potential environmental values, including ecosystem maintenance, are protected.

Doral Objectives

Objectives of the Groundwater Management Plan for the Dardanup Mineral Sands Project are listed below:

- Doral will consult with landowners, the Department of Agriculture and the Water Authority of Western Australia to ensure that operations at Dardanup do not unreasonably affect agricultural enterprises in neighbouring properties, especially in relation to surface water.
- Continue hydrological and technical studies, including regional monitoring of water bores, to facilitate pre-emptive predictions of impacts of mine dewatering on local and regional hydrology.
- Ensure backfilled mine areas have the capacity to transmit water from east to west in a fashion similar to that which currently occurs.
- Doral will licence all bores and other water supply and water management facilities in accordance with the requirements of the relevant legislation, in particular the *RIWI Act 1914*.

3.4.3 Potential Impacts and Management Strategies

Overview of Potential Impacts and the Proposed Monitoring Program

Potential impacts on groundwater from the western extension proposal have been identified as:

- Draw-down of groundwater levels in the vicinity of the western extension area due to dewatering. This may impact on groundwater dependant vegetation, wetlands and also affect other land users (of which there are 22 in the immediate surrounds);
- Adverse impacts on groundwater quality offsite due to the disturbance of ASS; and
- Contamination of groundwater due to accidental (minor) spill of hydrocarbons.

Groundwater monitoring will be conducted on the 16 piezometers already located around the western extension area to assess groundwater quality and drawdown. An additional seven piezometers will be installed to specifically monitor groundwater quality and drawdown from mining the western extension area. The proposed location of piezometers is shown in Figure 3.4-2.

All relevant aspects of the Groundwater Management Plan for the Dardanup Mineral Sands Project will be implemented in the western extension area. Control measures in this Plan have been successfully implemented at the Dardanup Mine to mitigate the potential environmental impacts of drawdown on groundwater levels in the vicinity of the mine. Compliance with the management objectives and strategies in this Plan was demonstrated to the DEC in a Performance Compliance Report (see Section 6.1.5). The Plan will be updated to include all relevant details for the proposal for a western extension. Groundwater monitoring requirements in the Radiation Management Plan will also be updated to include the western extension proposal.

Impact Assessment and Management Strategies of Other Land Users

The proposed mining operations will result in localised lowering of hydraulic head. A drawdown of hydraulic head of approximately 8m is expected in the Guildford Formation adjacent to active mining blocks margins, decreasing to 1m at a distance of approximately 950m from the block at the widest point. All piezometers within a 1km radius of the mine pits will be monitored daily for water levels.

A shallow hydraulic gradient is expected within the more conductive Leederville aquifer, where the hydraulic head is only expected to be drawn down by 3m adjacent to the block margins, with drawdown decreasing to 1m approximately 980m from the mine blocks.

Based on the time-series drawdown plots, bore L2B1 (Figure 3.4-2), located down gradient of the mine pit boundary, will be most affected by mining activities. In February 2010, hydraulic head in this bore will decline by approximately 0.73m.

Negligible dewatering influences are predicted for most bores located more than 2,000m from the mine site, while hydraulic head in all other bores is expected to be less than 1m (PB, 2007).

Landowners will be consulted to ensure bore yields are not significantly impacted. Doral will assist in maintenance of landowner bores and pumps for continuation of bore yields.

The trigger levels for groundwater are a 20% change in background levels for the site. The trigger values are presented in full for all ASS analytes in the ASSMP (Appendix – Soil). Examples of the trigger values for selected analytes are presented in Table 3-1.

Table 3-1
An Example of Trigger Values for pH, Alkalinity, Acidity and Electrical Conductivity (EC)

Bore ID	pH		Alkalinity (mg/L)		Acidity (mg/L)		EC (mS/cm)	
	Average	Trigger values	Average	Trigger values	Average	Trigger values	Average	Trigger values
BU001	**4.49**	3.59	**6.6**	5.28	**37.6**	45.156	**12430**	14916
BU002	**5.38**	4.3	**17.2**	13.76	**53.2**	63.9	**1205**	1446
BU003	**4.09**	3.27	**2.5**	2	**49**	58.8	**1660**	1992
BU004D	**5.73**	4.58	**56.8**	45.44	**44**	52.8	**1810**	1448
BU004M	**5.74**	4.59	**38.6**	30.88	**49.5**	59.7	**1806**	2167.2
BU005D	**4.9**	3.92	**5.7**	4.56	**42.7**	51.3	**3012**	3614.4
BU005M	**5.6**	4.48	**35.2**	28.16	**46.6**	55.92	**5339**	6406.8
BU006D	**4.72**	5.66	**2.1**	1.68	**55.1**	66.156	**987**	1184.6
BU006M	**5.26**	4.21	**22.6**	18.08	**49.2**	59.1	**2254**	2704.8
BU007D	**4.97**	3.98	**12.6**	10.08	**60.8**	72.96	**935**	1121.6
BU007M	**4.99**	3.99	**6.8**	5.44	**52.6**	63.12	**1026**	1231.2
BU008	**3.13**	2.5	**0.6**	0.48	**29**	34.8	**942**	1130.6
BU009	**4.93**	3.94	**3.6**	2.88	**54.8**	65.76	**842**	1010.4
BU010	**5.7**	4.56	**28.8**	23.04	**19.3**	23.16	**4226**	5071.2
BU011D	**5.05**	4.04	**7.4**	5.92	**37.2**	44.7	**816**	979.2
BU011M	**5.13**	4.1	**9**	7.2	**38.6**	46.32	**1051**	1261.2

In the event trigger values are exceeded the following contingency plan will be implemented:

1. Continue daily field monitoring;
2. Increase monitoring frequency for ASS parameters from monthly to fortnightly;
3. If groundwater quality does not return to background/acceptable levels, notify DEC in accordance with the timeframes set out by the *Contaminated Sites Act 2003* Part 2, Division 1, Section 11;
4. Appropriate remediation techniques will be determined with the DEC. This may include the use of various neutralising agents and a variety of methodologies for soil, dewatering effluent and groundwater remediation;
5. Cease mining operations until groundwater quality returns to background/acceptable levels; and
6. Supply downstream water users an alternative source of suitable quality water.

Impact Assessment and Management Strategies of Groundwater Dependant Vegetation

Soil and Water Consultants (SWC, 2007c) assessed the potential impact on vegetation in regards to groundwater dependence in a study titled *Final Report: Groundwater Dependant Ecosystem Assessment for the Proposed Burekup Minesite*. A copy of the study is provided in Appendix – Water and Wetlands.

Results of the assessment indicated that:

- The majority of vegetation is classed as Low Risk of impact if groundwater levels are lowered as a result of groundwater drawdown.
- Three vegetation units situated along the road verge on Dowdells Line are classed as Low to Moderate Risk of impact in response to groundwater dewatering.

Further detail on management strategies for vegetation in regard to groundwater drawdown is provided in Section 3.7.

Impact Assessment and Management Strategies on Henty Brook and Wetlands

Groundwater modelling conducted by Parsons Brinkerhoff (PB, 2007) has indicated that Henty Brook is unlikely to be impacted by mining activities. Negligible impacts were predicted in piezometers closest to Henty Brook. The model also predicted that the piezometric head will be lowered by up to 0.8m at the CCW and up to 0.4m at the REW.

It is proposed to monitor drawdown in piezometers to be located between the mine pits and:

- Henty Brook;
- The CCW; and
- The REW.

The proposed location of monitoring sites is shown in Figure 3.4-2.

Further detail on management strategies for wetlands in regard to groundwater drawdown is provided in Section 3.6.3.

Impact Assessment and Management Strategies for Groundwater Quality

The ASSMP includes daily and monthly sampling regimes for ASS parameters. The ASSMP includes trigger criteria and response actions; note trigger criteria will be a 20% change in background groundwater quality. The Contingency Plan (Section 5.2.2.2 of the ASSMP) outlines the actions should groundwater trigger values be breached. The initial response will be to increase the frequency of groundwater monitoring from monthly to fortnightly.

The results will be assessed against the values in Table 3 in the ASSMP for the specific bore, or (for new bores) against a 20% change in baseline water quality data. If groundwater does not show an improvement (i.e. a return to background levels), the DEC will be notified, and possible causes of the change in quality will be considered. Mining may need to cease until groundwater quality returns to background/acceptable levels, either naturally or through implementation of remediation techniques. A copy of the ASSMP is provided in Appendix - Soil.

There will be no hydrocarbons stored on-site in the western extension area. Any accidental spill of hydrocarbons will be minor as the result of a leak from mobile mine equipment or pumps. Management procedures for the clean up of spills and the treatment of oily waste will be carried out as per the Operational Procedures outlined in the EMS for these activities (see Section 6.1.4).

Department of Water Management Requirements

Discussions conducted with DoW during the preparation of this EPS have indicated a dewatering licence will be required for dewatering activities associated with mining the western extension area. Doral will be submitting an application and Dewatering Management Plan to the DoW prior to pre-mine establishment. DoW has indicated the dewatering licence may be given for the life of the mine.

3.5 Surface Water Resources

3.5.1 Existing Environment

Surface water resources in the vicinity of the western extension area were described in a study by Wetlands Research & Management (WRM, 2006) titled *Burekup Project Baseline Aquatic Biology and Water Quality Study*. A copy of this study is provided in Appendix – Water and Wetlands. The following description has been taken from WRM, (2006).

The western extension area is located within the Leschnault Estuary-Lower Collie Catchment, Henty Brook sub-catchment, which covers an area of 40km^2, as shown in Figure 3.5-1. Henty Brook itself is located approximately 3km to the north east of the western extension area, adjacent to Henty Road as shown on Figure 3.5-2. Of the 62% of the catchment which has been cleared, the majority occurred in the lower parts across the coastal plain; only 23% of the upper catchment has been cleared. Clearing in the lower catchment has primarily been for agricultural purposes, including dairy farming and viticulture. Water from the Henty Brook is currently used by landowners in the area for stock watering, irrigation for commercial vineyards and for domestic use.

The western extension is located within the Collie River Irrigation District proclaimed under the *Rights in Water and Irrigation Act 1914*. Several ephemeral waterways flow in a north-west direction across the site, as shown in Figure 3.5-2. These waterways drain into the Dowdells Line Drain. The Harvey Water Irrigation Channel follows the western boundary of the existing Dardanup Mine as detailed in Figure 3.5-2.

Background surface water quality data for five monitoring sites (including three Henty Brook sites) is presented in the WRM, (2006). The location of monitoring sites is shown graphically in Figure 3.5-2. Generally most of the physico-chemical variables measured were within the ranges expected for ‘slightly to moderately disturbed’ ecosystems (ANZECC & ARMCANZ, 2000).

3.5.2 Objectives

EPA Objective

To maintain the quantity of water so that existing and potential environmental values, including ecosystem maintenance, are protected.

Doral Objectives

The objectives and requirements of the Surface Water Management Plan for the Dardanup Mineral Sands Project are listed below:

- Prior to the commencement of mining, Doral shall prepare a Surface Water and Groundwater Monitoring and Management Plan, in consultation with neighbouring landowners, Agriculture Western Australia, the Water and Rivers Commission and the Dardanup LCDC, to the requirements of the DEP (now DEC);
- Doral will consult with landowners, the Department of Agriculture and the Water Authority of Western Australia to ensure that operations at Dardanup do not unreasonably affect agricultural enterprises in neighbouring properties, especially in relation to surface water;
- Dispose of excess water in a manner agreed in consultation with the Water Authority of Western Australia and the Department of Agriculture; and
- Doral will licence all bores and other water supply and water management facilities in accordance with the requirements of the relevant legislation, in particular the *RIWI Act 1914*.

3.5.3 Potential Impacts and Management Strategies

The potential impacts identified for surface water are:

- Disturbance to creek bed and banks;
- Alteration to the supply (i.e. volume) of surface water at sensitive receptors;
- Degradation of surface water quality at sensitive receptors; and
- Impacts to surface water quality from an emergency discharge of water.

Potential Impacts and Management Strategies for Ephemeral Creeks

Due to the nature of the mining operation, any ephemeral creeks that transverse the western extension will be temporarily diverted where they intersect a mine pit. The mining of waterways within a proclaimed surface water area will require a permit to interfere with bed and banks from the DoW. All restoration works will be carried out in accordance with the permit requirements.

Doral have successfully rehabilitated and restored (temporarily diverted) creeks at the Dardanup Mine, as per the conditions of a DoW permit to interfere with bed and banks. Site specific plans for the re-establishment of each creek will be implemented once mining has been completed, and include the re-establishment of creeks to pre-mining contours with pre-mining soil profile to a depth 1.5m. Typically, vegetation belts are re-established and fenced within waterway corridors during rehabilitation.

Potential Impacts and Management Strategies for Maintaining Surface Water Supply and Quality to Wetlands, Watercourses and Vegetation or Flora of Conservation Significance

Surface water flows in the Burekup area has been significantly modified by a network of agricultural drains. Proposed mining activities will maintain existing surface water flows (i.e. supply) to the sensitive receptors in the vicinity of the western extension area. These include Henty Brook, the ephemeral creeks and wetlands.

Henty Brook (the nearest water course) is located 1000m upstream of the western extension area and is therefore unlikely to be impacted in regards to surface water supply and quality. The supply of water to ephemeral creeks is discussed under the previous heading.

Wetlands include the CCW and the REW. A buffer of 200m will be established between the CCW and boundary of the disturbance area. The REW is located 350m from the boundary of the disturbance area.

Natural ecosystem processes will be maintained for these wetlands in terms of drying and wetting cycles. Monitoring to ensure that the surface water supply to wetlands is not impacted on is discussed in Section 3.6.3. Contingency actions, should monitoring detect adverse impacts, will include artificial irrigation of suitable quality water to ensure sufficient water supply for maintaining ecosystem functions.

Surface water supply will also be maintained for specific vegetation and flora of conservation significance located within the boundaries of the disturbance area. This includes the Low Woodland of *C.obesa,* located on multiple use palusplain and the (potential) population of *A.hexatpalus* (Priorty 4) (Refer to Section 3.7). The Low Woodland of *C.obesa,* has been excised from the disturbance area, apart from where the conveyor route corridor traverses the southern portion. The (potential) population of *A.hexatpalus* has also been quarantined and fenced off until a field survey is undertaken in Spring 2009 to determine if it is present or absent in the western extension area. Artificial irrigation for these areas will also be undertaken if necessary, as discussed under wetlands above.

Surface water quality monitoring will be conducted at the wetlands and Henty Brook. The proposed location of surface water monitoring sites is shown in Figure 3.5-2. The Surface Water Management Plan for the Dardanup Mineral Sands Project will be updated to include all aspects of surface water monitoring for the western extension area.

Potential Impacts and Management Strategies for the Emergency Discharge Point

An emergency discharge point will be designated for the western extension. This will be used in the event of heavy rainfall and excess groundwater flooding of the mine pits. Excess groundwater will be pumped from the mine pits into a catchment sump, before moving through a pipe into either the Harvey Water Irrigation Channel or the Dowdells Line Drain. This discharge has the potential to impact on the surface water quality of the receiving waterway. The use of these drains has been approved in principal in discussion with DoW and Harvey Water as part of the consultation process for this EPS.

Before excess groundwater is discharged off site it will meet strict water quality criteria. The above control measures, including monitoring prior to discharge, are currently undertaken at the Dardanup Mine as per the DEC Licence for Operation. The Emergency Surface Water Discharge Procedure for the Dardanup Mine will be updated to incorporate the locations of discharge points for the western extension.

3.6 Wetlands

3.6.1 Existing Environment

There are numerous shallow drainage lines which cross the Swan Coastal Plain, draining to wetlands and the sea (Welker, 2001 as cited in WRM, 2006).

There are also a great number and diversity of extensive wetland areas in this region, some of which are hydraulically connected to the superficial groundwater aquifer (Welker, 2001 as cited in WRM, 2006). The full title of this WRM (2006) report is cited in Section 3.5.1 and a copy is contained in Appendix – Water and Wetlands.

Based on wetland evaluations using the *EPA Bulletin 686* (1993) wetlands were assigned appropriate management categories following *Water and Rivers Commission Guidelines*. The management categories are:

- Conservation Category Wetland (CCW) – Wetlands support a high level of ecological attributes and functions;
- Resource Enhancement Wetland (REW) – Wetlands which may have been partially modified but still support substantial ecological attributes and functions; and
- Multiple Use – Wetlands with few important ecological attributes and functions remaining.

Hill *et al.* (1996) mapped wetlands of the coastal plain between Bunbury and Dunsborough, Burekup wetlands were included in this survey (wetlands of map sheet 2031 Burekup NW), however those in the current study were not assessed. The majority of wetlands within the Burekup area are highly modified from their natural state. In general they are *Melaleuca* wetlands over pasture, with Native macrophyte and emergent vegetation comprised sedges, such as the Common Spike-rush (*Eleocharis acuta),* Duckweed (*Lemna disperma)*, Pondweed (*Potamogeton* sp), and filamentous algae (WRM, 2006).

The Burekup (Iluka) study area, including the western extension proposal area, has in most part been classified as a multiple use palusplain wetland UFI13244 by Hill *et al*. (1996). The multiple use wetland covers a considerable portion of the study area and has been significantly modified by rural activity and land clearing. The area is characterised by a network of agricultural drains and predominant land use is pasture production and cattle grazing. Isolated pockets of vegetation remain in some paddocks and in road reserves. A Low Woodland of C*asuarina obesa* is located south of the Dowdells Line and St Helena Road intersection, this woodland is the most southern stand of *C. obesa* on the eastern side of the Swan Coastal Plain. For more information see Section 3.7 Flora and Vegetation.

Two additional wetlands have been added to the Geomorphic Wetlands Swan Coastal Plain Database:

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

Figure 3.6-1 shows the location of these wetlands in relation to the western extension area.

The CCW is located 200m to the east of the proposed western extension disturbance area (Figure 3.6-1). This wetland is classed as a seasonal sumpland that is reliant on direct fill by rainfall and surface water runoff. Groundwater underlying this wetland occurs at a depth of >15m below the soil surface (SWC, 2007c). The CCW comprises a healthy overstorey of dense *Melaleuca rhaphiophylla* and open *Eucalyptus rudis* (Plate 3.6.1). However the CCW is located in a cow paddock and the natural understorey of the CCW is completely degraded and consists of pasture grass only (Plate 3.6.2). A number of agricultural drains located around the CCW have possibly altered seasonal surface water flows.

Plate 3.6.1: Conservation Category Wetland (Dense Melaleuca overstorey within cow paddock)

Plate 3.6.2: Cattle grazing in Conservation Category Wetland

The REW is located 350m to the north west of the proposed western extension disturbance area and 500m from the proposed pit area (Figure 3.6-1). Groundwater underlying this wetland occurs at a depth of >10m below the soil surface. Waterlogged surface soils that are observed in this area occur in response to accumulation of surficial water (SWC, 2007c). This wetland comprised a *Melaleuca* overstorey over pasture grass with some *Eleocharis acuta* sedge (<5%) (Plate 3.6.3). The wetland has been significantly modified from its natural state by the same rural activities that have impacted the CCW.

Plate 3.6.3: Resource Enhancement Wetland (Melaleuca overstorey within cow paddock)

Plate 3.6.4: Resource Enhancement Wetland

Evaluation of Wetland Classification

WRM assessed the wetlands using the *EPA Bulletin 686* (1993). All wetlands were classified as 'multiple use' using *EPA Bulletin 686* (1993). Re-evaluation reduced the conservation value of a number of wetlands given the degree of rural activity, extent of clearing, degradation through cattle access and lack of understorey. Evaluation as 'multiple use' was primarily based on, the wetlands:

- Wetland's geology (wetlands in this area are on Bassendean sands and not Quindalup Dunes or on any geological unit confined to a river/estuary floodplain);
- Small size;
- Lack of understorey vegetation;
- Presence of drains in some wetlands (i.e. site numbers 1, 3, 4 and 5 no obvious signs of drains in or out of other wetland sites);
- Lack of open water for aesthetics or social activities; and
- Agricultural land use practice (cattle allowed to graze through all sites).

However, the regional ecological value of the remnant overstorey vegetation within the CCW was still considered to be high, given the extensive (historic) clearing of native vegetation for agriculture.

Baseline Wetland Biology and Water Quality Assessment (WRM, 2006)

This section has been summarised from the WRM, 2006 report which is attached in Appendix – Water and Wetlands.

A baseline survey of aquatic ecosystems within the Burekup area was conducted by WRM in spring 2005. The aim of the surveys was to identify riverine systems potentially at risk, determine the aquatic fauna present at each site (aquatic invertebrates, fish, frogs and waterbirds), determine conservation significance of the fauna and establish baseline conditions against which future changes may be assessed. Six survey areas were selected and included the CCW (UFI 2362) site 1 and the REW (UFI 2165) site 4. The remaining survey sites (2, 9, 3, and 5) were located in the multiple use palusplain wetland (UFI 13244) (Figure 3.5-2).

The current extent of seasonal inundation is likely to be highly altered from the natural condition as evidenced by extensive agricultural drain networks. The sites in the multiple use palusplain wetland were assessed as individual units of larger likely interconnected wetlands with poorly defined boundaries in accord with Part IIB of the EPA Bulletin 686 Questionnaire. The individual sites were described as well defined on the basis of remnant vegetation associations and not hydraulic connectivity.

<u>Wetland Biology</u>

The survey identified resident fauna to the lowest possible taxonomic level, compared biodiversity and invertebrate assemblages amongst sites and related differences in fauna to differences in water quality. Aquatic fauna communities at all sites were dominated by cosmopolitan species, typical of lowland rural regions.

The invertebrate assemblages of the study area are considered tolerant of a wide range of environmental conditions and are common, ubiquitous and frequently encountered in fresh water systems within Western Australia. Of note, however, was the collection of a number of microcrustaceans, the Rotifers (*Dicranophoroides caudatus)* and *Filinia cf. passa* from site B3 which were the first records of these species in Western Australia and the indeterminate Difflugiidae Rhizopod, which is likely a new species to science. Two species collected from Burekup represent extensions to their known ranges; the Hydrophild beetles (*Enochrus sama)* and *Berosus gibbae*. Two introduced species were recorded during the current study, the gastropod *Lymnaea stagnalis*, and the Simulid (black-fly larva) *Simulium ornatipes*.

Three species of frog were identified from the study area, including *Crinia insignifera, Crinia glaureti* and *Litoria adelaidensis*. All species are endemic and common in the south-west of Western Australia.

A total of eight bird species were observed using water bodies within the study area, including Pacific Black Duck (*Anas superciliosa)*, Australian Wood Duck (*Chenonetta jubata)*, Chestnut-breasted Shelduck (*Tadorna tadornoides)*, Straw-necked Ibis (*Threskiornis spinicollis)*, White Faced Heron (*Ardea novaehollandiae)*, Cattle Egret (*Ardeola ibis)*, Yellow-billed Spoonbill (*Platalea flavipes)*, and sacred Kingfisher (*Halcyon sancta)*. Loss of fringing vegetation has likely reduced suitable nesting sites across the floodplain and nearby wetlands. All species reported are common. None are listed under international (JAMBA/CAMBA) treaties.

<u>Water Quality</u>

Values for most of the physico-chemical variables measured were within the ranges expected for slightly to moderately disturbed' ecosystems (ANZECC & ARMCANZ, 2000).

The exceptions included dissolved oxygen at site B3, pH (all sites), nitrogen (B3 and B9), phosphorus (B3 and B9), zinc (B8), aluminium (B3 and B9), cadmium (B3 and B9), and copper (B3). The high levels of heavy metals were considered due to local geology and land use practices. Many fertilisers contain heavy metals.

Burekup Deposit Modelling of Groundwater (Parsons Brinckerhoff, 2007)

PB (2007) developed a three dimensional groundwater flow model and forecast the changes in hydraulic head resulting from mine operations in the Burekup Deposit. One of the key objectives of the study was to identify potential changes in hydraulic head beneath vegetated and wetland areas during the life of the mine (see Appendix – Water and Wetlands).

Groundwater modelling indicated that Henty Brook is unlikely to be impacted by mining activities. The model predicted that the piezometric head will be lowered by up to 0.8m in the vicinity of the CCW and up to 0.4m in the vicinity of the REW.

Groundwater Dependant Ecosystem Assessment for the Proposed Burekup Minesite (Soil Water Consultants, 2007c)

As a result of the predicted drawdown in the vicinity of the CCW and REW, additional studies on groundwater dependent ecosystems (GDE) effects were undertaken by SWC (2007c). The impact that groundwater drawdown has on ecosystems is related to the level of dependence that the ecosystem has on groundwater, the level of drawdown, the rate of drawdown and the duration of drawdown.

This assessment includes information on soil properties at the site and the water use requirements of the vegetation to determine groundwater dependence of each ecosystem present (SWC, 2007c).

The majority of vegetation in the vicinity of the western extension is not dependent on groundwater (non-phreatophytic). 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 the central and eastern portions of the proposed mine site (SWC, 2007c) as shown in Figure 3.7-4.

The CCW (site 1) and REW (site 4) are perched wetlands as a result of heavy clay soils and thus are not considered to be GDE. Ground water drawdown is not expected to impact vegetation in these wetlands.

The Low Woodland of *C.obesa* located to the south of Dowdells Line and St Helena Road intersection (site 2) has a low to moderate dependence on groundwater (SWC, 2007c). See Flora and Vegetation Section 3.7 for more information.

Over 95% of the wetlands on the Swan Coastal Plain are ephemeral and support biota adapted to seasonal cycles of drying and filling. As such, drying over summer and autumn does not adversely impact the aquatic fauna of these wetlands, and may actually promote greater invertebrate richness, whilst also mitigating the effects of moderate nutrient enrichment. To maintain the biodiversity of seasonal wetlands, the hydrology of dry and wet phases need to be managed such that patterns/timing of wetting and drying cycles are not altered significantly (WRM, 2006).

3.6.2 Objectives

EPA Objective

To maintain the integrity, ecological functions and environmental values of wetlands.

Relevant Standards and Legislation

- *DOW, DoIR and DEC Water Quality Protection Guidelines 1-11*;
- *Environmental Protection Act 1986*;
- *Environmental Protection (Swan Coastal Plan Lakes) Policy (1992)*;
- *Preliminary Position Statement No. 4 Environmental Protection of Wetlands (EPA, 2004b)*; and
- *EPA Draft Guidance No 26: Management of Surface Run-off from Industrial and Commercial Sites (1999).*

3.6.3 Potential Impacts and Management Strategies

The management strategy applies the control hierarchy of:

- Avoid – modify the plan to prevent the impact occurring;
- Mitigate – actions to be undertaken in the event of adverse trends in order to minimise or prevent the extent of the impact; and
- Repair/restore – post impact respond to ensure the recovery and restoration of pre–impact conditions.

This is supported by a monitoring regime that seeks to anticipate (and thereby allow the prevention of) adverse impacts occurring and collect the information necessary to understand the recovery of the relevant environmental values.

Potential Impacts

The potential impacts on wetlands are:

- Groundwater drawdown may have potential to impact on wetlands;
- Draw-down of surface water at Henty Brook and wetlands; and
- Degradation of surface water quality at Henty Brook and wetlands.

Management Strategies

<u>Prevention (Avoid)</u>

The objective of the mining proposal is to avoid any likelihood of adverse impacts on the CCW and REW from mining activities. The specific measures designed to achieve this objective are:

- A minimum 200m setback has between incorporated into the design between the edge of the CCW and the mine disturbance areas;
- The period for which the pits are dewatered will be kept to a minimum, thereby shortening the period for potential drawdown;
- The pit area close to the CCW and REW will be backfilled as soon as possible to enable re-instatement of the aquifer and thereby through flow across the mine void; and
- Dewatering within the impact risk zone (refer to Figure 3.7-4) will be timed to occur in winter as far as practical thereby reducing likelihood of wetland vegetation stress.

<u>Mitigation</u>

The overarching management objective for wetlands is to prevent permanent adverse impacts to the current function or values of the CCW and REW ecosystems.

A monitoring program for the CCW and REW will be put in place to monitor any changes in hydrology and tree health that might be a response to the mining operations. The following parameters will be measured – canopy health and cover, soil moisture, groundwater level and quality, surface water flow quality. Trigger values for surface water levels will be established in consultation with DEC.

In the event that monitoring demonstrates adverse trends the following actions (individually or in combination) will be implemented:

- There is some flexibility within the mining sequence to enable mining to move to alternative pits should adverse drawdown be noted within the vicinity of one particular pit;
- Pumping water to non active mine voids to supplement aquifer recovery;
- Short term cessation of activities likely to be causing the drawdown until such time as conditions allow for recommencement (e.g. soil moisture recharge due to rainfall, or alternatively via irrigation); and
- Artificial irrigation of the affected areas with suitable water.

Repair/Restore

In the event of an adverse impact to the wetland areas, subject to the views of the DEC the following strategies will be employed:

- Appropriate remedial works including infill seeding and or planting will be undertaken; and
- Recovery of the vegetation will be monitored against the baseline.

Net Environmental Benefit

Doral has committed to improving the current condition of the CCW, REW and the Low Woodland of *C. obesa*. These areas are currently used for cattle grazing and the understorey has been completely replaced with pasture grass. Doral will be undertaking the following activities to improve wetland attributes, function and value.

The CCW will be rehabilitated through techniques such as fencing and establishing an understorey around the perimeter of the wetland. The understorey can only be established around the perimeter of the overstorey species as light is limited under the canopy of *M. rhaphiophylla* and *E. rudis.* Rehabilitation design, species selection and post rehabilitation monitoring program will be planned in consultation with the DEC. Doral will maintain the fence and undertake monitoring for a three year period post mine closure.

Doral has received in-principle support from the land owner and DEC (in preliminary discussions) for the CCW and a portion of the buffer area to be placed in a conservation covenant to give long-term protection for the wetlands environmental values. The CCW components of this programme are part of the formal environmental offset package contained in Section 8.

The REW and the Low Woodland of *C. obesa* will be fenced off to prevent cattle access to allow regeneration of understorey species. Doral will maintain the fence and monitor vegetation recovery for a three year period post mine closure.

3.7 Flora and Vegetation

3.7.1 Existing Environment

Previous Regional Surveys and Regional Context

In a regional context, the western extension area lies within the Drummond Botanical Subdistrict of the Southwest Botanical province as recognised by Diels (1906) and later refined by Gardner (1942) and Beard (1979, 1980).

Beard (1990) described the Drummond Botanical Subdistrict as being a low-lying coastal plain with sandy soils and swampy deposits, and having a warm dry Mediterranean climate with 5-6 dry months per year. Vegetation of the Drummond Botanical Subdistrict is typically Banksia low woodland on leached sands, *Melaleuca* wetlands in areas of poorer drainage, and *Eucalyptus gomphocephala / E. marginate/ Corymbia calophylla* woodlands on soils with a higher nutrient content (Beard 1990).

The western extension area occurs within the Guildford vegetation complex as defined by Heddle *et al*. (1980). The Guildford complex is defined as “A mixture of open forest to tall open forest of *Corymbia calophylla – Eucalyptus wandoo – Eucalyptus marginata* and woodland of *Eucalyptus wandoo*. Minor components include *Eucalyptus rudis – Melaleuca rhaphiophylla*.” The Swan Coastal Plain Bioregion is characterised by *Banksia* spp. and *Eucalyptus gomphocephala* (Tuart) woodlands on sandy soils, *Casuarina obesa* woodlands on outwash plains (with *Corymbia calophylla* to the south), and *Melaleuca* spp. woodlands on swampy areas (DEC 2006a, cited in Mattiske Consulting Pty Ltd, 2006). This vegetation complex has been largely cleared for agricultural activities.

The Guildford Vegetation Complex has been largely cleared for agricultural activities and is under represented in the conservation estate (Government of Western Australia, 2000). The Guildford Complex, of which only 4.4% of the original extent remains on the southern Swan Coastal Plain within the Greater Bunbury Region. Of the 4.4% there is only 0.4% in existing and proposed Regional Open Space (EPA, 2003). The remnant vegetation is considered regionally significant under the Rarity criterion set out in *EPA Guidance No.10* (EPA, 2006a).

The vegetation complexes on the adjacent Darling Scarp and Plateau were revised and mapped by Mattiske and Havel (1998) for the purposes of the Regional Forest Agreement.

More recently, a Floristic Survey of the Whicher Scarp was undertaken by the Department of Environment Protection and Department of Conservation and Land Management (now DEC) in conjunction with the Wildflower Society (DEC, 2008). The survey provided a more detailed knowledge of the conservation status of species and communities that occur in this area. For the study the Whicher Scarp was divided into three sectors, west, central and north. The natural values of the remaining intact areas of the Whicher scarp include 46% remains naturally vegetated, ecological links between the Swan Coastal Plain and the Darling Scarp have been maintained, contains six unique vegetation complexes, diverse suite of woodland floristics, restricted and rare wetland communities, Whicher Scarp Wetlands, Whicher Scarp/Swan Coastal Plain Interface Wetlands.

The proposed western extension area is located approximately 2km to the west of the North Whicher Scarp survey area (DAFWA, 2007). The proposed disturbance area is not expected to have any impact on the natural values of the remaining intact areas of Whicher Scarp.

Flora and Vegetation Assessment of the Burekup Area

Iluka commissioned Mattiske Consulting Pty Ltd to conduct a vegetation survey on leases M70/720 and M70/652 for the former proposal to mine the Burekup Mineral Sands Deposit. The study area has been extensively cleared for agricultural purposes and contains isolated trees and several areas of native vegetation.

Mattiske Consulting Pty Ltd undertook a two season study of vegetation and flora within the area proposed for disturbance (leases M70/720 and M70/652) and its surrounds (Mattiske, 2006 and 2007). Copies of these reports are contained in Appendix – Flora and Vegetation. *EPA Guidance Statement 51: Terrestrial Flora and Vegetation Surveys* (EPA, 2004c) were incorporated into these surveys.

The survey was conducted initially in early December 2005 and again in September 2007. The objectives of the survey were:

- Identify all vascular plant species present;
- Review the conservation status of the vascular plant species with reference to current literature and listings by the Department of Environment and Conservation (2007a, 2007b) and the *Environment Protection and Biodiversity Conservation Act* (EPBC Act) *1999* (Department of the Environment and Water Resources, 2007a);
- Compare the plant communities at each site with those defined by Gibson et al. (1994) to aid in assessment of local and regional significance; and
- Review the impacts of the proposed clearing on the vegetation, flora, fauna species and Threatened Ecological Communities in local and regional contexts.

The methodology for the survey included:

- A search for Declared Rare Flora (DRF) and Priority Flora species and Threatened Ecological Communities (TECs) known to occur in the region using the databases compiled by the DEC (2006a, 2006b) and the Department of Environment and Water Resources (2007a, 2007b and 2007c).
- Describe and collect systematically the flora and vegetation at 32 survey sites. At each site additional environmental data were recorded with respect to topography, percentage litter cover, soil ratio, percentage of bare ground, outcropping rocks and their type, pebble type and size, time since fire. The average height and percent foliage cover of living and dead vascular plant species were recorded along with species and life form.
- Vegetation communities were mapped and the condition of each community was rated according to the scale used for assessing *Bush Forever Sites* (Government of Western Australia, 2000) as summarised in Table 3-2. In September 2007 survey vegetation communities were refined in spatial scale to exclude areas of cleared paddocks.
- In September 2007 survey nine quadrats (10m x 10m) were established in the main communities. In many cases the quadrats were altered to 50m x 2m length to accommodate the native vegetation in road verges as this was often the only intact vegetation.

Table 3-2
Vegetation Condition Rating Scale (Government of Western Australia, 2000)

Rating	Description	Explanation
1	Pristine	Pristine or nearly so, no obvious signs of disturbance.
2	Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
3	Very Good	Vegetation structure altered obvious signs of disturbance. Disturbance to vegetation structure covers repeated fire, aggressive weeds, dieback, logging, grazing.
4	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure covers frequent fires, aggressive weeds at high density, partial clearing, dieback and grazing.
5	Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure includes frequent fires, presence of very aggressive weeds, partial clearing, dieback and grazing.
6	Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas often described as "parkland cleared" with the flora comprising weed or crop species with isolated native trees or shrubs.

In relation to vegetation and flora, Coffey Environments have reviewed the Draft Iluka EPS, including survey reports to support the EPS. Advice provided by the GDMA on their review of the Draft EPS identified gaps in survey information (see Section 1.7). This information was used to scope the supplementary flora and vegetation work required.

Coffey Environments conducted a site visit on 12 September 2008. The objectives of this visit were to:

- Conduct a field meeting with Doral and Bunbury DEC to: communicate the change in project proponent and the alternative proposal to mine the deposit (from Iluka's); discuss the GDMA advice provided in response to the Draft Iluka EPS; identify proposed management strategies for the Doral proposal; and determine if there were any other environmental issues;

- Visit areas of environmental significance that may be impacted by the proposal. These areas included the CCW, *E. wandoo* woodlands in north west of study area and the Low Woodland of *C. obesa* at the intersection of Dowdells Line and St Helena Road; and
- Conduct a broad appraisal of vegetation communities and their general condition.

Plant Communities and Species Identified

In the flora and vegetation surveys conducted by Mattiske Consulting Pty Ltd (2006, 2007), a total of 199 taxa (including subspecies and varieties) from 139 genera and 53 families were recorded within the Burekup study area (see Appendix – Flora and Vegetation; Mattiske, 2007 for full list of species). Representation was greatest among the Poaceae (28 taxa), followed by Papilionaceae (18 taxa), Myrtaceae (16 taxa), Cyperaceae (15 taxa) and Mimosaceae (11 taxa). Weed species consisted of 24 Poaceae, 7 Papilionaceae and 3 Cyperaceae. The families with the highest native representation were Myrtaceae (16 species), Cyperaceae (12 species) and Mimosaceae (10 species).

A total of nine vegetation communities were recorded in the western extension area, seven of which occur inside the proposed western extension disturbance area. The key characteristics of each community are provided in Table 3-3. The distribution of the communities can be seen in Figure 3.7-2.

The study area was found to be in a disturbed or completely degraded state largely as a result of agricultural practices and grazing. The majority of the communities were disturbed and ranged from Completely Degraded to Good.

The condition rating recorded for each community is shown in Table 3-3.

Table 3-3
Vegetation Communities Recorded in the Study Area (Mattiske, 2007)

Community Code	Description	Condition Rating
A1*	Woodland of *Agonis flexuosa* – *Corymbia calophylla* – *Eucalyptus rudis* over weeds on loam soils along flowlines.	5
C1	Woodland of *Corymbia calophylla* – *Eucalyptus wandoo* over *Xanthhorrhoea preissii, Hypocalymma angustifolium* and weeds on sandy-loam soils.	3, 4, 5
C2*	Woodland to forest of *Corymbia calophylla* – *Eucalyptus rudis* – *Melaleuca rhaphiophylla* – *Melaleuca preissiana* over weeds on loam soils.	3, 4, 5
C3*	Low woodland of *Casuarina obesa* over *Melaleuca viminea* subsp. *viminea* and *Hakea varia* over *Chorizandra enodis* on sandy loam soils.	4, 5
C4*	Forest of *Corymbia calophylla* over *Banksia grandis*, *Xanthorrhoea preissii* and *Kingia australis* over *Cyathochaeta avenacea* on sandy loam soils.	4
C5	Woodland to forest of *Corymbia calophylla* – *Corymbia haemotoxylon* over *Xanthorrhoea preissii* over *Cyathochaeta avenacea* on sandy loam soils.	5
E1*	Woodland of *Eucalyptus wandoo* over *Melaleuca rhaphiophylla* over pasture on loam soils.	5
M1*	Low woodland to forest of *Melaleuca rhaphiophylla* with emergent *Corymbia calophylla* and *Eucalyptus rudis* over pasture on loam soils.	5
M2*	Woodland of *Melaleuca preissiana*, with *Eucalyptus rudis* and *Corymbia calophylla* over *Melaleuca lateritia*, *Viminaria juncea*, *Acacia saligna* and *Hakea varia* over *Lepidosperma longitudinale* on clay-loam soils.	3, 4, 5

Nb. * denotes vegetation communities within proposed western extension disturbance area.

Coffey Environments and DEC staff noted during their site visit on 12 September 2008 that:

- Community M2 had been mapped incorrectly in three areas namely: the CCW; due west of the CCW adjacent to Dowdells Line; and at the intersection of Dowdells Line and Mt Helena Road. Mattiske (2006) had identified *M. preissiana* as the dominant species. Coffey Environments identified the Melaleuca species present in the three locations as *M. rhaphiophylla*. Please note that the original community mapping of Mattiske (2006 and 2007) has been changed from M2 to M1 (Figure 3.7-2). This small alteration does not have any implications in respect to the proposed western extension area, however it must be noted that the understorey consisted of pasture over loam.

- Community C3 (Low woodland of *Casuarina obesa* over *Melaleuca viminea* subsp. *viminea* and *Hakea varia* over *Chorizandra enodis* on sandy loam soils) located at the intersection of Dowdells Line and Mt Helena Road mapped as Very Good was devoid of any understorey other than pasture grass. The pockets of Community C3 along the road verge in this area had an intact understorey but displayed signs of significant stress.
- The CCW (M1) understorey was completely degraded by grazing cattle and consisted of pasture grass only. The overstorey of *Melaleuca rhaphiophylla* with emergent *Corymbia calophylla* and *Eucalyptus rudis* was in general in good condition.

Flora of Conservation Significance

<u>Environment Protection and Biodiversity Conservation Act, 1999</u>

Threats of extinction of species are recognised at a Federal Government level and are categorised according to the *Environment Protection and Biodiversity Conservation Act (EPBC Act)*, 1999 (Department of the Environment and Water Resources, 2007a).

No plant taxa pursuant to section 179 of the *EPBC Act* were located in the study area.

<u>Wildlife Conservation Act, 1950</u>

Flora species of conservation significance are protected at the State level by the *Wildlife Conservation (Rare Flora) Notice 2003* of the *Wildlife Conservation Act, 1950*. The notice lists protected flora taxa that are extant and considered likely to become extinct or rare.

Generally speaking, species of flora that are considered as being of Declared Rare Flora (DRF) or priority conservation status where their populations are restricted geographically or threatened by local processes.

The DEC recognises these threats of extinction and consequently applies regulations towards population and species protection. Priority species are assigned to one of four Priority categories and maintained on a “Reserve List” which is reviewed on an annual basis. These categories are:

- Priority 1 – Poorly known taxa from one or a few populations (generally less than five) which are under threat, either due to small population size, or being on lands under immediate threat.
- Priority 2 – Poorly known taxa which are known from one or a few populations (generally less than five) at least some of which are not believed to be under immediate threat (i.e. not currently endangered).
- Priority 3 – Poorly known taxa which are known from several populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of populations, or known populations being large, and either widespread or protected.
- Priority 4 – Taxa that have been adequately surveyed and whilst rare, are not threatened by identifiable factors.

No DRF species, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act 1950* (WC Act) and as listed by the DEC (2006a and 2006b) were located during the surveys. Several Priority Flora species have previously been recorded in and near the disturbance area (Figure 3.7-1), however no Priority Flora species were recorded in the study area during the Mattiske survey.

A range of Priority species are known from the area near Burekup, the majority of which occur near Railway Road beyond any direct or indirect impacts of the proposed mining operations (Figure 3.7-1). A discussion of the two Priority flora species that have been listed within the proposed Western Extension disturbance area is provided below:

- *Grevillea rosieri* (Priority 2 Species) *Grevillea rosieri* has been recorded in the eastern part of the project area (near Offer Road). This taxon is known currently from eight records at the State Herbarium. The occurrence of the *Grevillea rosieri* appears unusual in that it is known from Kalannie and Mollerin in the Wheatbelt and Florabase (Department of Environment and Conservation 2007a) suggests that one of the recordings may be a planting out of its range.

- *Aponogeton hexatepalus* (Priority 4 Species) *Aponogeton hexatepalus* (Stalked Water Ribbons) has been recorded in two locations previously within the proposal area (near Mt Helena Road). This taxon required local ponding and seasonally wet conditions. This taxon is known currently from 25 records at the State Herbarium and is known to occur from Perth southwards on the Swan Coastal Plain.

Coffey Environments requested a species specific search of the DEC's Threatened Flora Database for *A. hexatepalus.* The results of the database search show that there are 71 known records of the species, 13 of which are in the general locality of the Burekup area. Of the 13 records (4,500 plants) 8 are located to the north west of the extension area in the railway reserve adjacent to South West Highway, 1 record (70 plants) occurs within the western extension area and 1 record (300 plants) to the west of the extension area.

The record in the western extension area is located on the northside of St Helena Road, 150m west of the Dowdells line intersection in the roadside verge. The population was first recorded in August 1985 (20 plants), resurveyed in 1990 (50 plants) and again in 1993 (70 plants).

The Mattiske vegetation surveys did not record *A. hexatepalus* within the survey area (Mattiske 2006, 2007). As this species is highly dependent on seasonally wet conditions and ponding it is highly unlikely that presence of *A. hexatepalus* would have been recorded.

<u>Threatened Ecological Communities</u>

Communities are described as TEC if they have been defined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee and found to be Presumed Totally Destroyed (PD), Critically Endangered (CR), Endangered (EN) or Vulnerable (VU). Selected plant communities have also been listed as "Threatened Ecological Communities" under the *EPBC Act*. Three categories exist for describing the vulnerability or status of threat to Threatened Ecological Communities (DEWHA) Critically Endangered (CD), Endangered (E), and Vunerable (V).

Several TECs occur in the general Capel and Bunbury region (Table 3-4). Communities 10b and 3a are listed as endangered under the *EPBC Act 1999* (Department of the Environment and Water Resources 2007b). TECs 3c and 8 are located to the north west of the western extension area near Railway Road beyond any direct or indirect impacts of the proposed mining operations (Figure 3.7-1).

There were no TECs recorded in the study area (Mattiske, 2006 and 2007). However a localised patch of *Corymbia calophylla* community (C4) that has similar dominant species to TEC Community type SCP 3a occurs in the study area which is listed as Critically Endangered by the State and Endangered under the *EPBC Act* (Mattiske Consulting Pty Ltd 2006). The overall similarity is very low due to the highly degraded condition of the vegetation in the road reserve (Mattiske, 2007).

TEC SCP 3a is described as *Corymbia calophylla – Kingia australis* woodlands on heavy soils. The C4 community is restricted to 0.6ha (rated Good) in Simpson Road verge and is adjacent to the proposed western extension disturbance (Figure 3.7-3).

Table 3-4
Potential Threatened Ecological Communities Found in the General Bunbury and Capel Area

Gibson *et al.* (1994) plant community	General Description	Status(DEC)	Status(EPBC Act 1999 Category)
10b	Shrublands of southern Swan Coastal Plain Ironstones (Busselton area)	Endangered	Endangered
2	Southern wet shrublands, Swan Coastal Plain	Endangered	not listed
3a	*Corymbia calophylla – Kingia australis* woodlands on heavy soils, Swan Coastal Plain	Critically Endangered	Endangered
1b	*Corymbia calophylla* woodlands on heavy soils of the southern Swan Coastal Plain	Vulnerable	Not listed
7	Herb Rich shrublands in clay pans	Vulnerable	Not listed
3c	*Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands	Critically Endangered	Endangered
8	Herb rich saline shrublands in clay pans	Vunerable	Not listed

Other Flora of Interest

The Low Woodland of *C.obesa* (mapped as C3 on Figure 3.7-2) is thought to be the southern most stand on the eastern side of the Swan Coastal Plain, and therefore is considered a significant occurrence.

The stand of *Eucalyptus wandoo* within the (Iluka) study area is one of the most extensive known stands of mixed age on the southern portion of the Pinjarra Plain. The majority of the Wandoo is located outside of the western extension disturbance area.

Mountain Marri (*Corymbia haemotoxylon)* (mapped as C5 on Figure 3.7-2) located in the Waterloo roadside verge is a disjunct and significant population. *Corymbia haemotoxylon* is considered to be a distinguishing feature of the Whicher Scarp vegetation and is normally associated with the middle and upper slopes of the central and southern sectors of the Scarp (DEC, 2008). The western extension disturbance area is located approximately 1km to the east of Waterloo Road and is not expected to have a direct impact on the *Corymbia haemotoxylon.*

Mattiske (2006 and 2007) identified a CCW to the east of the disturbance area and a REW wetland north of the disturbance area (Figure 3.6-1). Both wetlands are located in paddocks (no perimeter fencing) and are heavily grazed by cattle resulting in an understorey of pasture grass only. These wetlands are discussed in more detail in Section 3.6.

Introduced and Declared Weed Species

A total of 86 of the 199 taxa recorded in the flora survey were introduced or weed species (Mattiske Consulting Pty Ltd, 2006). Four of the 86 species are 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; and
- *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).

3.7.2 Objectives

EPA Objective

To maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

Doral Objectives

Objectives of the Flora and Vegetation Management Plan for the Dardanup Mineral Sands Project are to:

- Minimise clearing and land disturbance, consistent with safe and efficient operations;
- Enrich and establish native vegetation alongside existing permanent public roads and roads developed or disturbed as a result of project activities; and
- Meet the State Laws governing flora conservation as contained in the *Wildlife Conservation Act* and its regulations, which are administered by the Department of Conservation and Land Management (CALM).

Relevant Standards and Legislation

- *Environmental Protection Act 1986*;
- *Wildlife Conservation Act 1950*;
- *Environment Protection and Biodiversity Conservation Act 1999*; and
- *EPA Guidance Statement No.51 – Terrestrial Flora and vegetation surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004c).

3.7.3 Potential Impacts and Management Strategies

The program applies the control hierarchy of:

- Avoid – modify the plan to prevent the impact occurring;
- Mitigate – actions to be undertaken in the event of adverse trends in order to minimise or prevent the extent of the impact; and
- Repair/restore – post impact respond to ensure the recovery and restoration of pre–impact conditions.

This is supported by a monitoring regime that seeks to anticipate and thereby allow the prevention of adverse impacts occurring and collect the information necessary to understand the recovery of the relevant environmental values.

Potential Impacts

The potential impacts of the proposed western extension have been identified as:

- Direct loss of vegetation due to the proposed land clearing required for development of the new mining area;
- Indirect impact on vegetation of groundwater drawdown as a result of dewatering;
- Introduction and spread of weeds;

- Direct impact on vegetation of dust; and
- Direct impact on vegetation of road widening (there are no plans to widen Waterloo Road).

Vegetation Clearing

The total disturbance area of the western extension proposal is 219.38ha. The distribution of native vegetation to be cleared is shown on Figure 3.7-3, along with the condition rating of this vegetation. Native vegetation to be cleared comprises:

- 0.13ha rated as Very Good;
- 2.04ha rated as Good; and
- 25.15ha rated as Degraded (9.2ha is Completely Degraded agricultural land).

The remaining land in the disturbance area has already been cleared for pastoral grazing.

Remnant vegetation in the western extension area is considered regionally significant as it is part of the poorly reserved (4.4% of pre European is remaining) Guildford Vegetation Complex (EPA, 2003). This complex is under the reserve requirement of 10% (currently 0.4% is reserved under existing and proposed regional open space). Doral will be clearing 0.15% (2.17ha) of the Guildford Vegetation Complex that is rated Good to Very Good.

The mine footprint and main access has been planned to quarantine areas of vegetation in close proximity to the western extension area rated as Very Good and Good. The potential population of Priority 4 species *A. hexatepalus* on St Helena Road is located within the western extension area adjacent to the proposed pit area.

Further survey work confirming this population cannot be undertaken until Spring 2009 due to the seasonal nature of the species. In the interim, the area will be quarantined and fenced, and the DEC will be consulted on potential management options.

Groundwater Drawdown

The impact that groundwater drawdown has on ecosystems is related to the level of dependence that the ecosystem has on groundwater, the level of drawdown, the rate of drawdown and the duration of drawdown.

Groundwater drawdown impacts on vegetation have been assessed for the western extension area using maximum predicted groundwater drawdown contours and the GDE class. The response curves and risk assessment methodology from Froend, Bowen and Associates (2004) have been adapted to assess risk levels.

The locations of communities that have some degree of dependency on groundwater are shown in Figure 3.7-4. The impact of ground water drawdown may impact Community C1 (1.3ha), Community C2 (1.6ha), Community C3 (3.7ha), Community M1 (1.7) and Community M2 (0.9ha) (SWC, 2007c).

Introduction and Spread of Weeds

The main method of spread of weeds would be through the introduction of infected materials to uninfected areas. The nature of mining operations is such the strict hygiene controls are essential to prevent mining activities from providing a vector for spread. Similarly, land disturbance provides an additional opportunity for weed species to establish in areas.

Effective weed control during operations and rehabilitation will prevent this occurring.

Management Strategies

Prevention (Avoid)

It is essential to ensure that the likelihood and magnitude of stress to vegetation and flora from mining activities is minimal. The specific measures required to achieve this centre around:

- Where possible, Doral will avoid the need to clear and strip topsoil through reviewing material handling sequences to remove the need for creation of stockpiles (topsoil through use of direct return wherever realistic and suitable, and overburden through sequencing mining, stripping and backfill operations to minimise the need for external stockpiling);
- The mine footprint will be planned to minimise the area of clearing required and will locate clearing envelopes outside areas containing sensitive species;
- The period for which the pits are dewatered will be minimised, thereby shortening the period for potential drawdown; and
- Dewatering will be timed with winter as far as practical thereby reducing likelihood of wetland vegetation stress.

Mitigation

Doral's overall principles for managing the potential impacts of its mine operations on vegetation and flora in the western extension are to:

- Minimise clearing and land disturbance, consistent with safe and efficient operations;
- Meet the State and Commonwealth laws governing flora conservation as contained in *Wildlife Conservation Act (1950)* and regulations and the EPBC Act 1999;
- Minimise the requirement for access corridors by multiple use of easements and restrict vehicles and mining equipment to designated roads and mining areas;
- Monitor and manage dust during clearing and mining operations;
- Quarterly visual assessment of vegetation health, including weed assessment, will be undertaken for areas of vegetation remaining adjacent to the project area;
- Monitor vegetation health on a monthly basis in GDE areas at risk when dewatering activity is occurring;
- Periodic review of the site species list to determine that the priority status of any particular species has not changed; and
- Minimise the timeframe between disturbance and rehabilitation.

In the event that monitoring demonstrates adverse trends the following actions (individually or in combination) will be implemented:

- There is some flexibility within the mining sequence to enable mining to move to alternative pits should adverse drawdown be noted within the vicinity of one particular pit;
- Short term cessation of activities likely to be causing the drawdown until such time as conditions allow for recommencement (e.g. soil moisture recharge due to rainfall, or alternatively via irrigation); and
- Artificial irrigation of the affected areas and/or modification of mining activities.

Repair and Restore

All areas disturbed will be rehabilitated based on a comprehensive understanding of the landform; soil/vegetation/hydrological relationships and how these are recreated post mining.

Control measures in the Rehabilitation and Decommissioning Plan for the Dardanup Mineral Sands Project have been successfully implemented at the Dardanup Mine to mitigate potential environmental impacts (see Section 2.7). The same control measures will be implemented in the western extension area. Compliance with the management objectives and strategies in this Plan was demonstrated to the DEC in a Performance Compliance Report (see Section 6.1.5). The Plan will be updated to include all relevant details for the proposal for a western extension.

The Rehabilitation and Decommissioning Plan for the Dardanup Mineral Sands Project will be updated to include the following restoration measures for the western extension area:

- Fences will be constructed and maintained around the CCW, REW and in the Low Woodland of C.*obesa*.
- CCW understorey rehabilitation plan and program will be designed in consultation with the DEC where possible local provenance species will be included in the design of the understorey;
- Include native vegetation in the rehabilitation strategies; and
- Enrich roadside vegetation to ensure that native vegetation is represented in the post mining landscape; to an extent at least comparable with that which currently exists.

3.8 Fauna

3.8.1 Existing Environment

Fauna Habitat in the Project Area

Mattiske Consulting Pty Ltd surveyed the vegetation in 2006 and 2007 (Mattiske, 2006, 2007) (Appendix - Flora and Vegetation) Ninox Wildlife Consulting (2006) prepared a report titled *A Vertebrate Fauna Assessment for the Burekup Mineral Sands Project Area* (Appendix – Fauna). These reports have been used to assess the potential impact of mining the western extension area on fauna and fauna habitat.

The proposed western extension area is mostly farm land, as shown in Figure 2.2-1. Both the vegetation reports (Mattiske, 2006 and 2007) and the fauna report (Ninox, 2006) indicate that the habitat in almost the entire proposal area is either degraded or completely degraded. The vegetation that remains is small areas of degraded remnant vegetation and isolated trees, many of which are dead, and roadside vegetation. Aerial photographs of the site indicate that a small section of road side vegetation, and some areas along some creek and drainage lines, may contain vegetation suitable for supporting some fauna. The area also contains small creeks and wetlands; although almost this entire habitat has been disturbed, mostly by cattle grazing. Waterways in the study area appear to be seasonal.

Previous Fauna Investigations, 2006

The desktop assessment conducted by Ninox 2006 (Appendix – Fauna) included a search of the State and Commonwealth vertebrate fauna databases; a review of fauna survey data for the general area; and Ninox's own unpublished data. In addition, WRM (2006) (Appendix – Water and Wetlands) undertook a baseline aquatic biology and water quality study of the area.

The western extension area is located approximately 1,000m from Henty Brook and close to other wetlands (Figure 3.6-1). WRM (2006) described the riverine condition of Henty Brook as degraded due to pastoral practices and unrestricted stock access to the natural water bodies.

Aquatic vegetation was virtually absent in the brook. Most of the wetlands were *Melaleuca* wetlands over pasture. Native macrophyte and emergent vegetation comprise the sedges in these wetlands.

WRM (2006) recorded 119 macroinvertebrates in the aquatic systems which they classified as moderately diverse for seasonal waters. These macroinvertebrates were mostly considered tolerant of a wide range of environmental conditions and are common, ubiquitous and frequently encountered.

Henty Brook contained the Nightfish (*Bostockia porosa*), Western Pygmy Perch (*Edelia vittata*) and the exotic Mosquitofish (*Gambusia holbrooki*), all of which are abundant in other rivers, streams and brooks in the south-west of Western Australia. Three species of frogs were recorded: *Crinia insignifera*, *C. glauerti* and *Litoria adelaidensis*, all of which are widely distributed and abundant in the south-west of Western Australia.

Gaps in the survey work carried out by Ninox (2006) were identified by the GDMA, as discussed in Section 1.7. These items were used to scope the supplementary fauna work detailed in this EPS. Additional field survey work undertaken to address the concerns of the GDMA is described below.

Level 1 Fauna Risk Assessment (including a Field Survey), October 2008

<u>Purpose and Scope</u>

In response to the above, Doral commissioned Coffey Environments to conduct a Level 1 fauna assessment (see Appendix – Fauna) to verify the information and assumptions in the Ninox (2006) report and specifically to look for Black Cockatoo breeding hollows and feeding habitat, the presence of Southern Brown Bandicoots and Western Ringtail Possums.

Remnant vegetation on site was to be investigated to determine if there is potential for ecological or fauna habitat corridor linkages across the site or in the local region.

The findings of the field survey and proposed management strategies have been included into this report. A full report has been prepared by Coffey Environments (2008b) and submitted to the DEC - Environmental Impact Assessment Division on 24 November 2008.

The Level 1 fauna assessment of the western extension area, included:

i. A desktop study which included a literature review and a search of the relevant databases; and

ii. A reconnaissance survey to verify the desktop survey and to delineate fauna values present in the area.

As part of the reconnaissance survey, Coffey Environments undertook a search of the entire area proposed to be disturbed by the project looking for evidence of fauna listed by State or Commonwealth Government agencies as being of conservation significance. Both aspects of the Level 1 vertebrate fauna assessment have been completed.

A search of the Western Australian Museum fauna data-base (FaunaBase) and Terrestrial Ecosystems Fauna database was undertaken to develop a list of potential birds, reptiles, mammals and amphibians in the project area. The search of both of these data-bases contained fauna habitat that is not included in the project area. The inclusion of these habitats means that the created lists will include numerous species that would generally not be expected to occur in the project area. In addition, vagrants can be recorded almost anywhere and are always found in these lists. It is only possible to list the species at a site by undertaking a comprehensive survey, which is not required in a Level 1 vertebrate fauna risk assessment.

Coffey Environments also searched the DEC Threatened and Priority Species database (33.00^{o} to 33.50^{o}S, and longitude 115.60^{o} to 115.90^{o}E) and the Commonwealth Department of Environment, Heritage, Water and Arts *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* on-line database (search area 33.21^{o} to 33.38S, and longitude 115.72^{o} to 115.89^{o} E) for species of conservation significance that are likely to be found in the area.

Four general fauna survey datasets were sourced that provide a regional context. ATA Environmental (2007) and Western Wildlife (2007) surveyed habitat around Preston Beach, which is to the north-west of the Burekup site and Ecologia Environmental Consultants (2001) surveyed a development site in Australind which is west of the project area. WRM (2006) reported on aquatic fauna for the local area.

<u>Site Reconnaissance and Targeted Species Search</u>

Terrestrial Ecosystems and Coffey Environments undertook a site visit on 27 October 2008.

The reconnaissance survey was used to specifically look for evidence of or habitat suitable for the conservation significant Brush-tailed Phascogale (*Phascogale tapoatafa)*, Chuditch (*Dasyurus geoffroii)*, Western Ringtail Possum (*Pseudocheirus occidentalis)*, Quokka (*Setonix brachyurus)*, Balston's Pygmy Perch (*Nannatherina balstoni),* tree hollows providing nest sites for Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and Baudin's Cockatoo (*Calyptorhynchus latirostris*) and suitable foraging areas for Great Egret (*Ardea alba*) and Cattle Egret (*Ardea ibis).*

During the reconnaissance surveys numerous nests/dreys were recorded high up in trees along the road side verges and in one of the paddocks adjacent to the proposed project. Although previous fauna surveys and assessments of this site had not identified the presence of Western Ringtail Possums in the area, a precautionary approach was adopted and the area was searched at night using spotlights, specifically looking for Western Ringtail Possums.

<u>Significant Fauna Species Recorded or Predicted to Occur in the Project Area</u>

Conservation significant vertebrate species potentially occurring in the general area are shown in Table 3-5, with an indication of whether they could be found in the western extension area. A brief description on the potential for each of the species to be present in the western extension area is provided after Table 3-5.

Table 3-5

Conservation Significant Species Potentially Found in the Western Extension Area as Listed under the *EPBC Act (1999)*, *Wildlife Conservation Act (1950)* or on the DEC Priority Species List

Species	Common Name	EPBC List	State List	Potential Occurrence
Dasuridae				
Phascogale tapoatafa	Brush-tailed Phascogale	V	S1	Unlikely to occur
Dasyurus geoffroii	Chuditch, Western Quoll	V	S1	Unlikely to occur
Pseudocheiridae				
Pseudocheirus occidentalis	Western Ringtail Possum	V	S1	May occur in the area
Macropodidae				
Setonix brachyurus	Quokka	V	S1	Unlikely to occur
Peramelidae				
Isoodon obesulus fusciventer	Southern Brown Bandicoot		P5	May occur in the area
Vestertilionidae				
Falsistrellus mackenzei	Western False Pipistrelle		P4	May occur in the area
Kuhliidae				
Nannatherina balstoni	Balston's Pygmy Perch	V		Unlikely to occur
Falconidae				
Falco peregrinus	Peregrine Falcon		S4	May infrequently be seen flying in the area
Psittacidae				
Calyptorhynchus latirostris	Carnaby's Black Cockatoo	V	S1	Likely to occur in the general area
Calyptorhynchus baudinii	Baudin's Black Cockatoo	En	S1	Likely to occur in the general area
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo		S1	Likely to occur in the general area
Apodidae				
Apus pacificus	Fork-tailed Swift	M		May infrequently fly over the area
Meropidae				
Merops ornatus	Rainbow Bee-eater	M		Likely to occur in the area
Ardeidae				
Ardea alba	Great Egret	M		May infrequently be seen in the area
Ardea ibis	Cattle Egret	M		May infrequently be seen in the area
Botaurus poiciloptilus	Australiasian Bitten		S1	Unlikely to occur in the proposal area
Accipitridae				
Haliaeetus leucogaster	White-bellied Sea Eagle	M		May infrequently be seen flying in the area

Species	Common Name	EPBC List	State List	Potential Occurrence
Charadriidae				
Charadrius rubricollis	Hooded Plover		P4	Unlikely to occur in the proposal area
Scolopacidae				
Numenius madagascariensis	Eastern Curlew		P4	Unlikely to occur in the proposal area
Boidae				
Morelia spilota imbricata	Carpet Python		S4	Unlikely to occur in the proposal area
Fish				
Galaxiella nigrostriata	Black Strike Minnow		P4	Unlikely to occur in the proposal area
Muridae				
Hydromys chrysogaster	Water-rat		P4	May occur in the general area

V = Vulnerable under the *EPBC Act (1999)*,

En = Endangered under the *EPBC Act (1999)*,

M = Migratory under the *EPBC Act (1999)*,

S1 = Schedule 1 species under the *Wildlife Conservation Act (1950)* and

P = Priority species with DEC.

Southern Brush-tailed Phascogale (*Phascogale tapoatafa tapoatafa*) – Vulnerable under the *EPBC Act 1999* and Schedule 1 under the *Wildlife Conservation (Specially Protected Fauna) Notice 2008 (2)*

It is considered that the lack of a substantial remnant dry sclerophyll forest or open woodland that contains lots of tree hollows in the proposal area probably means that the Brush-tailed Phascogale is not present on the site.

Chuditch or Western Quoll (*Dasyurus geoffroii*) – Vulnerable under the *EPBC Act 1999* and Schedule 1 under the *Wildlife Conservation (Specially Protected Fauna) Notice 2008 (2)*

Chuditch potentially inhabited the woodlands prior to vegetation clearing, but given the level of disturbance it is unlikely to be found in the area. The lack of a remnant Jarrah forest (i.e. preferred habitat) in the proposal area would suggest that it is unlikely to be found in the western extension area.

Western Ringtail Possum (*Pseudocheirus occidentalis*) – Vulnerable under the *EPBC Act 1999* and Schedule 1 under the *Wildlife Conservation (Specially Protected Fauna) Notice 2008 (2)*

During the reconnaissance survey of the proposal area, numerous trees contained what looked like Western Ringtail Possum drey. However, it was possible that the accumulation of sticks and vegetation in some of these trees were the nests of birds (e.g. Australian Ravens). These accumulations of vegetation were mostly in the mature trees, often isolated in the paddocks or in road side verges. Scratchings on the trunk of some trees containing vegetation suggested that the bark had been removed by possums climbing the tree. Trees containing these accumulations of vegetation were located at sites as shown on Figure 3.8-1.

A search of the area containing dreys located a single Western Ringtail Possum in an area about 1km to the south-east of the proposal area in an un-made section of Offer Road reserve (MGA Zone 50 389231E 6307992N). It is therefore possible that Western Ringtail Possums are in the proposal area, however, given the number of foxes and cats, they are likely to be in low densities in open areas, and only infrequently use isolated trees in paddocks.

Southern Brown Bandicoot or Quenda (*Isoodon obesulus fusciventer*) – Priority 5 with DEC

No Quenda scratchings were observed and they were not recorded during other surveys in the area. There was evidence of foxes (active den located) and cats in the area, both of which predate on bandicoots. Given the openness of the vegetation, Coffey Environments considers that it is unlikely that Quenda are present on the site, but if they are then they are more likely to be located in the densely vegetated shrubby areas, particularly along the creek lines.

Quokka (*Setonix brachyurus*) – Vulnerable under the *EPBC Act 1999* and Schedule 1 under the *Wildlife Conservation (Specially Protected Fauna) Notice 2008 (2)*

Due to the absence of densely vegetated areas or tea-tree thickets, and the presence of foxes within the proposal area, Coffey Environments considers it unlikely that the Quokka is present on the site.

Western False Pipistrelle (*Falsistrellus mackenziei*) – Priority 4 with DEC

This bat has not been recorded in this area, and the lack of a substantial remnant dry sclerophyll forest or open woodland that contains lots of tree hollows in the proposal area, suggests to Coffey Environments that it is unlikely to be found roosting in the proposal area. It may however, be found in adjacent areas and forage over the proposal area. The species is unlikely to be significantly impacted by the proposed development as it can move to adjacent areas.

Balston's Pygmy Perch (*Nannatherina balstoni*) – Vulnerable under the *EPBC Act 1999*

The western extension area is outside of its known current distribution, and given that the creeks in the proposal area are seasonal and highly degraded, it is unlikely the Balston's Perch is present in the proposal area.

Peregrine Falcon (*Falco peregrinus*) – Schedule 4 under the *Wildlife Conservation (Specially Protected Fauna) Notice 2008 (2)*

It is considered that this species is possibly an infrequent visitor to the area, however the loss of habitat is unlikely to have an impact on this species.

Carnaby's Cockatoo (*Calyptorhynchus latirostris*) – Vulnerable under the *EPBC Act 1999* and Schedule 1 under the *Wildlife Conservation (Specially Protected Fauna) Notice 2008 (2)*

All trees containing hollows were 'scratched' and 'knocked' and no Black Cockatoos emerged. No Black Cockatoos were observed foraging in the area. As most Black Cockatoos feeding chicks would regularly forage within 2km of their nest, Coffey Environments concluded it was unlikely that any Black Cockatoos were nesting in the proposal area.

Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) – Vulnerable under the *EPBC Act 1999* and Schedule 1 under the *Wildlife Conservation (Specially Protected Fauna) Notice 2008 (2)*

Chewed Marri nuts found at the base of a few trees indicated foraging by Baudin's Black Cockatoo some time ago. There were no freshly chewed nuts. All trees containing hollows were 'scratched' and 'knocked' and no Black Cockatoos emerged, and we saw no evidence Black Cockatoos were currently foraging in the area. As most Black Cockatoos feeding chicks would regularly forage within 2km of their nest, Coffey Environments' concluded it was unlikely that any Black Cockatoos were nesting in the proposal area.

Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) – Schedule 1 under the *Wildlife Conservation (Specially Protected Fauna) Notice 2008 (2)*

All trees containing hollows were 'scratched' and 'knocked' and no Black Cockatoos emerged. No Black Cockatoos were observed foraging in the area. As most Black Cockatoos feeding chicks would regularly forage within 2km of their nest, Coffey Environments concluded it was unlikely that any Black Cockatoos were nesting in the proposal area.

Fork-tailed Swift (*Apus pacificus*) – Migratory under the *EPBC Act 1999*

As this is a migratory species that mostly feeds while flying, it is unlikely that the proposed development will have a significant impact on this species when it is in the area.

Rainbow Bee-eater (*Merops ornatus*) – Migratory under the *EPBC Act 1999*

This bird was seen during the reconnaissance survey. It is considered that there is limited potential for the bird to rely on the site due to heavy loamy substrate and limited potential for nesting. There are many other suitable foraging and breeding sites for this species in the general vicinity.

Great Egret (*Ardea alba*) – Migratory under the *EPBC Act 1999*

Ecologia (2001) reported seeing the Great Egret in riparian habitat at Barnes Ave in Australind. It is possible that the Great Egret may infrequently be seen in the general area; however, the proposal site does not contain a large shallow area of freshwater, so it is unlikely to be an important foraging area.

It is considered that it may infrequently be seen in the general area, but the proposed development will not significantly impact on this species.

Cattle Egret (*Ardea ibis*) – Migratory under the *EPBC Act 1999*

WRM (2006) noted the presence of the Cattle Egret in the Iluka study area. As the pasture land supporting cattle grazing is very common in the area, it is Coffey Environments' view that clearing of the proposed western extension area is unlikely to significantly impact on this species, as they will move and forage in other neighbouring areas.

White-bellied Sea Eagle (*Haliaeetus leucogaster*) – Migratory under the *EPBC Act 1999*

The White-bellied Sea Eagle may infrequently be seen flying in the area, however, as the proposal area provides no particular resource that would attract this species, the clearing of the vegetation is unlikely to significantly impact on this species.

Carpet Python (*Morelia spilota imbricata*) – Schedule 4 under the *Wildlife Conservation (Specially Protected Fauna) Notice 2008 (2)*

It is highly unlikely that this species would be found in the proposal area due to the abundance of foxes and cats, and the highly degraded nature of the area.

Hollow Trees

During the reconnaissance survey of the proposal area, trees containing hollows that might provide suitable nesting sites for Black Cockatoos were recorded. These were mostly in the mature trees, often isolated in the paddocks or dead stags. Galahs, Australian Ringneck Parrots and Kingfishers were seen emerging from a number of these tree hollows and it was presumed that they were either preparing a nest site or had laid eggs which they were incubating or were supporting chicks.

Trees containing suitable hollows for nest sites were located at sites as shown on Figure 3.8-1.

Fish

Waterways in the study area appeared to be seasonal and would probably dry out during summer. *Gambusia holbrooki* was observed in a couple of the isolated pools in the creek line in one of the paddocks.

Aquatic Habitat and Fauna

WRM (2006) sampled the aquatic fauna and physico-chemistry of the seasonal Henty Brook and surrounding wetlands that run through the proposal area in November 2005 with the objective of identifying resident fauna to the lowest possible taxonomic level. Their objective was to compare biodiversity and invertebrate assemblages among sites and relate these to differences to differences in water quality.

WRM (2006) concluded that riverine condition of Henty Brook was degraded due to pastoral practices and unrestrained livestock access to the natural water bodies. In-stream vegetation was virtually absent, with only isolated clumps of submerged macrophytes and emergent sedges. Terrestrial native understorey vegetation was sparse and dominated by pasture grasses and weeds. Overstorey vegetation ranged from open to moderately dense mixed woodlands of peppermint and *Eucalyptus* sp..

Most of the wetlands were Melaleuca over pasture. Native macrophytes and emergent vegetation comprised sedges, such as *Eleocharis acuta* and *Lemma disperma*, *Potamogeton* sp. and filamentous algae.

WRM (2006) commented that 'the regional ecological value of the remanent overstorey vegetation within site B1 was still considered to be high, given the extensive (historic) clearing of native vegetation for agriculture. This highlights the pitfalls of using the EPA Bulletin 686 in assessing wetland conservation because it does not adequately make allowances for floristic complexity, vegetation density, vegetation health and condition, and/or less conspicuous fauna'.

WRM (2006) reported that the invertebrate assemblages of the Burekup Project area are considered tolerant of a wide range of environmental conditions and are common, ubiquitous and frequently encountered in freshwater systems in Western Australia. It noted the collection of a number of microcrustaceans, the rotifers *Dicranophiroides caudatus* and *Filinia cf. passa* from site B3 which were the first record for these species in Western Australia and a possible new species Difflugiidae Rhizopod. WRM (2006) also noted the presence of the stone fly *Newmanoperla exigua* in Henty Brook, which is endemic to the south-west corner of Western Australian and are typically regarded as ecologically significant, owing to their sensitivity to water quality.

Native fish, *Bostockia porosa* and *Edelia vittata* were recorded in Henty Brook along with the freshwater gilgie *Cherax quinquecarinatus*. The feral *Gambusia holbrooki* was also present in the waterways. These fish and crustacean are common and widespread in the south-west.

Three frogs were identified in the Burekup Project area, *Crinia insignifera*, *C. glauerti* and *Litoria adelaidensis*. All species are common and endemic to the south-west of Western Australia.

WRM (2006) concluded that 'While the current (Iluka) proposal for Burekup is unlikely to directly affect flows in Henty Brook (located 1000m from the western extension), there is the potential for indirect impacts through groundwater drawdown, further vegetation loss, increase soil nutrient and contaminants and the release of mine dewatering discharge into 'natural' watercourses. Since the water bodies are naturally seasonal, maintenance of summer surface flows would not be required to maintain the existing ecosystems, however, survival of remnant vegetation and some invertebrate fauna (e.g. gilgies) will be dependent on depth and spatial extent to which water tables are lowered over summer and the impact to soil moisture content at depth. Similarly, most macroinvertebrates fulfil their entire larval stage within an aquatic environment and as such, may be made locally extinct by a reduction in groundwater flows, if channel pools and sediments dry before adults emerge. A final consideration is summer drawdown of ground water levels due to dewatering which may lead to drying of any permanent pools (summer refuges for vertebrate fauna). This will depend on the spatial extent of dewatering in the vicinity of the proposed pit. Time and budgetary constraints meant the existence of Henty Brook over summer could not be ascertained. If present, larger pools are likely to provide dry season refuge for fish and crayfish and should be maintained. Spatial extent of dewatering drawdown should be determined relative to any summer refuge pools'.

<u>Terrestrial Fauna Assemblage</u>

Terrestrial vertebrate fauna assemblages present would bear no resemblance to those that existed prior to vegetation clearing and farming. Some vertebrate taxa have specific habitat requirements and even minimal levels of disturbance will see them disappear from the area. Others are more accommodating of disturbance and will continue in the area, often in reduced numbers. Some species are quite plastic in their habitat requirements, or can utilise remnant vegetation and road side verges and will persist in the area in spite of major disturbance, and there is a small group (often exotics) that will flourish in disturbed areas. The proposal area therefore has the potential to provide habitat for a limited range of the original native fauna that can accommodate a high level of disturbance or persist in road site verges or small remnant pockets of vegetation.

It is therefore highly likely that the existing fauna assemblages represent a small fraction of what once existed and would be dominated by those species that are very plastic in their requirements and can tolerate heavy predation pressure from foxes and cats and disturbance.

Ecological Functional Value at the Ecosystem Level

From a fauna perspective, some of the aquatic and wetland ecosystems and road side verges provide the highly modified functional ecosystems in the proposal area. The remaining area is highly degraded and would contain ecosystems characteristic of this level of disturbance.

Linear Corridors or Ecological Linkages

Road side verges provide linear corridors for the movement of terrestrial fauna through the landscape. These road side verges are narrow and discontinuous, so their ability to function as movement corridors for terrestrial fauna is severely restricted. Coffey Environments noticed for example, *Egernia kingii* were present in a number or the road side corridors and were clearly able to sustain a viable population given a capacity for limited movement across unvegetated terrain.

Aerial species (e.g. birds and bats) can use these vegetated corridors as foraging and staging posts for movement through the landscape. Road side verges are valuable for this group of taxa and should be retained where possible.

Adequacy of the Available Data to Assess Potential Impacts of the Proposed Development on Fauna in the Area.

The EPA Position Statement No.3 (EPA, 2002a) and Guidance Statement No.56 (EPA, 2004d) comment on the level of fauna survey required for proposed developments. Although the size the proposed development exceeds the 75ha criteria (Table 3, EPA, 2004d) indicating that the scale of impact is high and there is a potential for the site to contain a significant habitat, the EPA generally does not require a Level 2 fauna assessment to be undertaken in a highly disturbed area. The targeted nocturnal species search confirmed the presence of Western Ringtail Possums for adjacent landholdings, however none were located within the proposal area.

Coffey Environments' view is that adequate information is available on the fauna for the site to make an informed assessment of the potential impact on fauna within and adjacent to the proposal area.

3.8.2 Objectives

EPA Objective

To maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

3.8.3 Potential Impacts and Management Strategies

The proposed development has the potential to impact on fauna through:

- Reduction in foraging habitat for Black Cockatoos;
- Potential for a small number of Western Ringtail Possums to be displaced due to vegetation clearing;
- Fauna living in, or utilising road side vegetation may be killed or displaced with the vegetation clearing;

- A potential reduction in the usefulness of the roadside vegetation acting as a habitat linkage across site;
- A localised loss of aquatic ecosystems;
- A loss of potential breeding opportunities (i.e. hollows) for avifauna that utilise mature trees and tree hollows; and
- Change in traffic volumes, and in the level of dust, noise, light and vibration may impact on fauna in adjacent habitats.

<u>Summary of Findings</u>

The proposed western extension will result, at least temporarily, in a loss of pasture, isolated live and dead trees in paddocks, and probably the loss of aquatic macro-invertebrates at a local level. The proposed western extension area excludes a treed wetland on the north-eastern section and adjacent to Dowdells Line.

There was no evidence of Black Cockatoos using tree hollows in the proposal area for nesting sites, although Coffey Environments did find evidence of Baudin’s Black Cockatoo foraging on Marri nuts in trees along the road side verge. Other conservation significant birds that forage on the site are the Rainbow Bee-eater and the Cattle Egret, and it is possible that the Peregrine Falcon, Fork-tailed Swift, White-bellied Sea Eagle and the Great Egret may infrequently be seen in the area, however, the proposed mining of the western extension area is unlikely to significantly impact on any of these species as they are able to move to adjoining areas.

Coffey Environments’ assessment is that it is unlikely that the Chuditch, Brush-tailed Phascogale, Quokka or Southern Brown Bandicoot is in the proposal area. Occasionally the Western False Pipistrelle maybe recorded aerially foraging in the area, but it is unlikely to be significantly impacted on by the proposed mining of the western extension. Balston’s Perch is unlikely to be in the creeks of the western extension area, and therefore it is unlikely to be impacted on by mining of the western extension.

Road side verge vegetation is discontinuous and therefore has limited potential to provide movement corridors for small terrestrial vertebrates in the area, however, it was noted that *Egernia kingii* were living in these corridors, and it is possible there are other vertebrate fauna communities being supported in these areas. These vegetated corridors are used for birds as foraging, resting and nesting sites and probably by bats. In order to retain the existing vertebrate fauna in the area, every effort should be made to retain these vegetated corridors.

Of a possible seven species and five migratory species listed for the area under the *EPBC Act 1999*, it is possible that the Western Ringtail Possum may be in the proposal area in low numbers, although it was not observed. However, dreys were found in trees in the road side verges and in adjacent paddocks.

Faunal assemblages can vary appreciably from site-to-site, even for adjacent sites that have similar vegetation (Cowan and How, 2004; Thompson et al. 2003; Thompson and Thompson 2005; 2008). The faunal assemblage information from WAM and DEC databases and fauna surveys in the region (ATA Environmental, 2007; Western Wildlife, 2007; Ecologia Environmental Consultants, 2001; WRM, 2006) did not contain data to suggest the fauna assemblages in the proposed western extension area are of conservation significance, or contains conservation significant fauna not addressed on the previous page.

On this basis, and from a visual inspection of the site, Coffey Environments' concluded that the proposed area does not contain fauna habitat that has high ecological significance or is in low abundance in the bioregion. Therefore the western extension proposal is unlikely to cause any significant loss of a fauna ecosystem of conservation significance or to significantly impact on an ecosystem of high conservation significance.

A lowering of the water table in adjacent areas may potentially result in the drying of permanent pools, and a localised loss of aquatic invertebrate and vertebrates' dependant on this free standing water. Management strategies to deal with this proposed impact are dealt with in Section 3.4.3 Groundwater potential impacts and management strategies and in Section 3.6.3 Wetlands.

Risk Assessment and Management Strategies

Risk Assessment

An environmental risk assessment has been undertaken to identify the potential impacts that mining might have on the biodiversity of the western extension area and broader region. The results of the assessment have been summarised and are shown in Table 3-6 below. A full risk table has been provided in the Level 1 Survey Report (see Appendix – Fauna).

Any risk assessment is a product of the likelihood of an event or impact occurring and the consequences of that event or impact. Likelihood and consequences are categorised and described below. The assessed risk level (likelihood x consequences) is then calculated as the overall risk for the western extension proposal. This is followed by an assessment of the acceptability of the risk associated with each of the events or impacts. Disturbances and vegetation clearing have an impact on the fauna at multiple scales – site, local, landscape and regional. Each of these is considered in the risk assessment. This assessment should be considered in the context of the summary in Table 3-8.

Table 3-6
Fauna Impact Risk Assessment Descriptors

Likelihood		
Level	Description	Criteria
A	Rare	The environmental event may occur or one or more conservation significant species may be present in exceptional circumstances.
B	Unlikely	The environmental event could occur or one or more conservation significant species could be present at sometime.
C	Moderate	The environmental event should occur or one or more conservation significant species should be present at sometime.
D	Likely	The environmental event will probably occur or one or more conservation significant species will be present in most circumstances.
E	Almost certain	The environmental event is expected to occur or one or more conservation significant species is expected be present in most circumstances.
Consequences		
Level	Description	Criteria
A	Insignificant	Insignificant impact on fauna of conservation significance or regional biodiversity, and the loss of individuals will be insignificant in the context of the availability of similar fauna or fauna assemblages in the area.

B	Minor	Impact on fauna localised and no significant impact on species of conservation significance in the project area. Loss of species at the local scale.
C	Moderate	An appreciable loss of fauna in a regional context or limited impact on species of conservation significance in the project area.
D	Major	Significant impact on conservation significant fauna or their habitat in the project area and/or regional biodiversity and/or a significant loss in the biodiversity at the landscape scale.
E	Catastrophic	Loss of species at the regional scale and/or a significant loss of species categorised as 'vulnerable' or 'endangered' under the *EPBC Act 1999* at a regional scale.

Acceptability of Risk	
Level of risk	Management Action Required
Acceptable	No action required.
Moderate	Avoid if possible, routine management with internal audit and review of monitoring results annually.
High	Externally approved management plan to reduce risks, monitor major risks annually with external audit and review of management plan outcomes annually. May a referral to the Commonwealth under the *EPBC Act 1999*.
Extreme	Unacceptable, project should be redesigned or not proceed. Probably requires a referral to the Commonwealth under the *EPBC Act 1999*.

Table 3-7
Fauna Risk Matrix

		Likelihood				
		Rare or very low (A)	**Unlikely or low (B)**	**Moderate (C)**	**Likely (D)**	**Almost certain (E)**
Consequences	Insignificant (A)	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
	Minor (B)	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
	Moderate (C)	Acceptable	Moderate	Moderate	High	High
	Major (D)	Moderate	Moderate	High	High	Extreme
	Catastrophic (E)	Moderate	High	High	Extreme	Extreme

Table 3-8
Risk Assessment of the Impact of Clearing Vegetation

			Before Management		
Risk	Issue	Impact	Likelihood	Consequence	Significance
Fauna survey data	Inadequate survey data to adequately assess the risks	Unknown loss of fauna, fauna of conservation significance, and fauna assemblages, and an incomplete fauna assessment	C	A	Acceptable
	Inadequate regional data	Incomplete data on regional fauna leading a poor appreciation of the impact on biodiversity values	C	B	Acceptable
Clearing vegetation	Impacting on fauna habitat and assemblage at the local scale	Loss of terrestrial fauna in the project area	E	A	Acceptable
	Impacting on fauna habitat and assemblage at the landscape scale	Loss of some fauna in specific habitat types	E	A	Acceptable
	Impacting on fauna habitat and assemblage at the regional scale	Loss of some fauna from the bioregion.	E	A	Acceptable
	Impacting on a threatened terrestrial ecological community	Loss of an undetected threatened ecological fauna community	A	C	Acceptable
	Impacting on a threatened aquatic ecological community	Loss of an undetected threatened ecological fauna community	A	D	Acceptable
	Habitat fragmentation	Fauna movement restricted resulting in the death of fauna and a loss of biodiversity	A	A	Acceptable
Death or loss of conservation significant fauna	Significantly impacting on Western Ringtail Possum	Death or the reduced viability of the Western Ringtail Possum	B	C	Moderate
	Significantly impacting on the Western False Pipistrelle	Death or the reduced viability of the Western False Pipistrelle	A	B	Acceptable
	Significantly impacting on the Southern Brown Bandicoot	Death or the reduced viability of the Southern Brown Bandicoot	A	B	Acceptable
	Significantly impacting on the Carnaby's Cockatoo	Death or the reduced viability of the Carnaby's Cockatoo	A	C	Acceptable
	Significantly impacting on the Baudin's Cockatoo	Death or the reduced viability of the Baudin's Cockatoo	A	C	Acceptable

			Before Management		
Risk	Issue	Impact	Likelihood	Consequence	Significance
	Significantly impacting on the Great Egret	Death or the reduced viability of the Great Egret	A	B	Acceptable
	Significantly impacting on the Cattle Egret	Death or the reduced viability of the Cattle Egret	A	B	Acceptable
	Significantly impacting on the White-bellied Sea Eagle	Death or the reduced viability of the White-bellied Sea Eagle	A	B	Acceptable
	Significantly impacting on the Peregrine Falcon	Death or the reduced viability of the Peregrine Falcon	A	B	Acceptable
	Significantly impacting on ecologically important invertebrate assemblage	Loss of endemic species	D	B	Acceptable
Human impacts	Noise, light and vibrations	Reduce biodiversity by forcing individuals to move out of the area	E	A	Acceptable
	Road fauna deaths	Loss of fauna from the area due to vehicle traffic	E	A	Acceptable
	Dust	Loss of fauna habitat and a consequential reduction in the biodiversity	E	A	Acceptable
	Spread of weeds	Changed vegetation and a resulting loss of fauna habitat	E	A	Acceptable
Dewatering	Lowering the water table	Local extinction of aquatic macro-invertebrates	D	A	Moderate
	Further loss of vegetation	Loss of habitat for remaining invertebrates and vertebrates	E	A	Moderate
	Increased soil nutrients and contaminants	Changed fauna habitat, particularly for aquatic invertebrates	D	A	Moderate
	Drying of permanent pools in Henty Brook	Local extinction of native fish and gilgies	C	B	Acceptable

Management Strategies

To minimise the impact of mining the western extension area and associated vegetation clearing on fauna, the following management measures will be implemented:

- Every effort will be made to avoid clearing trees with hollows that are suitable for nest sites for birds;
- Roadside vegetation will be retained wherever possible to provide a corridor for limited fauna movement and fauna habitat. Where possible, the road side vegetation will be augmented by widening the vegetated area and in fill planting of degraded areas as part of the Rehabilitation Program;

- A fauna management plan will be prepared with a specific section that requires that a suitably trained zoologist will be present to catch and translocate fauna, including Western Ringtail Possums and Brush-tailed Phascogale, when the large trees in the proposal area are being cleared;
- Any changes to the creek bed profiles during earth works and mining will be returned to pre-construction conditions;
- The rehabilitation plan for the western extension area will include appropriate key performance indicators;
- The impact of dust on the adjacent vegetation and fauna habitats will be systematically monitored with appropriate triggers that will initiate corrective actions; and
- ‘Road kills’ will be removed as soon as possible.

4 POLLUTION – IMPACT ASSESSMENT AND MANAGEMENT

4.1 Air Quality (Dust)

4.1.1 Existing Environment

The Dardanup Mine is located within rural farming land set against the foothills of the Whicher Scarp, 20km to the east of Bunbury. Farm houses and residential dwellings are scattered around the local area within the vicinity of the mine site. The prevailing winds (for most of the year) in the South West Region of Western Australia come from the east in the mornings and the south-west in the afternoons. In the winter months, strong westerly and north-westerly winds are prevalent.

Dust at the Dardanup Mine can be generated by the movement of heavy machinery on unsealed internal haul roads, overburden stripping, and exposure of stockpiles and open pits to the elements of weather. Air quality parameters at the mine are regulated through the DEC License to operate and managed in accordance with the Dust Management Plan for the Dardanup Mineral Sands Project. Ambient total suspended particulates (TSP) monitoring has been undertaken for the duration of the mine in accordance with the DEC Operating License requirements, focusing on the concentration of TSP leaving the site and potentially impacting neighbouring properties. The number of TSP monitoring sites have increased and correspond to active mine areas and nearby residences. Since 2005 (commencement of the current monitoring regime), an average TSP concentration of 49µg/m^3 between September and March has been recorded in comparison with the License limit of 250µg/m^3.

Refer to Table 4-1 for a summary of predicted prevailing wind directions from September to May (dry months).

Table 4-1
Predicted Prevailing Wind Direction In Relation to Residence Locations

Time of Day	0900 hours			1500 hours			Dardanup Mine Monthly Mean Dust Concentration (µg/m^3)
Month	Predicted Prevailing Wind Direction*	Residence Most Susceptible to Predicted Prevailing Wind Direction	Distance to Western Extension (m)	Predicted Prevailing Wind Direction**	Residence Most Susceptible to Predicted Prevailing Wind Direction	Distance to Western Extension (m)	
Sept	W	R11	703	NW	R11	703	34
Oct	E	Dardanup Mine	Adjacent	SW	R8	713	41
Nov	E	Dardanup Mine	Adjacent	SW	R8	713	61
Dec	E	Dardanup Mine	Adjacent	SW	R8	713	52
Jan	SE	R7	989	SW	R8	713	49
Feb	SW	R8	713	SW	R8	713	58
Mar	SW	R8	713	SW	R8	713	54
Apr	SE	R7	989	SW	R8	713	53
May	SE	R7	989	NW	R11	703	42

*Prevailing (at 0900 hours) wind direction taken form Bureau of Meteorology data collated from 1995 to 2008.
** Prevailing (at 1500 hours) wind direction taken form Bureau of Meteorology data collated from 1965 to 1985.

The western extension area, located within 100m to 2.1km of the Dardanup Mine has been extensively cleared of native vegetation for agriculture with a cover of pasture. There is minimal dust generated from this area in its current land use. Farm houses and residential dwellings are scattered within the vicinity of the proposed mining area.

4.1.2 Objectives

EPA Objective

To ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.

Doral Objectives

Objectives from the Dust Management Plan for the Dardanup Mineral Sands Project are listed below:

- To minimise the creation of airbourne dust and therefore its potential release from the boundaries of the mine site. An overriding strategy in this regard will be as stated in Proponent Commitment 8 – "Minimise clearing and land disturbance, consistent with safe and efficient operations".

Doral will revise and update the Dust Management Plan for the Dardanup Mineral Sands Project to include the proposal for a western extension area.

4.1.3 Potential Impacts and Management Strategies

Potential Impacts

Dust generation can result in adverse impacts on surrounding vegetation, flora and fauna and create nuisance to landowners in the vicinity of the mine disturbance areas. The risk of significant off site impacts are considered low due to the similarities between the existing Dardanup Mine and the proposed western extension and the proven performance of the dust management strategies at the Dardanup Mine.

The transport of ore by overland conveyor to the Dardanup Mine will reduce the potential for dust generation by the movement of heavy vehicles on unsealed internal haul rods. There is minimal dust expected to be generated from the conveyor as the ore being transported will be wet.

Dry mining has the potential to generate dust from the clearing of topsoil and overburden, by vehicular movement, and surface lift-off from exposed surfaces during dry and windy ambient conditions. Dust may also be generated from rehabilitation activities, and areas recently rehabilitated, prior to the establishment of vegetation. The generation of airborne dust is more prevalent in the summer months when winds are strong and from the south-west and south-east directions.

The main sensitive receptors are considered to be residences located between approximately 750m and 1,000m from the western extension boundary to the south-west. This includes residences R6 to R11 (refer to Figure 4.2-1) for locations. However, this is applicable when mining in the southern portion of the proposed western extension. In the southern portion of the extension area, two residences (R10 and R11) are within approximately 750m of the proposed mine void and may be affected by dust during strong wind events from the east.

The nearest residence in the northern section of the western extension area, while being approximately 550m from the proposed pit area and a vacated rental property, will not be directly affected by wind from any direction previously mentioned.

Management Strategies for the Western Extension Area and the Dardanup Mine

Mining of the western extension area will be done in two broad stages over the 3.5 to 5 year mine life; the southern portion will be mined over a 2 to 2.5 year period and the northern section over a one year period. Mining will be progressive and pits only opened up for excavation as required in order to minimise the disturbance area at any one time and therefore reduce the risk of dust generation.

During the pre-mine establishment phase in the western extension area, management will include (but not be limited to) employing two water carts for dust suppression on unsealed roads and in new areas of ground disturbance.

It is proposed to locate topsoil and overburden stockpiles between the residences and mining activities to mitigate the effects of wind-borne dust on nearest neighbours in the western extension area. Vegetative cover on the perimeter stockpiles will be encouraged. Doral will continue to manage mine dust levels in order to comply with occupational health and safety conditions (*Mine Safety and Inspection Regulations, 1995*).

A range of control techniques will continue to be implemented to eliminate, minimise and control dust generation activities at the Dardanup Mine. The same control techniques will be employed in the western extension area, as appropriate.

Control techniques identified in the Dust Management Plan for the Dardanup Mineral Sands Project include:

- Minimising the area required for safe and efficient operations;
- The retention and removal of pasture and understorey species together with the topsoil;
- Timing of topsoil stripping such that soil conditions are moist but not saturated. This will minimise dust generation and soil structural damage;
- Watering all unsealed roads on a routine basis for the purpose of dust suppression;
- Restrictions on the areas open at any one time to ensure safe and efficient operations;
- The management and monitoring of ore loading and unloading operations (including the conveyor transfer points) such that dust generation is minimised and controlled;
- Scheduling topsoil stripping as such to avoid periods of high winds. To minimise dust generation and mobilisation during these operations water spraying is employed. When necessary, stripping operations are to be suspended under particularly high wind conditions;
- Minimising the number and size of stockpiles and the direct use of overburden as backfill (combined with sand and clay tails) together with the direct replacement of top-soil to minimise the potential for dust generation;
- The re-use of pit voids as tailing storage areas to minimise the disturbance footprint and reduce ground areas potentially vulnerable to dust generation;
- The co-disposal of sand tails and clay fines into pit backfill areas. This homogenous mixing increases the average particle size and reduces the potential for dust generation. When and where necessary, spraying with water or other dust suppression measures (e.g. hydro-mulching, erection of wind barriers) is employed;

- Encouraging vegetative cover on stockpiles, especially the topsoil stockpiles. Many of these vegetative species generate from stored seed to minimise dust generation;
- Spraying HMC stockpiles at the mine and the dry separation plant with water if they dry to the extent dust generation occurs. HMC stockpiles generally have a moisture content of between 5–9% and are not vulnerable to the adverse effects of strong winds causing dust;
- Spreading noise control bunds and pond embankments with fine clay solution or hydromulch such that dust control and soil erosion measures are achieved;
- Employ routine maintenance and housekeeping practices to ensure that waste materials in and around the mine voids and infrastructure do not accumulate and lead to the generation of unacceptable airborne particulates; and
- Inform all employees and contractors of the importance of reducing the creation of dust generating activities.

Dust Monitoring

Additional monitoring sites for airborne dust measurement in the western extension area will be selected on the basis of prevailing wind direction, location and nature of mining activities, location of nearby residential dwellings. The location of monitoring sites will be determined in consultation with the DEC (SW Region) as part of the Licence amendment to allow mining operations in the western extension area.

Visual monitoring will be carried out during the mine establishment period (daily) focussing on operations such as topsoil stripping and the establishment of noise control bunds.

Monitoring requirements during mining operations in the western extension area are expected to be similar to the established programme at the Dardanup Mine, as set out in the DEC Licence. This includes monitoring for Total Suspended Particulates (TSP) using a high volume sampler in accordance with Australian Standards. Monitoring is carried out monthly during the period between September and March, or on a more frequent basis when the potential for dust generation is highest or in response to complaints. Specific limits for monitoring, measurement and reporting for air quality (in relation to dust) in the western extension area will be determined in the amended DEC Licence.

4.2 Noise

4.2.1 Existing Environment

The proposed western extension area to the Dardanup Mine is primarily pastoral farmland. Farm houses and residential dwellings are scattered around the local area within the vicinity of the mine site. The prevailing winds (for most of the year) in the South West Region of Western Australia come from the east in the mornings and the south-west in the afternoons. In the winter months, strong westerly and north-westerly winds are prevalent.

4.2.2 Objectives

EPA Objective

To protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring the noise levels meet statutory requirements and acceptance standards.

Doral Objectives

Objectives of the Noise Management Plan for the Dardanup Mineral Sands Project are listed below:

- Conduct operations so that noise emissions do not unreasonably impact on people in the vicinity, including residents;
- Ensure that noise emissions meet the requirements of the noise control regulations applying from time to time under the EP Act; and
- Conduct noise surveys (including baseline measurements) and assessments (including baseline measurements) and assessments (including the impact of tonal noise) at the Dardanup site to meet the requirements of the former DEP (now DEC).

The Noise Management Plan for the Dardanup Mineral Sands Project will be updated to include the requirements for noise management and monitoring for the western extension area.

4.2.3 Potential Impacts and Management Strategies

Noise Modelling Studies

SVT Engineering Consultants (2007a) were commissioned by Iluka, to carry out noise monitoring for a period of two weeks at four locations surrounding the western extension area in March 2007. Monitoring locations were close to and surrounding the proposed Iluka disturbance area. Monitoring data indicated that the background noise in the proposed western extension area was 25 to 29 dB(A) (L90 of LA90) during both day time and night time hours.

A noise impact assessment was carried out in October 2008 for the Doral proposal by SVT Engineering Consultants (2008a) for the western extension. An acoustic model was developed to predict noise levels at the nearest representative noise sensitive premises for day and night time operations under both worst-case and calm meteorological conditions. A copy of the report is contained in Appendix – Noise. Closest residents (noise sensitive premises) to the western extension area are shown in Figure 4.2-1.

A second impact assessment was carried out in November 2008 by SVT Engineering Consultants (2008b) to review the worst case scenarios incorporating noise management strategies designed in consultation with Doral to further reduce the potential impacts. A copy of the report is contained in Appendix – Noise. The acoustic model demonstrates the noise control strategies are effective in sufficiently lowering predicted noise levels at sensitive receiver locations.

Noise limits for the sensitive receivers are listed in Table 4-2 as assigned by *Environmental Protection (Noise) Regulation 1997*, Part 2 r8 (2) Table 1.

Table 4-2
Noise Limits at Receiving Locations

Residence	Influencing Factor in dB	Assigned Noise Limits (LA_{10}) in dB(A)		
		Day	**Evening**	**Night**
All Residences	0	45	40	35

Four scenarios were assessed which included both one construction scenario and three mining scenarios. Scenario 1 refers to the pre mine establishment phase which is restricted to day time activity only. Scenario 2 is applicable to mining the southern portion of the deposit and scenarios 3 and 4 refer to mining the northern portion of the deposit. Mining is applicable to both day and night time activity. The scenarios are summarised in Table 4-3.

Table 4-3
Operating Scenarios

Phase	Scenario	Operating Time	Likely Commencement
Pre mine establishment	1	Day	April 2009
Mining	2	Day/Night	October 2009
Mining	3	Day/Night	Jan – Mar 2011
Mining	4	Day/Night	Jan – Mar 2012

Findings from the second assessment are summarised in Tables 4-4 showing the predicted worst case noise levels at each residence during the four scenarios. A 5dB tonality penalty was also applied where required depending on the dominating noise sources. If an exceedance of the assigned day or night levels (Table 4-2) has been predicted at a residence it is shaded grey and the maximum exceedance expected for all scenarios is also shown in Table 4-4. A majority of exceedances relate to Scenario 1 (construction) Scenario 2 (mining activities in the southern portion of the deposit) due to the proximity of the residences in the vicinity and prevailing wind conditions, both wind speed and direction. Refer to Figure 4.2-1 for the distribution of residences in the vicinity of the western extension proposal area.

Table 4-4
Worst Case Noise Levels for Residences (R#) Modelled

Residence	Assigned Noise Limit Day/Night	Adjusted Worst-case Day and Night Noise Levels in dB(A)								
		Scenario 1	Scenario 2		Scenario 3		Scenario 4		Max Exceedance	
		Day	Day	Night	Day	Night	Day	Night	Day	Night
R1	45/35	45.8*	45.7*	34.6	43.1*	32.1	32.5	11.5	0.8	-
R2	45/35	37.4	42.2*	33.3	44.1*	32.7	38.8*	12.3	-	-
R3	45/35	29.9	29.0	25.5	35.6*	25.5	34.6*	10.4	-	-
R4	45/35	25.8	25.0	21.9	41.3*	21.8	33.1	20.8	-	-
R5	45/35	35.3	35.5	31.1	33.1	30.8	33.0*	17.4	-	-
R6	45/35	47.8*	44.0*	32.8	35.1	32.7	32.7*	15.3	2.8	-
R7	45/35	48.6*	43.1*	31.5	34.4	31.7	32.1*	14.3	3.6	-
R8	45/35	47.0	45.7*	36.1	40.2*	31.7	24.8	11.8	2.0	1.1
R9	45/35	50.4*	43.5*	30.3	40.2*	31.5	24.8	11.6	5.4	-
R10	45/35	51.9*	45.8*	31.4	42.6*	33.5	26.8	12.8	6.9	-
R11	45/35	49.2*	46.6*	32.4	37.3	32.7	28.5	12.5	4.2	-

Note: * Values adjusted for tonality (5dB penalty).
Values shaded are above criteria in *Environmental Protection (Noise) Regulation 1997*

In accordance with r13 of the *Environmental Protection (Noise) Regulation 1997*, assigned noise levels are not applicable to the pre mine establishment period which is represented by Scenario 1 as long as *the pre mine establishment work was carried out in accordance with control of environmental noise practices set out in Section 6 of AS 2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites*. The remaining predicted exceedances all relate to mining Scenario 2 and specific wind directions as detailed in Table 4-5 below. Of the five predicted expected non-compliances during Scenario 2, four relate to day time activities and the assigned noise level exceedances are expected up to 1.6dB. Night time non compliance at R8 is negligible at an expected exceedance of 1.1dB.

Table 4-5
Compliance Assessments for Worst Case Day and Night Operations Modelled

Residence	Noise Limit	Scenario 2		Scenario 3		Scenario 4	
		Complies (Yes) or Maximum Exceedance (dB)	Non-compliant wind directions	Complies (Yes) or Maximum Exceedance (dB)	Non-compliant Wind Directions	Complies (Yes) or Maximum Exceedance (dB)	Non-compliant Wind Directions
Day							
R1	45	0.7	E-S	Yes		Yes	
R2	45	Yes		Yes		Yes	
R3	45	Yes		Yes		Yes	
R4	45	Yes		Yes		Yes	
R5	45	Yes		Yes		Yes	
R6	45	Yes		Yes		Yes	
R7	45	Yes		Yes		Yes	
R8	45	0.7	N – E	Yes		Yes	
R9	45	Yes		Yes		Yes	
R10	45	0.8	NE – SE	Yes		Yes	
R11	45	1.6	NE - S	Yes		Yes	
Night							
R1	35	Yes		Yes		Yes	
R2	35	Yes		Yes		Yes	
R3	35	Yes		Yes		Yes	
R4	35	Yes		Yes		Yes	
R5	35	Yes		Yes		Yes	
R6	35	Yes		Yes		Yes	
R7	35	Yes		Yes		Yes	
R8	35	0.1	NW - SE	Yes		Yes	
R9	35	Yes		Yes		Yes	
R10	35	Yes		Yes		Yes	
R11	35	Yes		Yes		Yes	

To demonstrate that compliance is achievable with assigned noise levels during Scenario 2, the height of stockpiles on the western side of the proposal area was revised to 10m above ground level to act as noise barriers. This strategy was proven to be effective as shown in Table 4-6 where the predicted noise levels at near-by residences are compliant with assigned noise levels. A 5dB tonality penalty was also applied where required. Additional measures will be employed, prior to and during mining, to further optimise noise bund design and machinery selection, where required.

Table 4-6
Predicted and Adjusted Noise Levels for Worst Case Operations of Scenario 2 after the Installation of Proposed Noise Barriers

Residence	Day-Time Noise Levels in dB(A)		Night-Time Noise Levels in dB(A)	
	Predicted	Adjusted Due to Tonality	Predicted	Adjusted Due to Tonality
R1	40.0	45.0*	33.6	33.6
R2	37.1	42.1*	33.3	33.3
R3	29.0	29.0	25.2	25.2
R4	24.3	24.3	21.2	21.2
R5	35.5	35.5	31.1	31.1
R6	39.0	44.0*	32.8	32.8
R7	38.1	43.1*	31.5	31.5
R8	39.8	44.8*	32.5	32.5
R9	37.5	42.5*	29.6	29.6
R10	39.8	44.8*	31.2	31.2
R11	40.0	45.0*	32.4	32.4

Note: * Values adjusted for tonality (5dB penalty).

Potential Impacts

Mining of the western extension has the potential to generate noise as a result of the following operations:

- Overland conveyor and its drive;
- Road hopper, primary scalping screen and pumps; and
- Mobile equipment.

The generated noise will propagate and increase noise levels in the area surrounding the proposed western disturbance area. There are 8 (occupied) residences located between 703m and 1675m from the boundary of the disturbance area.

Management Strategies

Noise generated by the mining activities will be managed to comply with *Environmental Protection (Noise) Regulations 1997*. Occupational noise will be addressed and managed to comply with the *Mines Safety and Inspection Regulations 1995* (Part 7, Division 1).

The following management measures will be implemented to reduce noise emissions from the western extension area:

- Optimise the layout and schedules of mining activities.
- Place topsoil/overburden stockpiles and/or build noise bunds along the pit edges to mitigate noise propagation, including the use of noise attenuating fencing where practicable.
- Build a noise bund along the south side of the access road and overland conveyor shown as overburden stockpile on Figure 2.2-1.
- Place an ore stockpile or build a noise bund in the west and south sides of the road hopper shown as overburden stockpile on Figure 2.2-1.

- Restrict mining activities during night/evening time.
- Use quieter equipment where practicable.
- Reduce the number of equipment items operating where practicable.
- Set-up noise monitoring stations to monitor noise impacts at the closest residential locations.
- Optimise the mobile equipment operations in different modes for different wind conditions.

If noise limits are exceeded after the above management strategies are in use, the following contingency actions will be implemented:

- Attenuation of machinery where practical.
- Amenities agreements will be sought with affected residences (Refer to Table 4-5 for non-compliant wind directions).
- Temporary shutdown of relevant (noise generating) operations to ensure compliance during certain persistent wind conditions.

The modelling study for the proposed western extension was reassessed in November 2008 to confirm that the above proposed management strategies will be sufficient to comply with the *Environmental Protection (Noise) Regulations 1997*. Noise modelling (SVT Engineering Consultants, 2008a) has indicated Doral will be compliant with noise regulations when the appropriate noise barriers are installed.

4.3 Greenhouse Gas Emissions

4.3.1 Existing Environment

Sources of greenhouse gas emissions from the Dardanup Mineral Sands Project are outlined below for the Dardanup Mine.

Background

The Kyoto Protocol is an international agreement, to which Australia is a signatory, designed to foster action to manage the human-enhanced greenhouse effect. The protocol is the set of rules fostered by the United Nations Framework Convention on Climate Change (UNFCCC) in 1997 designed to stabilise greenhouse gas concentrations in the atmosphere at such a level to ensure ecosystems can adapt, food production is not threatened and economic production can proceed in a sustainable manner. All signatories to the protocol are required to reduce their greenhouse emissions from 1990 levels by at least five percent by 2008-2012. The six gases are specifically covered in the Kyoto Protocol are:

- Carbon Dioxide (CO_2);
- Methane (CH_4);
- Nitrous Oxide (N_2O);
- Hydroflurocarbons (HFCs);
- Perflurocarbons (PFCs); and
- Sulphur hexafluoride (SF_6).

The Australian Framework Convention on Climate Change (FCCC) recognises that all parties have a common but differentiated responsibility to address climate change. In its third National Communication to the UNFCCC in 2002, Australia's own requirement is to limit our greenhouse gas emissions in the target period to no more than eight percent above 1990 base year levels. The national Greenhouse Strategy (NGS) was developed to provide a national framework for the advancement of Australia's greenhouse response. *The Australian national Greenhouse Gas Inventory Committee* (NGGIC) has prepared state and national inventories which cover the major greenhouse gases or gas groups of gases and reports them expressed as Carbon Dioxide Equivalents (CO_2eq).

The National Greenhouse and Energy Reporting Act 2007 (NGER) establishes a national framework for corporations to report greenhouse gas emissions, reduction measures, removals, offsets and energy consumption from production starting from 1 July 2008. This reporting system replaces the Greenhouse Challenge program; a voluntary program between government and industry to account for and abate greenhouse emissions.

The Western Australian Greenhouse Strategy is a subsidiary document to the NGS and addresses the need for: the state to have a response tailored to the interests of Western Australia; integration of considerations with other government commitments; the pursuit of actions consistent with cost effectiveness and multiple benefits; recognition of the importance of partnerships between governments, industry and the community in delivering an effective response; and action to be informed by research.

The EPA Guidance Statement No.12, Minimising Greenhouse Gas Emissions (EPA, 2002b) applies to new proposed projects and extensions to projects formally assessed by the EPA where greenhouse gas emissions are a relevant environmental consideration (under Section 4.1 of the guidance statement).

Greenhouse gas emissions are considered relevant to the western extension even though trigger levels of energy consumption and emission generation have not been exceeded when assessed on a facility basis. The proposal for the western extension to the Dardanup Mine generally adopts the objectives of the guidance statement by:

i. Applying best practice to maximise energy efficiency and minimise emissions; and

ii. Implementing a program to monitor and report emissions and energy use, and periodically assess opportunities to further reduce emissions over time.

Dardanup Mine

Greenhouse gas emissions are generated from:

- The consumption of fossil fuels in mining and haulage equipment; and
- Organic decay emissions from cleared native vegetation from new disturbance areas (very minimal, as mining is in pastureland with a low percentage of native vegetation cover).

There is no on-site power generation. Electricity for the running of the feed preparation plant, wet concentrator, workshops, site office and amenities is supplied by Western Power and reticulated to the mine by overhead transmission lines at 22kV.

Current annual emissions from the Dardanup Mine are 23.92kt CO_2eq with the annual energy consumption of 162.79Tj.

4.3.2 Objectives

EPA Objective

To minimise emissions to levels as low as practicable on an on-going basis and consider offsets to further reduce cumulative emissions.

4.3.3 Potential Impacts and Management Strategies

Potential Impacts

Implementation of the western extension proposal will result in an increase in greenhouse gas emissions both directly and indirectly, as a result of:

- The consumption of electricity.

  Additional mine equipment will include an overland conveyor, ancillary equipment to the conveyor and pumps. The additional equipment will require up to 800kW, an increase of up to 30% more than current consumption of 2500kW. The actual usage will be around the 480kW mark, or 20% increase from current usage, as not all the connected equipment will be operating at any one time. With this in mind, there is expected to be only minor increase in greenhouse gas emissions.

- Mobile mining equipment and transportation consuming fossil fuels.

  There will be an increase in the number of heavy vehicle movements. Currently, there is an average of 11 round trips per day of trucks hauling HMC to the dry separation plant; this is anticipated to increase to 15 round trips per day. In addition, there will be an average of five round trips from the Dardanup Mine to Capel per day, a distance of approximately 34km.

- The clearing of vegetation.

  This will be very minimal as most of the disturbance area is used for pasture.

Management Strategies

Mining activities will continue to be a consumer of electricity from the grid, natural gas and diesel fuel. Greenhouse gas emissions will be minimised by the adoption of the following strategies:

- Restricting to a practical minimum the area of native vegetation that is to be cleared;
- Progressively rehabilitating mine landforms and disturbed areas as they become available;
- Synergistic linking of process steps where possible to reduce net greenhouse gas outputs;
- Replacement of fossil fuels where possible with renewable (e.g. biodiesel);
- Identification of energy efficiency opportunities, conservation measures, and reduction in fugitive emissions when and where practical;
- Using the methodology developed by the National Greenhouse Gas Inventory Committee to record and estimate emissions from mining activities; and
- Consideration given to carbon sequestration options including but not limited to forestry and revegetation activities, geological re-injection and any feasible options as they become viable.

Examples of how the above strategies are being (or will be) incorporated into the proposed extension project are provided below:

- Currently, most of the disturbance area is degraded pasture. Where native vegetation was cleared, all millable timber was donated to the nearby Heritage Park, and a large number (approximately 50) *Xanthorrhoea spp* (grass trees) were transplanted.
- Rehabilitation operations involve the back-fill principle and take place on an on-going basis.
- The earthmoving contract company currently use a 20% biodiesel blend to run all machines on site.
- Accounting for emissions is currently undertaken using the National Pollution Inventory (NPI) methodology.

The decision to use a conveyor rather than internal haulage by truck in the western extension area stems from the direct cost saving of using conveyor transport instead of mechanical transportation. A greenhouse gas emission reduction has been achieved by this decision. An estimate using the on-line calculator (Department of Climate Change, 2008) shows a saving of approximately 1.7kT CO_2eq annually over the life of the mine.

4.4 Waste Management

4.4.1 Existing Environment

Mining operations at the existing Dardanup Mine generate a number of waste materials which require disposal. These include:

- Hydrocarbons – diesel, lubricants and hydraulic fluids;
- Sewage;
- Scrap metal;
- Non-metal scrap (e.g. uncontaminated piping, plastic, fibreglass or wood);
- General refuse; and
- Domestic putrescible wastes.

Any wastes created on the western extension will be similar to the above list.

4.4.2 Objectives

Relevant Standards and Legislation

- *The Waste Avoidance and Resource Recovery Act 2007*;
- *The Waste Avoidance and Resource Recovery Levy Act 2007*;
- *The Waste Avoidance and Resource Recovery Regulations 2008*; and
- *The Waste Avoidance and Resource Recovery Levy Regulations 2008.*

Waste Principals

Principal 1: Prevention – to avoid the creation of waste.

Principal 2: Recovery – to efficiently re-cover, re-treat and re-use all wastes.

Principal 3: Disposal – to responsibility manage waste into the environment.

4.4.3 Potential Impacts and Management Strategies

<u>Hydrocarbons</u>

Fuel will continue to be stored at the Dardanup Mine with a fuel truck servicing machinery working in the western extension. Any hydrocarbon spills that occur will be managed in accordance with the EMS Operational Procedures for Spill Response and Oily Waste Treatment, as set out in Section 6.1.4. These procedures require all hydrocarbon waste to be disposed of at the nearby Piacentini workshop hydrocarbon waste facility.

<u>Sewage</u>

An amenities building will contain toilets for domestic use. The effluent disposal system will consist of a septic tank and leach drain.

<u>Scrap Metal</u>

Any metal scraps generated by works associated with the western extension will be placed in a skip bin for removal from site, then recycled by J & P Metals at their facility located in Picton.

<u>Non-metal Scrap, General Refuses and Domestic Putrescibles Waste</u>

All waste materials including non-metal, general refuse and domestic putrescible waste will be stored in a designated area until they are removed to an authorised offsite refuge disposal site.

5 SOCIAL ENVIRONMENT – IMPACT ASSESSMENT AND MANAGEMENT

5.1 Aboriginal Cultural Heritage

5.1.1 Existing Environment

The western extension area lies within the Gnaala Karla Booja native title claim (WC98-058). A total of 14 representatives of the Gnaala Karla Booja native title claimant group were involved in the following surveys:

i. An ethnographic survey of the proposed disturbance area was undertaken by Ethnosciences in April 2007 titled *Report of an Ethnographic Survey of the Proposed Iluka Resources Limited Burekup Mineral sands Mine (M70/0652, M70/0720), near Bunbury, Western Australia*.

ii. An Archaeological Survey was undertaken by Anthropos Australis Pty Ltd (2007) titled *The Report of an Aboriginal Archaeology Survey of the Proposed Burekup Mineral Sands Mine (M70/0665, M70/720) South West Region Western Australia.*

Copies of these reports are contained in Appendix – Aboriginal Heritage.

An additional survey was undertaken in October 2008 for the western extension proposal. The survey was conducted by Ethnosciences and the findings provided in a report titled *Report of an Ethnographic Survey of the Proposed Dardanup Mine Western Extension Area (M70/0652, M70/0720), near Bunbury, Western Australia*. A copy of this report is contained in Appendix – Aboriginal Heritage.

Ethnographic research of the indigenous people of the south-west region has been conducted since the early twentieth century, commencing with the works of Daisy Bates (1985) and continuing with Berndt (1979) and Tindale (1974), focusing on the regional differences of local communities. The survey was conducted to satisfy the requirements of the *Aboriginal Heritage Act 1972* and the *EP Act* to address the heritage and cultural interests and concerns of Aboriginal people.

Though a number of sites are listed on the *Register of Aboriginal Sites* in the area surrounding, no previously listed Aboriginal sites are located within the western extension. One wetland (Wetland 1) with cultural significance was identified in the Ethnosciences Report (2007) and a second wetland (Wetland 2) was also identified in the course of the recent survey (Ethnosciences, 2008) for the western extension. These wetlands are referred to elsewhere in the EPS document as the CCW (for Wetland 1) and the Low Woodland of *C.obesa* near Dowdells Line and St Helena Road (for Wetland 2).

Concern was also expressed regarding groundwater quality and a small creek running through the study area at Lot 3557 and Lot 3558 and the potential to unearth Aboriginal cultural material, including skeletal material, during operations.

5.1.2 Objectives

EPA Objective

To ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation.

Doral Objectives

Objectives of the Cultural and Heritage Considerations Management Plan for the Dardanup Mineral Sands Project are listed below:

- Ensure that the requirements of the *Aboriginal Heritage Act 1972* are met; and
- Maintain awareness of more localised heritage and historical values.

The Cultural and Heritage Considerations Management Plan will be updated with the proposal for the western extension.

5.1.3 Potential Impacts and Management Strategies

Management strategies to mitigate the potential impacts of the western extension proposal in relation to Aboriginal cultural heritage are outlined below:

i. Avoid the wetlands, monitor the groundwater system and reinstate the creek to its original line once mining operations have ceased. Both wetlands identified to have cultural significance will be closely monitored for impacts by assessing groundwater and surface levels and vegetation status. Management strategies in relation to these items are outlined in Sections 3.4, 3.5 and 3.6 of the EPS; and

ii. Implement an Aboriginal Heritage Management Plan in order to ensure that any cultural material, including skeletal material, unearthed in the course of the development is treated in accordance with the provisions of the *Aboriginal Heritage Act 1972*.

An Aboriginal Heritage Management Plan will be developed prior to the commencement of mining, as per item ii above. This will be incorporated into the Cultural and Heritage Considerations Management Plan for the Project, as identified in Section 5.1.3.

Aboriginal Relationships

Doral will consult with the Gnaala Karla Booja claimant group on a regular basis to ensure members are well informed of the western extension progress. The Gnaala Karla Booja claimant group will also be consulted in developing and implementing an Aboriginal Heritage Management Plan and training program for relevant employees to assist in the identification and handling of any previously unidentified archaeological material.

6 ENVIRONMENTAL MANAGEMENT SYSTEM AND RISK ASSESSMENT

6.1 Environmental Management and Performance

Doral is committed to its environmental performance and has developed, implemented and continually improved its Environmental Management System (EMS). Doral's EMS is in line with the requirements of the Australian/New Zealand Standard AS/NZS ISO 14001:1996 (ISO 14001).

The establishment of an EMS for Doral is a requirement of DEC which is stated in the Audit Table titled *Mineral Sands Mine, Dardanup (Assessment 1138, Statement 484)* (Audit Table). Please refer to Table 6-1 which shows an extract from the DEC Audit Table that states the requirement for the development and implementation of an EMS.

Table 6-1
Exert from *Mineral Sands Mine, Dardanup (Assessment 1138, Statement 484)*

Audit Code Subject	What action must be taken How action must be taken and / or objective of action. Objective Evidence that action has been taken	Project Phase when action to be taken Where it is to be taken	To requirement s of On advice from	Compliance Status
484:M3.1 EMS	Action: Demonstrate that an Environmental Management System is in place. How: The EMS shall include the following elements: 1) Environmental policy and commitment; 2) Planning of environmental requirements; 3) Implementation and operation of environmental requirements; 4) Measurement and evaluation of environmental performance; and 5) Review and improvement of environmental outcomes. Objective: To manage the relevant environmental impacts of the project and to fulfil the requirement of the conditions and procedures of the Minister's statement. Evidence: EMS documentation.	Design prior to commencement of ground disturbing activities	EPA DEP	23/10/01: Cleared (DEP letter of 23/10/01 advised clearance of element - Audit Branch

The following provides an outline of Doral's current EMS as well as identifying proposed actions for the integration of the western extension into the EMS.

6.1.1 Background

Doral is committed to operating in an environmentally responsible manner. Doral have developed their EMS in order to:

- Manage the environmental impacts of their operation; and
- Ensure that effective management of the environment is integral to Doral's operations.

6.1.2 Policy

Doral have developed an environmental policy that states Doral's intentions and commitment to environmental performance.

The environmental policy is the foundation of the EMS and provides the framework for setting and reviewing objectives and targets. Doral will review this policy in light of the western extension proposal to ensure that the Environmental Policy is still valid and relevant.

6.1.3 Planning

This component of Doral's EMS consists of the following elements: environmental aspects; legal and other requirements; objectives and targets; and environmental management programs.

Environmental Aspects and Impacts

Doral has established System Procedure SP-*01 Environmental Planning – Aspects and Impacts* to identify the environmental aspects of its current activities, products and services. Doral has also detailed methods in SP-01 to determine which of those environmental aspects have a significant impact on the environment.

It is proposed that a comprehensive workshop will be conducted to revise the Environmental Aspects and Impacts procedure including a risk analysis to incorporate activities from the western extension proposal.

Legal and Other Requirements

All legal requirements will be updated in regards to the western extension proposal including requirements under any Ministerial Statements and Audit tables.

Objective and Targets

Doral has established System Procedure SP-03 Objectives and Targets to identify environmental objectives and quantifiable targets which meet the company's environmental policy. These environmental objectives and targets will be reassessed in light of the western extension proposal.

Environmental Management Program

An environmental management program has been developed for the purpose of turning the objectives and targets into actions. The Environmental Management Program includes performance indicators that will be used to assess environmental performance. This program will be updated in light of the revised SP-03 Objectives and Targets.

Environmental Management Plan's (EMP's) for the Project are contained in '*The Dardanup Mineral Sands Project, Pre-Construction Approvals – Supporting Documentation'* (GHD, 2001). This document was prepared to allow site construction and ground disturbance works to commence.

The EMP's for the Project are as follows:

- Flora and Vegetation Management Plan;
- Surface Water Management Plan;
- Groundwater Management Plan;
- Dust Management Plan;
- Noise Management Plan;

- Radiation Management Plan;
- Rehabilitation and Decommissioning Plan;
- Visual Management Plan;
- Cultural and Heritage Considerations Management Plan; and
- Acid Sulphate Soil Management Plan.

6.1.4 Implementation and Operation

This component of Doral's EMS is concerned with the implementation of the EMS and the development of necessary capabilities and support mechanisms to achieve Doral's environmental policy, objectives and targets. This component consists of the following elements: structure and responsibility; training awareness and competence; communication; environmental management system documentation; document control; operational control; and emergency preparedness and response. All components of Implementation and Operation will be reviewed in light of the western extension proposal. Particular emphasis and resources will be employed in the area of Operational Control and Emergency preparedness and response.

Operational Control

Numerous Operation Procedures have been developed for the Doral EMS which will be updated for the western extension proposal including:

- Contractor Management;
- Vegetation Clearing;
- Topsoil Management;
- Flora Management;
- Spill Response;
- Oily Waste Treatment;
- Atmospheric Monitoring;
- Surface and Ground Water Management, which includes the Emergency Surface Water Discharge Procedure;
- Waste Management; and
- Chemical Management.

Results of the proposed workshop conducted for identifying new Impacts on Aspects will guide the development of new Operational procedures.

6.1.5 Checking and Corrective Action

This component of Doral's EMS relates to the monitoring and evaluation of Doral's environmental performance and consists of the following elements: monitoring and measurement; non-conformance and corrective and preventive action; records; environmental management system audit; and management review.

A Performance Compliance Report was prepared to audit compliance with environmental commitments and conditions at the Dardanup Mine and Picton Dry Separation Plan for the first four years of mining operations. Audit items included the DEC Audit Table 484, the EMP's, the EMS and the DEC Licences to operate the mine and the dry separation plant. Compliance with these items was demonstrated in this Performance Compliance Report. It is anticipated that internal audits will be programmed whilst integrating the western extension proposal into Doral's EMS.

6.1.6 Review and Improvement

Management Review

System Procedure SP-12 *Management Review* was implemented for senior management to undertake reviews to assess the ongoing suitability and effectiveness of the EMS. It is anticipated that the frequency of Management Review will need to increase in light of incorporating the western extension proposal.

Doral continues to demonstrate a sound level of environmental performance and continual improvement. Doral is in an excellent position to incorporate the western extension proposal into their existing EMS in a rapid and best practice manner.

6.2 Risk Assessment for the Western Extension Proposal

Doral has conducted a risk assessment for all aspects of the western extension proposal. The key risks are shown in Table 6-4. For the purpose of this assessment, the risk matrix used is in line with the EPASU matrix and is shown in the following section.

6.2.1 Likelihood and Consequence Definitions and Risk Matrix

The following definition Tables 6-2 and 6-3 were provided to Doral by the EPASU in order to assess potential impacts and present them in a manner that is in line with the EPSAU risk matrix.

Table 6-2
Likelihood and Consequence Definitions

Likelihood Definition		Significance/Environmental Consequence	
Almost certain	• Is expected to occur in most circumstances • Common repeating occurrence • Planned occurrence/action	Catastrophic	• Widespread • Persistent • Threatens biodiversity at regional level • Extensive impacts at species and community level that are regionally significant • Requires massive intervention over long period of time

Likelihood Definition		Significance/Environmental Consequence	
Likely	• Will probably occur in most circumstances • Know to occur, or "it has happened"	Major	• Extensive impacts at vegetation community and species level that are locally significant • Widespread • Can be ameliorated over medium to long term • Requires intervention to ameliorate
Moderate	• Might occur at some time • Could occur or "I've heard of it happening"	Moderate	• Sub-lethal to humans • May cause significant deterioration of local communities (animals and plants) • Medium term • Requires some intervention to ameliorate
Unlikely	• Could occur at some time • Not likely to occur	Minor	• Nuisance value to humans • May cause adverse effects in sensitive individuals • Insignificant impact at population level • Some mortality amongst sensitive biota at community level • Short term • Minor intervention to ameliorate
Rare	• May occur only in exceptional circumstances • Practically impossible	Insignificant	• No impact on humans • Minor impact on biota • No intervention required • Short term • Instantaneous impact on biota

Table 6-3
Risk Matrix

	Consequences/significance					
Likelihood		**Insignificant**	**Minor**	**Moderate**	**Major**	**Catastrophic**
	Almost certain	Moderate	Moderate	High	Extreme	Extreme
	Likely	Moderate	Moderate	High	Extreme	Extreme
	Moderate	Low	Moderate	Moderate	High	High
	Unlikely	Low	Low	Moderate	High	High
	Rare	Low	Low	Low	High	High

6.2.2 Risk Assessment of Key Environmental Impacts

Key environmental impacts of the western extension proposal have been identified in Table 6-4 on the following page. A risk assessment has been conducted in order to:

- Identify pre-management risks (i.e. a 'do nothing approach').

- Set out the actions to mitigate these risks. This risk rating is recorded as "*pre-management risk*" in Table 6-4.
- Reassess the risk subsequent to the implementation of management actions. This risk rating is recorded as *'post-management risk'* in Table 6-4.

In all key environmental impacts, the risk was low to moderate post management.

A separate risk assessment was conducted specifically for fauna at multiple scales: site, local, landscape and regional (see Section 3.8). Management strategies will be addressed in the Fauna Management Plan.

Table 6-4
Risk Assessment of Key Environmental Impacts (Pre- and Post Management) of the Western Extension Proposal

Aspect	Item	Description of Potential Impact	Pre-Management Risk			Actions to mitigate risk	Post-Management Risk		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Disturbance of Potential Acid Sulfate Soils (PASS) which could lead to groundwater acidification and contamination by heavy metals and radionuclides, alteration to soil structure and 'acid scalds'. The risk of disturbing PASS material has been assessed at the following locations (see items 1 and 2 below). Note: oxidation of PASS located beyond the mine pit area as a result of drawdown is addressed in item 5 in "groundwater drawdown'.									
Impacts to Soil	1	Within the mine pits.	Unlikely	Minor	Low	PASS (520 BCM) which was identified at only one location within the mine pits has been mapped and will be avoided (i.e. not disturbed) by mining. If groundwater monitoring indicates oxidation of this PASS material from dewatering activities in the vicinity of this area, the groundwater contingency plan will be enacted (see item 2).	Rare	Moderate	Low
	2	Below the mine pits.	Moderate	Major	High	Groundwater drawdown from below the pit floor will be prevented by employing only suction pumps for dewatering activities (no submersible pumps will be used). Suction pumps will be installed at a designated height above the base of the pit (usually 0.5m) in order to maintain a saturated pit floor. Visual inspections will be conducted several times per day. If groundwater monitoring indicates oxidation of any PASS material the following groundwater contingency plan will be enacted: • Continue daily field monitoring to confirm the presence or absence of ASS; • Increase monitoring frequency for ASS parameters from monthly to fortnightly; • If groundwater quality does not return to background/acceptable levels, notify DEC in accordance with the timeframes set out by the *Contaminated Sites Act 2003* Part 2, Division 1, Section 11;	Unlikely	Moderate	Moderate

Aspect	Item	Description of Potential Impact	Pre-Management Risk			Actions to mitigate risk	Post-Management Risk		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
						• Determine the most appropriate remediation techniques in consultation with the DEC. This may include the use of various neutralising agents and a variety of treatment methodologies for soil, dewatering effluent and groundwater remediation; • Cease mining operations until groundwater quality returns to background/acceptable levels; and • Supply downstream water users with an alternative source of suitable quality water, if required.			
Draw-down of groundwater levels in the vicinity of the western extension area due to dewatering. The risk of potential impact from groundwater drawdown on the following sensitive receptors has been assessed:									
Impact to Ground water	3	Groundwater dependant vegetation.	Unlikely	Minor	Low	The Low Woodland of *C.obesa* has been excised from the mine plan (i.e. disturbance area), apart from where the overland conveyor and associated services traverses the southern area of the wetland Visual monitoring of canopy health will be undertaken monthly during dewatering activities and quarterly for the duration of mining. If monitoring data shows adverse findings, the following (one or more) contingencies will be enacted: • Minimise dewatering during susceptible months. • Artificial irrigation of (suitable quality) water to the affected areas. • Modification of mining activities (in keeping with the natural wetting and drying cycles). Adverse results may also trigger more detailed monitoring, including soil moisture testing.	Rare	Minor	Low

Aspect	Item	Description of Potential Impact	Pre-Management Risk			Actions to mitigate risk	Post-Management Risk		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Impact to Groundwater	4	Wetland sites, including CCW and REW.	Likely	Minor	Moderate	A buffer of 200m to the CCW from the proposed disturbance area will be established to minimise any risk of impact. See item 3 for contingency actions if monitoring data shows adverse findings.	Rare	Minor	Low
	5	Other land users.	Almost certain	Minor	Moderate	Only minor remnant drawdown is expected 8 months after mining operations have ceased. As a contingency, suitable quality water will be supplied to downstream users if required.	Moderate	Minor	Moderate
Alteration to the supply of surface water at sensitive receptors (*note surface water supply is already impacted at these receptor sites due to agricultural drainage)									
Impact to Wetlands, Surface Water and Flora and Vegetation	6	Sensitive receptors include: • Ephemeral creeks; • Wetland sites, including CCW and REW; and • The Low Woodland of C.obesa.	Likely	Moderate	High	• Any temporary disturbance to creek bed and banks will be undertaken as per the conditions of a permit to be obtained from DoW: • Rehabilitation works will reinstate the creeks to their previous natural state. Note: similar restoration works have been carried out successfully at the Dardanup Mine. • The Low Woodland of *C.obesa* has been excised from the mine plan (i.e. disturbance area), apart from where the overland conveyor and associated services traverses the southern area of the wetland. • As a contingency, suitable quality water will be supplied to wetlands and the Low Woodland of *C.obesa* if required, in keeping with the natural wetting and drying cycles. These cycles will be identified by the monitoring program.	Rare	Minor	Low

Aspect	Item	Description of Potential Impact	Pre-Management Risk			Actions to mitigate risk	Post-Management Risk		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Degradation of surface water quality at sensitive receptors.									
Impact to Surface Waters and Wetlands	7	Sensitive receptors include: • Ephemeral creeks; and • Wetland sites, including CCW and REW.	Moderate	Minor	Moderate	• All mine pit water is re-circulated through the mine process and therefore not directly discharged to surface waters. • In the case of an extreme rainfall event and excess groundwater flooding the pits, water will be discharged from the emergency discharge point. Before excess groundwater is discharged off site it will be pumped into a catchment sump, where it will be tested before being discharged into either the Harvey Water Irrigation Channel or the Dowdells Line Drain. Water to be discharged will meet strict water quality criteria, as per requirements for emergency discharge water in the DEC Licence for the Dardanup Mine. • The closest watercourse (Henty Brook) is located 1000m upstream and will not be impacted. • A buffer of 200m to the CCW from the proposed disturbance area will be established to further minimise any risk of impact. Ecological values and attributes will be improved at this wetland by fencing and establishing an understorey. This CCW is currently grazed by cattle. • The REW is situated 350m from the boundary of the nearest mine pit.	Rare	Minor	Low

Aspect	Item	Description of Potential Impact	Pre-Management Risk			Actions to mitigate risk	Post-Management Risk		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Impact to Vegetation of Conservation Significance									
Impact to Flora and Vegetation	8	Impact to one potential population (20 to 70 individual plants) of *Aponogeton hexatepalus* (Priority 4).	Moderate	Moderate	Moderate	• Conduct further field surveys to ascertain the presence of *A hexatepalus* in the western extension area. Field survey to be conducted in September 2009. Note: this population has not been found in recent surveys and it is unsure if it still exists. • Quarantine and fence off areas where the species is likely to be present.	Unlikely	Minor	Low
	9	Loss of 0.15% (2.17ha) of the Guilford Vegetation Complex. There is 4.4% of this vegetation complex (pre European) remaining.	Almost Certain	Moderate	High	• Implement Environmental Offsets which includes rehabilitation of approximately 20ha of Guildford Vegetation Complex. • Doral commit to providing $250,000 over 5 years to manage the offset area. • The area will also be fenced and a weeding program put in place.	Unlikely	Minor	Low
	10	Clearing of *C. obesa* to establish the overland conyeyor and associated services in the southern portion of this vegetation stand.	Almost certain	Moderate	High	• Minimise the requirement for access corridors by multiple use of easements and restrict vehicles and mining equipment to designated roads and mining areas. • Collect seed of local provenance for rehabilitation purposes. • Minimise the timeframe between disturbance and rehabilitation.	Rare	Minor	Low

Aspect	Item	Description of Potential Impact	Pre-Management Risk			Actions to mitigate risk	Post-Management Risk		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Impact to Fauna of Conservation Significance									
Impact to Fauna	11	Impact on Western Ringtail Possum foraging habitat in road reserves.	Moderate	Minor	Moderate	• A fauna management plan will be prepared with a specific recommendation that requires a suitably trained zoologist to be present to catch and translocate fauna. • Roadside vegetation will be retained when possible to provide a corridor for limited fauna movement and habitat. • Provision of additional habitat (20ha of Guilford Complex) provided as an Environment Offset.	Likely	Minor	Low
	12	Impact on Black Cockatoo's by a loss of foraging habitat (Marri's). There is evidence that the disturbance area has been used some time ago (historically) for foraging.	Moderate	Minor	Moderate	• A fauna management plan will be prepared with a specific recommendation that requires a suitably trained zoologist to be present to catch and translocate fauna. • Every effort will be made to avoid clearing trees with hollows that are suitable for nest sites for birds. • Roadside vegetation will be retained when possible to provide a corridor for limited fauna movement and habitat. • Provision of additional habitat (20ha of Guilford Complex) provided as an Environment Offset.	Likely	Minor	Low
Impact of Noise on Surrounding Residents.									

Aspect	Item	Description of Potential Impact	Pre-Management Risk			Actions to mitigate risk	Post-Management Risk		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Noise	13	There are 8 residences located between 703m and 1675m for the boundary of the disturbance area.	Almost certain	Moderate	High	The following management measures will be implemented to reduce noise emissions from the western extension area: • Optimise the layout and schedules of mining activities. • Place topsoil/overburden stockpiles and/or build noise bunds along the pit edges to mitigate noise propagation, including the use of noise attenuating fencing where practicable. • Build a noise bund along the south side of the access road and overland conveyor. • Place an ore stockpile or build a noise bund in the west and south sides of the road hopper. • Restrict mining activities during night/evening time. • Use quieter equipment where practicable. • Reduce the number of equipment items operating where practicable. • Set-up noise monitoring stations to monitor noise impacts at the closest residential locations. • Optimise the mobile equipment operations in different modes for different wind conditions. Contingency actions if noise levels are exceeded will include: • Attenuation of machinery where practical. • Amenities agreements will be sought with affected residents. • Temporary shutdown of relevant (noise generating) activities to ensure compliance during certain persistent wind conditions.	Moderate	Minor	Moderate

Aspect	Item	Description of Potential Impact	Pre-Management Risk			Actions to mitigate risk	Post-Management Risk		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Disturbance of sites of Aboriginal cultural significance.									
Impacts to Aboriginal Sites	14	Disturbance to sites identified as having cultural significance. (These have been identified as the CCW and the Low Woodland of *C.obesa)*	Unlikely	Moderate	Moderate	• A buffer of 200m to the CCW from the proposed disturbance area will be established to minimise any risk of impact. • Ecological values and attributes will be improved at this wetland by fencing and establishing an understorey. • The Low Woodland of *C.obesa* has been excised from the mine plan (i.e. disturbance area), apart from where the overland conveyor and associated services traverses the southern area of the wetland. • Implement an Aboriginal Heritage Management Plan in order to ensure that any cultural material, including skeletal material, unearthed in the course of the development is treated in accordance with the provisions of the *Aboriginal Heritage Act 1972*. • Doral will consult with the Gnaarla Karla Booja claimant group throughout the life of mine.	Rare	Moderate	Low

6.3 Summary of Environmental Management Commitments

Table 6-5 provides a summary of Doral's management commitments for the western extension. These commitments will be refined in consultation with the administering authority during the assessment and subsequent implementation of the proposal.

Table 6-5
Proposed Environmental Management Commitments

Number	Topic	Commitment	Actions to Achieve Commitment	Timing	Advice
1	Soil Resources	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.	March 2009	DoIR
2		Doral will implement an approved ASSMP to appropriately manage ASS material identified.	Adhere to the ASSMP (see Appendix – Soil) during the mining operation.	Duration of the operation	DEC
3	Groundwater	Doral will apply for a dewatering licence and provide the DoW with a Dewatering Management Plan.	Prepare and submit a Dewatering Management Plan and an application for a Dewatering Licence. Implement the Dewatering Management Plan.	March 2009	DoW
4		Doral commit to ensuring backfilled mine areas have the capacity to transmit water in a fashion similar to that which currently occurs.	• Implement the co-disposal techniques as per current mining activities at the Dardanup Mine. The pit volume is progressively filled 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.	March 2009	DoIR/DoW
5		Doral will comply with relevant legislation and guidelines for groundwater management.	Doral will licence all bores and other water management facilities, as required.	Duration of the operation	DoW
6		Doral will install an additional seven piezometers, including locating piezometers between the mine pits and the CCW and REW.	• The western extension proposal will be incorporated into the existing Dardanup Mineral Sands Project Groundwater Management Plan and the Plan will be enacted. • Adhere to groundwater monitoring requirements from the ASSMP; and • Update the water monitoring requirements of the Radiation Management Plan to include the western extension area and enact the Plan.	March 2009	DoW
7		Groundwater monitoring will be conducted in the vicinity of the western extension area.		Duration of the operation	DoW

Number	Topic	Commitment	Actions to Achieve Commitment	Timing	Advice
8	Surface Water	Doral will comply with Harvey Water's requirements including their approval letter, to: • Not impact on downstream users; • Consult with Harvey Water; and • Gain land owner approval to cut off irrigation water to their property.	• Liaise with Harvey Water and provide a plan to use the irrigation channel as a discharge point; • Continually liaise with Harvey Water and downstream land owners; and • Notify DEC of the emergency discharge point to be included in operation licence.	March 2009 and duration of the operation	Harvey Water/DEC
9		Doral will obtain all necessary permits for the temporary diversion of seasonal waterways.	• Submit the appropriate documentation for a permit to interfere with bed and banks; and • Site specific plans for each waterway will be developed to enable restoration works to pre-mine contours. These plans will be implemented when diversion of the waterways are completed.	Before mining waterways and post mining	DoW
10		Doral will supply suitable quality water to sensitive environmental receptors and land users in the vicinity of the mine should adverse impacts resulting from mining be detected.	• Liaise with landowners to ensure that bore yields are not significantly impacted. • Doral will assist in the maintenance of landowner bores and pumps for the continuation of bore yields. • Surface water supply will be monitored and maintained as per natural ecosystem processes at CCW, REW, and the Low Woodland of *C. obesa*.	Duration of the operation	DoIR/DoW/DEC
11		Doral will monitor surface water locations (including all wetlands) in the immediate vicinity of the western extension.	• The western extension proposal will be incorporated into the existing Dardanup Mineral Sands Project Surface Water Management Plan and the Plan will be enacted.	Duration of the operation	DoIR/DoW/DEC
12	Wetlands	Doral will fence the CCW and REW. This will provide a barrier to cattle and should assist in returning some associated wetland values.	• Fence CCW and REW. • Maintenance of fencing prior to and post rehabilitation for approximately 3 years post mining. • Covenant the CCW.	March 2009; maintenance prior to and post rehabilitation and for 3 years post mining.	DEC

Number	Topic	Commitment	Actions to Achieve Commitment	Timing	Advice
13	Vegetation and Flora	Doral will use seed of local provenance for revegetation.	Collect seed at the appropriate time of year and store to preserve seed viability.	Duration of the operation and post mining.	DEC
14		Doral will monitor the condition of the vegetation that is adjacent to the disturbance area during the life of the mining operation.	Monitoring (visual/photo) of vegetation condition every three months during mine operation, every month during dewatering activity in areas designated as GDE; and annually for 3 years post mining.	Duration of the operation and post mining	DEC
15		Doral commit to conducting further survey work to determine the presence or absence of a population of *A. hexatepalus* that has previously been recorded in the western extension proposal area.	• Quarantine and fence the area of the last recorded sighting of the population; • Conduct survey work in Spring 2009; and • Consult with the DEC on potential management strategies, based on the results of the survey.	Prior to site works commencing. Survey in Spring 2009.	DEC
16		Doral will fence 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.	Prior to commencing site works.	DEC
17		Doral will develop criteria for triggering infill planting.	Triggers will be determined in consultation with the DEC using the following assessment tools and mitigation measures: • Quarterly visual assessment of vegetation health, including weed assessment, will be undertaken for areas of vegetation remaining adjacent to the western extension area; • Monitor vegetation health on a monthly basis in GDE areas at risk, when dewatering activity is occurring; • Periodic review of the site species list to determine that the priority status of any particular species has not changed; • Appropriate remedial works including infill seeding and or planting will be undertaken; and • Recovery of the vegetation will be monitored against the baseline.	Duration of the operation	DEC

Number	Topic	Commitment	Actions to Achieve Commitment	Timing	Advice
18	Fauna and Rehabilitation	Doral will prepare a fauna management plan.	A qualified zoologist will prepare a fauna management plan which will include the following: • A trained zoologist will be present to manage fauna when large trees are being cleared. • Where possible clearing trees with hollows that are a suitable habitat for fauna will be avoided.	January/February 2009	DEC
19		Doral will retain roadside vegetation wherever possible as a corridor for limited fauna movement and fauna habitat.	Adequate instruction of mine plan design (to retain roadside vegetation) to earthworks contractors in order to ensure minimal disturbance.	Prior to site works commencing	DEC
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. Plant species selection will focus on fauna habitat and be of local provenance wherever possible.	Post mine disturbance	DEC
21	Air Quality (Dust)	Doral will actively implement dust controls to minimise the creation of airborne dust, and therefore its potential release across the boundaries of the mine site.	• Incorporate the western extension proposal into the existing Dardanup Mineral Sands Management Plan and enact the Plan. • During the pre-mine establishment phase in the western extension area, management actions will include (but not be limited) employing two water carts for dust suppression on unsealed roads and in new areas of ground disturbance.	Pre mine establishment and duration of operation.	DEC
22	Noise	Doral will actively implement noise controls to minimise the generation of noise, and therefore its potential to impact on surrounding residences.	• Include the western extension into the existing Dardanup Mineral Sands Project Noise Management Plan. Enact the Plan. • Implement findings from the acoustic modelling study (October 2008) and the additional modelling study (November 2008). If management strategies are exceeded the following contingencies will be enacted: i. Attenuation of machinery; ii. Where possible, reach amenities agreements with affected residences; and failing the above	Duration of the operation	DEC

Number	Topic	Commitment	Actions to Achieve Commitment	Timing	Advice
			iii. A temporary shutdown of relevant (noise generating) operations to ensure compliance during certain wind conditions.		
23	Greenhouse Gas Emissions	Doral will minimise greenhouse gas emissions.	• Restricting to a practical minimum the area of native vegetation to be cleared; • Progressively rehabilitating mine landforms and disturbed areas as they became available; • Synergistic linking of process steps where possible to reduce net greenhouse gas outputs; • Replacement of fossil fuels where possible with renewable; • Identification of energy efficient opportunities, conservation measures, and reduction in fugitive emissions when and where practical; • Using the methodology developed by the National Greenhouse Gas Inventory Committee to record and estimate emissions from mining activities; and • Consideration be given to carbon sequestration options including but not limited to forestry and revegetation activities, geological re-injection and any feasible options as they become viable.	Duration of the operation	DEC
24	Waste Management	Doral will dispose of wastes generated by the western extension in an appropriate manner.	• Update relevant Operating Procedures in the EMS (e.g. Hydrocarbon Management Procedure) to incorporate the western extension. Implement the Operating Procedures.	Duration of the operation	DEC
25	Aboriginal Cultural Heritage	Doral will consult with the Gnaala Karla Booja claimant group on a regular basis to: • Ensure members are well informed of the western extension progress. • Develop and implement an Aboriginal Heritage Management Plan.	Prepare and implement an Aboriginal Heritage Management Plan. The Plan will include a training program for relevant employees to assist in the identification and handling of any previously unidentified archaeological material. Consult the Gnaala Karla Booja claimant group on a regular basis for the life of mine.	March 2009 Duration of the operation	DIA

Number	Topic	Commitment	Actions to Achieve Commitment	Timing	Advice
26	Rehabilitation	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.	Annually	DEC
23	Environmental Offsets	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.	Within one year from the commencement of mining	DEC
24	Reporting	Doral will produce an Annual Environmental Report. Doral will produce an ASSMP Closure Report. Doral will report annually on the Environmental Offset.	• Prepare an Annual Environmental Report; • Prepare an ASSMP Closure Report; and • Prepare an Annual Report for Environmental Offsets that includes evidence of expenditure.	• Annually • Prior to Mine Closure • Annually	DEC
25	EMS	Doral will continue to implement the existing Dardanup EMS to ensure continual environmental improvement.	Continually improve the Doral Dardanup Mineral Sands Project EMS. Update all relevant aspects of the EMS for the Dardanup Mineral Sands Mine.	Monthly initially Yearly review	DEC

7 STAKEHOLDER CONSULTATION

7.1 Background

Iluka conducted stakeholder consultation during the period May 2005 to May 2008 in regards to their former proposal to mine the Burekup Mineral Sands Deposit.

7.2 Western Extension Proposal

Doral have engaged relevant stakeholders to discuss the proposal for a western extension to the Dardanup Mineral Sands Project. The Iluka table was used to identify stakeholders to be included in the Doral consultation process.

Key aims of the EPS document identified in Section 1.7 - Purpose and Scope of the EPS are to:

i. Provide evidence of the stakeholder consultation process that has been undertaken to communicate the proposal to the public and government agencies; and

ii. Demonstrate that responses from the consultation process have been incorporated (wherever relevant) into the environmental strategies and commitments for the management of biophysical, pollution and social factors relating to the proposal.

Evidence of the stakeholder groups consulted, the extent of communication and feedback from the stakeholders to the key issues raised (in relation to the proposed western extension) is demonstrated in Table 7-1 on the following pages. Doral's responses to the issues raised are also summarised in the table. Some of the main items from Table 7-1 are highlighted below:

- Land access agreements were negotiated with relevant neighbours (see Appendix - Land).
- Strategies to manage key concerns in relation to biophysical, social or pollution factors were discussed with the relevant GDMA.
- The proposal for a western extension to the Dardanup Mineral Sands Project was presented by Doral General Manager, Mike Ferraro, at an ordinary meeting of the Shire of Dardanup.
- A public meeting was organised by the Shire on 13 October 2008 in regard to proposed road closures associated with the western extension. No environmental concerns were raised by the public in the meeting.
- Neighbouring landowner environmental concerns related mostly to potential dust and noise off site impacts. Doral management strategies were explained in detail.
- Ethnographic survey was completed in consultation with the Gnaala Karla Booja Future Acts Committee was also consulted. Concerns relating to the wetlands were discussed and the Committee was satisfied with Doral's wetland management strategies. Ongoing monitoring for bones in the vicinity of the wetlands was agreed.

Table 7-1
Summary of Key Stakeholder Issues

Stakeholder Group	Extent of Communication	Key Issues/Questions Raised	Doral Mineral Sands Pty Ltd's Response
Shire of Dardanup	13 May 2008 - An initial proposed project briefing provided and an overview of possible road closures and timeframes.	No issues with proposed road closures as they presented several feasible alternative routes. Shire advised Doral to formally provide a brief to the Council at a Shire meeting. No other technical issues.	Doral submitted a detailed road closure report by 12 September 2008. Formal proposal of road closures was presented to the Council on 24 September 2008.
	8 September 2008 - A second briefing provided to discuss timing of road closures.	Shire Health Services to be consulted if any effluent treatment to be constructed. A public meeting would be required for effective consultation of the local community.	Doral to contact Manager Health Services to seek advice on effluent facility for western extension amenities. Doral requested a list of additional stakeholder contact details for consultation from the Shire. Doral agreed to hold a public meeting at Burekup on 13 October 2008.
	4 September 2008 - Shire Councillors briefed at meeting on the western extension project.	The Council was satisfied with how Doral were to address the following issues: • Affects on the irrigation; • Affects on the school bus route; and • Shire reserved their opinion pending the outcome of the planned public meeting.	Irrigators will not be affected. Consultation conducted with Harvey Water on this issue and respective landowners. Alternate road available to local school bus to ensure no doubling back on pick up route. Public meeting was held on 13 October 2008. See section in this table for outcomes of the meeting.
EPASU	27 August 2008 - Presented a brief and discussed the proposal to mine the western extension area, Iluka's draft EPS feedback, change in proponent and achievable timeline for an EPS approval.	Iluka would need to formally withdraw their proposal to enable Doral to be Doral for the western extension project. Likely level of assessment for the Doral project was indicated by the EPASU as being an EPS. The history of approvals for the Dardanup Mine be presented (visually) in a plan as part of the referral.	A referral document was submitted to the EPASU on 19 September 2008 including summary of approvals for the Dardanup Mine.

Stakeholder Group	Extent of Communication	Key Issues/Questions Raised	Doral Mineral Sands Pty Ltd's Response
	14 October 2008 - EPASU were telephoned to discuss level of assessment and timeline.	The level of assessment had not been set as Iluka had not yet formally withdrawn their proposal. The implications of change of proponency were uncertain but would not hold up the approvals process as not sure when the resources will become available, but may simplify things. Last EPA meeting this year is 11 December 2008 and making this meeting was very probable.	Withdrawal by Iluka was not planned to take place until settlement later in October 2008. Doral pursued Iluka to withdraw their proposal prior to settlement. Iluka withdrew their proposal on 15 October 2008 prior to settlement.
	10 November 2008 – Doral met with the EPASU to get feedback on the Draft EPS submitted on 17 October 2008. Doral is seeking advice/feedback on the Draft EPS in order to prepare a final EPS in time for the EPA meeting on 11 Dec 2008.	The EPASU response included the following points. If the disturbance area of the western extension proposal is located within the boundary of the Iluka disturbance area then the EPASU will not need to go back to the GDMA for advice before the 11 Dec meeting, apart from noise and fauna which contain the results of new survey and modelling work. Results of the new survey work need to be included in the EPS. The EPS needs to bring in more detail from the appendices in terms of management measures. The figures need to have more detail from the text. Where there are residual risks after best management practise the EPA looks for environmental offsets.	Doral committed to submitting an updated version of the EPS, as per the advice provided at the meeting within an agreed timeframe.
DEC Bunbury	14 August 2008 - A brief on Doral's proposal for the western extension.	It was indicated the western extension can be managed under one licence with the Dardanup Mine (through licence amendment). It would be the DEC's (Bunbury) preference the western extension was managed under one license.	Doral to provide a letter clarifying if a works approval is needed (as requested by DEC). This is currently being developed.

	12 September 2008 - A meeting was held onsite at the western extension area to discuss Doral's proposal, including feedback already provided to Iluka.	• Presence of Carnaby's and nesting hollows in Wandoo woodlands – DEC suggested mapping each tree that contain suitable hollows;
		• Dowdells Line/St Helens Road wetland (walked through area):
		  • Does not have values of a conservation category wetland. Need to provide comment on ecological water requirements i.e. impact of drawdown on vegetation.
		• Conservation Category Wetland (visited wetland site):
		  • Need to demonstrate hydrology won't be impacted.
		  • Monitoring bores need to be in place.
		  • Buffer extent is negotiable.
		  • Address other issues relating to a reduced buffer i.e. noise, dust.
		  • Suggestions of fencing wetland and possible rehabilitation zone of understorey plantings.
		  • Need to provide comment on ecological water requirements i.e. impact of drawdown on vegetation.
		• General comments:
		  • Keep informed of EPS process.
			Doral have commissioned additional studies on the wetlands, vegetation and fauna for the western extension. These issues have been summarised in Section 3.

Stakeholder Group	Extent of Communication	Key Issues/Questions Raised	Doral Mineral Sands Pty Ltd's Response
		• Address gaps in Iluka EPS. • Reference Whicher Report and relevance to project area. • Ensure vegetation is discussed in regional context. • Hydrology issues.	
DoW Bunbury	25 September 2008 - Doral held a meeting brief the DoW on the western extension. A letter from the DoW confirming the outcomes of this meeting is attached in the volume of appendices.	<u>Dewatering Licence</u> A dewatering licence will be needed, DoW require: • An application form, a copy of the Acid Sulfate Soils and Dewatering Management Plan and proof of legal access; and • If appropriate information is given to the DoW, the dewatering licence can be issued for the life of the mine. <u>Permit to Interfere with Bed and Banks</u> A permit to interfere with bed and banks must be submitted to DoW, along with a plan to re-establish the creeks after mining. <u>Emergency Discharge Point</u> • Liaise with Shire to discharge into Dowdells Line stormwater drain if required; • Liaise with Harvey Water for agreement to discharge into their drains if required; and • If using ephemeral creeks consult the DEC. <u>Additional comments</u> • The DoW need to know about any drop in the water levels of the CC Wetland; • Location of the bores will depend on the volume and location of dewatering and where current water users are located; and • Water balances for the site will need to be presented to DoW. <u>Mining Tenement Conditions with regards to the DoW:</u> • Condition 9 – Dewatering Licence is required; • Condition 12 – This will come under the current Dardanup Licence to Operate issued by the DEC; • Condition 13 – Yes, no further information required; and • Condition 25 – Application for permit to interfere with bed and banks, permission from Harvey Water.	Doral commit to submitting applications for a dewatering licence and a permit to interfere with bed and banks as required by the DoW. Doral have liaised with Harvey Water (see section in this table) for permission to discharge into the irrigation channel. Doral will liaise with the DoW with regards to the additional comments and will provide bore locations figures and water balances for the site. Monitoring of groundwater bores will be conducted during mining of the western extension, including monitoring of (proposed) piezometers between the wetlands and mine pits.
DoIR Perth	21 August 2008 - Brief provided on Doral's proposal for the western extension and request for approvals to run in parallel with the EPA.	Doral will need to prepare a Mining Proposal and present the proposal in draft form to allow DoIR to provide feedback to assist in meeting tight timeline. Agreement for approvals to run in parallel.	Doral are currently preparing a Mining Proposal.

Stakeholder Group	Extent of Communication	Key Issues/Questions Raised	Doral Mineral Sands Pty Ltd's Response
DEC (Environmental Management Branch)	24 November 2008 – Meeting at DEC Kensington to discuss environmental offset package.	DEC stated that Doral need to work through EPA Guidance Statement No. 19 (Environmental Offsets - Biodiversity) and identify the Critical Assets, the impacts on those assets and whether an offset is required. DEC considered the Guildford Vegetation Complex was poorly reserved and likely to warrant an offset even for land that is mapped as Degraded as the trees in the paddocks still provide habitat and corridors. DEC commented that any offset package should be drafted according to Figure 3 in the Guidance Statement and contain the elements of Principle G (offset needs to be clearly defined, registered, transparent, auditable and enforceable). The concept of covenanting land to the east that is in good condition was considered appropriate by DEC as part of an offset, together with rehabilitating (and if possible) covenanting the CCW on the site.	Doral will prepare an environmental offset and submit it to the DEC for informal comment prior to submitting the EPS to the EPA. The offset package was submitted to the DEC for comment on 25 November and comments received back from DEC on 25 November. Minor alterations made to the offset package as a result of comments.
Public Meeting – Burekup Hall	13 October 2008 - A public meeting was held at the Burekup Hall to discuss the proposed road closures in relation to the western extension. A brief presentation of the proposal was presented.	No environmental issues were raised during the question and answer session.	No response required.
Land Conservation District Committee (LCDC)	Meeting request by phone to Carmel Boyce (committee member) 17 October 2008. Email with information pack attached sent 17 October 2008 also requesting meeting with the committee.	No environmental issues were raised.	No response required.
Dardanup and Districts Residents' Association	2 October 2008 - Doral provided a briefing to the Association regarding the western extension proposal.	The expected noise impact and how Doral are going to manage the impacts. The duration of the closure of Dowdells Line.	The noise modelling has been completed. Doral commit to ensuring noise impacts on neighbours to the western extension comply with noise regulations. Refining of the noise modelling will be ongoing to ensure the appropriate outcomes are reached for the western extension. This satisfied the groups concerns. A two week closure of Dowdells Line was of no concern to the Group.
Harvey Water	7 October 2008 - A presentation to the Harvey Water management and technical staff for the western extension to provide a brief on	Harvey Water agree for Doral to alter the location of the channels for the purposes of mining the leases, ensuring: • Downstream users are not impacted. and ensuring normal flow to end users;	Doral will comply with Harvey Water's requirements as outlined in their approval letter. Doral to provide a plan for agreement to use the irrigation channel as an emergency discharge point.

Stakeholder Group	Extent of Communication	Key Issues/Questions Raised	Doral Mineral Sands Pty Ltd's Response
	potential impacts affecting the irrigation system.	• Doral consults with Harvey Water on the plan to do such before implementation and there is mutual agreement on the plan; and • Alternatively, Doral gains landowner written agreement to cut off irrigation water and provides this jointly signed advice to Harvey Water. Permission was granted to use the irrigation drain as an emergency flood water discharge point.	
Landowners	30 April to 13 October 2008 - Initial briefing on western extension provided to neighbouring and near-by land users.	• Compensation for any disturbance to land availability. • Interruption to irrigation water supply to end users. • Ensure rehabilitated soil structure would be maintained or improved, in particular the clay content at surface needs to be maintained. • Management strategy to minimise off site dust impacts. • Management strategy to minimise off site noise impacts (reversing beepers in particular). • Radiation issues present. • Impacts from blasting. • Potential impacts on groundwater levels.	Land access and compensation agreements have been settled with all landowners. Doral would ensure that irrigation supply was maintained in a manner that was agreed with landowner and Harvey Irrigation. Doral commit to returning soil to equal if not improved standard as part of rehabilitation program. As per Doral's licence conditions Doral have a Dust Management Plan for the Dardanup Mineral Sands Project. The Dust Management Plan will be updated to include the western extension. Management strategies (as outlined in Section 4.1 of this EPS). Doral would be operating within legislative requirements. Noise modelling for worst case scenarios is required for EPA approval. Heavy machinery will be fitted with reversing squawkers instead of traditional beepers as the sound travels far less. Naturally occurring radioactive minerals exist within the orebody. Tails concentrated with radioactive minerals (still relatively low but higher than background) is diluted back into the pit with non radioactive tails to end up at levels well below required levels. Doral have legislative requirements to ensure background radiation or lower is achieved at rehabilitation. Doral do not blast as part of the mining process. Doral mine relatively shallow. Doral dewater the superficial aquifer to the extent that we need to access with mining equipment. Doral have not seen impact from

Stakeholder Group	Extent of Communication	Key Issues/Questions Raised	Doral Mineral Sands Pty Ltd's Response
			mining via our monitoring bores. Doral have a monitoring program currently in place which will be updated for the western extension which DoW and the EPA will need to approve.
Native Title (Gnaala Karla Booja Future Acts Committee)	6 October 2008 - Meeting held on site to discuss the proposal for a western extension.	Wetlands were particularly important as it was a place where much of the food and water was sourced from. The group wanted to see the proposal be successful and understood its importance to Doral. As the wetlands are where people gatherings had occurred it is also the most likely place where burials may be present. Requested monitoring for bones around the wetlands.	Doral showed how the wetlands have been excised from the project and how Doral would be monitoring the health of the wetlands via measurement of the water table during the mining operation. Creek diversion and reinstatement was explained. The members were satisfied with Doral's method. Education for mining group in case burial sites or potential sites needed to be identified. Doral committed to notifying group of any significant sites and ceasing works nearby until assessed.

8 ENVIRONMENTAL OFFSETS

8.1 Overview

Discussion's with the DEC has determined that an environmental offset package is expected for the western extension in accordance with EPA Position Statement No.9 *Environmental Offsets* (EPA 2006b) and Guidance Statement No.19 *Guidance for Environmental Offsets* (EPA, 2006c).

The Environmental Protection Authority released its Final Guidance Statement Number 19 on Environmental Offsets - Biodiversity in September 2008. Environmental offsets are required by the EPA to counterbalance unavoidable adverse environmental impacts. Ideally the offset will achieve a net environmental benefit rather than replacement on a one-for-one basis. In considering environmental offsets, the EPA will have regard to the following eight principles:

Principal A - Environmental offsets should only be considered after all other reasonable attempts to mitigate adverse impacts have been exhausted;

Principal B - An environmental offset package should address both direct offsets and contributing offsets, as appropriate;

Principal C - Environmental offsets should ideally be 'like for like or better';

Principal D - Positive environmental offset ratios should apply where risk of failure is apparent;

Principal E - Environmental offsets must entail a robust and consistent assessment process;

Principal F - Environmental offsets must meet all statutory requirements;

Principal G - Environmental offsets must be clearly defined, publicly registered, transparent, auditable and enforceable; and

Principal H - Environmental offsets must ensure a long lasting benefit.

The objective of an offset is to counterbalance any residual significant environmental impact, aspiring to an overall environmental benefit from the project. Offsets target "like for like" or as near to as practical. For example, a reduction of biodiversity should be offset by a gain in biodiversity in a comparable area as opposed to a reduction in greenhouse gas emissions. The magnitude of the offset is in general terms proportional to the magnitude of the residual impact and the expectation for providing a net environmental benefit for the project.

8.2 Proposed Environmental Offsets

A summary of Doral's proposed environmental offsets, as required by Principal G of the EPA's Guidance Statement No.9 is detailed in Table 8-1.

Table 8-1
Environmental Offsets Summary

Section A: Administrative information
1. Proposal or scheme name: Proposal for a Western Extension to the Dardanup Mineral Sands Project to include the Burekup Mineral Sands Deposit. Doral Mineral Sands Pty Ltd.
2. Summary of proposal or scheme: The Burekup Minerals Sands Deposit (mining tenements M70/652 and M70/720) is located approximately 150km south of Perth and 11km east of Bunbury in the Shire of Dardanup. Doral propose to mine the deposit, commencing by mid 2009. The proposed mining includes the following key features: • Removal and stockpiling of 5.8 Million Bank Cubic Metres of overburden; • Removal of 9.5 Million tonnes of ore for the production of 900,000 tonnes of heavy mineral concentrate; • Construction of a conveyor belt to the existing Doral processing facilities immediately to the east of the orebody; and • Rehabilitation of the site after mining.
Section B: Type of environmental asset (s) – State whether Critical or High Value, describe the environmental values and attributes
Critical Assets • The area to be disturbed contains vegetation within the Guildford Vegetation Complex which is poorly reserved. The vegetation is mostly highly disturbed and exists as scattered to dense trees over pasture within paddocks as well as some more intact vegetation along road reserves. • One CCW occurs close to but outside the mine disturbance area (see Plates 8.2.1 and 8.2.2). • Some of the road reserve vegetation may provide foraging habitat for the Western Ringtail Possum at different times of the year. • Marri trees in the area have historically provided foraging habitat for Baudin's Black Cockatoo. Survey work carried out for this EPS saw no evidence that Black Cockatoos were currently foraging in the area. **High Value Assets** • The area contains a known population of the Priority 4 plant species *Aponogeton hexatepalus*. The population (2B on DEC's records) has had between 20-70 plants recorded from within a road reserve. Surveys by Mattiske in 2006 and 2007 did not re-locate this population.

Section C: Significant impacts (describe the significant adverse environmental impacts related to the proposal or scheme before mitigation measures are applied)

The proposal will result in the following adverse environmental impacts:

- Clearing of 0.13ha of Guildford Vegetation Complex in Very Good condition, 2.04ha in Good condition and 25.15ha in Degraded condition. Remnant vegetation in the western extension area is considered regionally significant as it is part of the poorly reserved (4.4% of pre European is remaining) Guildford Vegetation Complex (EPA, 2003). This complex is under the reserve requirement of 10% (currently 0.4% is reserved under existing and proposed regional open space). In summary, Doral will be clearing 0.15% (2.17 ha) of the Guildford Vegetation Complex that is rated Good to Very Good;
- Loss of approximately 450 trees from within paddocks and road reserves, the majority of which are Paperbark (*Melaleuca rhaphiophylla*) as well as some Marri (*Corymbia calophylla*) and Wandoo (*Eucalyptus wandoo*) trees;
- Potential indirect impact on the CCW;
- Loss of potential Western Ringtail Possum foraging habitat in road reserves;
- Loss of Marri trees that have been historically used (i.e. some time ago) as foraging habitat for Baudin's Black Cockatoos; and
- Potential loss of a population of *Aponogeton hexatepalus* (20-70 plants). Note: this population has not been found in recent surveys and it is unsure if it still exists (see Section D).

Section D: Mitigation measures (describe all measures to Avoid, Minimise, Rectify and Reduce)

- Loss of trees within the orebody footprint is unavoidable for a mining operation (see Section F for offset of clearing);
- A buffer of 200m will be set between the mine operations and the CCW. In addition, the following measures will be put in place to avoid any indirect impacts from dewatering:
  - Dewatering of the pit within the potential impact zone of the CCW will occur in winter as far as practicable and for as short a time as possible to avoid any impacts of local groundwater drawdown (the CCW is a perched wetland therefore groundwater drawdown is not likely to affect the hydrology of the wetland);
  - A monitoring program will be put in place to monitor the water levels in the CCW as well as tree health. Trigger values for water levels will be determined in consultation with DEC together with a contingency plan in the event that dewatering is considered to have an adverse impact on water levels in the CCW. Contingency measures could include irrigation of the CCW with the water from dewatering operations, or ceasing mining in the area until conditions allow for recommencement;

- Any road reserve that is required to be upgraded for the operation will be surveyed prior to design for the possible presence of Western Ringtail Possums, Western Ringtail Possum foraging habitat trees as well as Marri trees (foraging for Baudin's Cockatoos). Where possible, works will avoid areas of potential Western Ringtail Possum and Baudin's Cockatoo habitat; and
- The site where the population of *Aponogeton hexatepalus* has previously been recorded from will be quarantined and fenced until further works in winter and spring of 2009 confirm whether or not the population still exists. If the population still exists then DEC will be consulted on potential management options.

Section E: Significant residual impacts (describe all the significant adverse residual impacts that remain after all mitigation attempts have been exhausted)

- Clearing of 0.13ha of Guildford Vegetation Complex in Very Good condition, 2.04ha in Good condition and 25.15ha in Degraded condition.
- Loss of approximately 450 trees from within paddocks and road reserves, the majority of which are Paperbark (*Melaleuca rhaphiophylla*) as well as some Marri (*Corymbia calophylla*) and Wandoo (*Eucalyptus wandoo*) trees.

Section F: Proposed offsets for each significant residual impact (identify direct and contributing offsets). Include a description of the land tenure and zoning / reservation status of the proposed offset site. Identify any encumbrances or other restrictions on the land that may impact the implementation of the proposed offset and provide evidence demonstrating how these issues have been resolved.

1. Doral propose to secure and rehabilitate approximately 20ha of Guildford Vegetation Complex located within their Dardanup Mineral Sands Mine immediately to the east of the western extension area (see Figure 8-1). The area contains approximately 10ha of upland and valley/drainage line vegetation from the Guildford Complex, predominantly Marri and Jarrah woodland with some Banksia (*B. grandis* and *B. attenuata*). The condition of the remnant native vegetation is considered Good to Very Good. Approximately 10ha of the area is either completely cleared or parkland cleared. The valley part of the site is approximately 1.4km long and provides a corridor of good quality native trees linking the palusplain area to the west to vegetation on farms to the east (refer to Plate 8.2.3).

   The area is currently unprotected and not managed for its environmental values. Doral propose to place a conservation covenant over this land to give the site protection for its environmental values. In addition, Doral commit to providing $250,000 over 5 years to manage the area which will include rehabilitation of the degraded and parkland cleared areas with trees, and understorey where possible, that are consistent with the soil type and surrounding vegetation. The area will also be fenced and a weeding program put in place.

2. Doral commit to offsetting the approximately 450 trees to be cleared with the planting of 5,000 trees within the offset site described in point 1 above. Tree species for rehabilitation of this area are expected to be predominantly Marri trees with some Jarrah and Banksia trees.

3. Doral have support from the owners of the CCW to place the wetland and a buffer within a conservation covenant. The CCW Covenant Area has been agreed in principal in preliminary discussions with the owner and the DEC (see Figure 8-1). The details of the Conservation Covenant and associated management strategies will be finalised within one year from the commencement of mining. The CCW will be fenced and managed to improve its environmental values. Management will include weeding and rehabilitation with appropriate wetland species for the area. A CCW understorey rehabilitation plan and program will be designed in consultation with the DEC. Where possible, local provenance species will be included in the design of the understorey.

4. Post mining rehabilitation (to be incorporated in the Rehabilitation and Decommissioning Plan for the Project) will include the planting of trees within strategic corridors such as adjacent to road reserves and fence lines to link strengthen or improve corridors for native fauna. The areas for replanting will be determined in consultation with DEC and included in the Plan.

5. Doral will submit an annual report to the DEC outlining the status of the commitments in this section. The annual report will be for the 12 months following Ministerial approval. Annual reports will be submitted within 3 months of the end of each 12 month period.

6. The Annual report will provide summary evidence of expenditure by Doral for the maintenance of the Offset to the agreed amount of $250,000 over 5 years.

7. Doral will commit to finalising the covenant requirements and Rehabilitation and Decommissioning Plan for this area within 12 months of commencing mining.

Section G: Spatial data relating to offset site/s (see *EPA Guidance Statement No.19: environmental offsets- biodiversity*, Appendix 4)

Figure 8-1 of this offset is CAD-drafted figures and is spatially correct. The drafting file can be provided to the EPA on disc if required.

Section H: Relevant data sources and evidence of consultation (consultation with agencies, relevant stakeholders, community and references to sources of data / information). Include details of specific environmental, technical or other relevant advice and information obtained to assist in the formulation of the offset.

The Willoughby Offset Area proposed for covenanting and rehabilitation within the Dardanup Mineral Sands Mine area was surveyed by ATA Environmental in 2003. The Environmental Offset was discussed with the DEC in November 2008.

Plate 8.2.1: Conservation Category Wetland
(Dense canopy of Melaleuca overstorey within cow paddock)

Plate 8.2.2: Cattle grazing in Conservation Category Wetland

Plate 8.2.3: Willoughby's Offset Area

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