

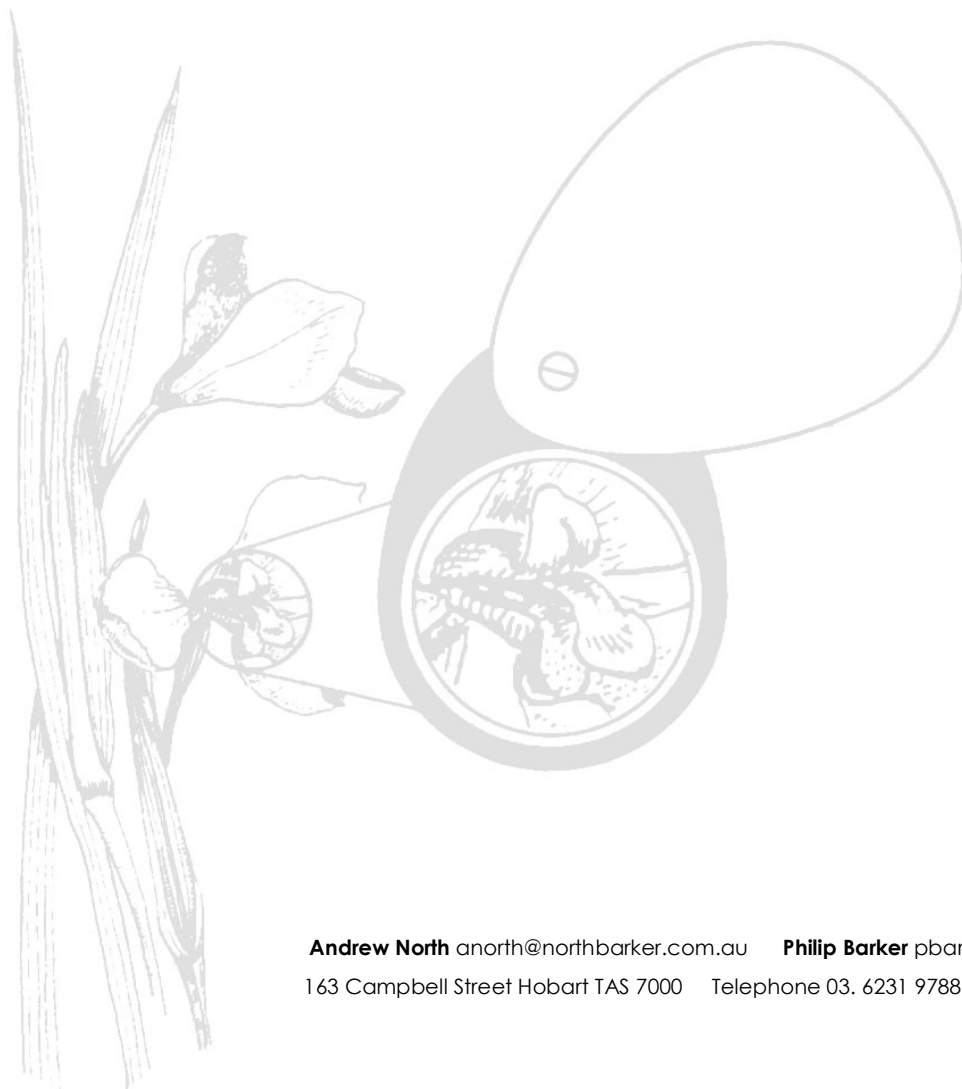


Nelson River – Shree Minerals Mine & Infrastructure Proposal

Flora and Fauna Habitat Assessment

22nd March 2011

For Shree Minerals



SUMMARY AND RECOMMENDATIONS

Shree Minerals has commissioned Pitt and Sherry to develop a Development Proposal and Environmental Management Plan (DPEMP) for the proposed Nelson Bay River Mine and associated infrastructure. The proposed Nelson Bay River site is located partly within the Arthur Pieman Protected area and partly on State Forest approximately 4 km inland from Couta Rocks and Nelson Bay on the west coast of Tasmania. The closest township is Arthur River, adjacent to the mouth of the Arthur River.

Pitt and Sherry has engaged North Barker Ecosystem Services to undertake a flora and fauna habitat assessment to assess the natural values of the deep pit/ open cut mine and associated infrastructure sites including waste dump, tailings dam, processing plant and direct shipping pit within the study area. In addition the balance of the exploration lease was also surveyed to allow for infrastructure to be moved at a later date without requiring additional survey. This report presents the findings of the vegetation and habitat assessment.

Vegetation Communities

None of the vegetation communities within the mining lease are threatened. The native vegetation communities recorded within the specific infrastructure areas identified are:

Deep pit/ open cut mine:

- Wet *Eucalyptus obliqua* forest over *Leptospermum* (WOL)
- Dry *Eucalyptus nitida* forest and woodland (DNI)
- Western wet scrub (SWW)

Direct shipping pit:

- Wet *Eucalyptus obliqua* forest over *Leptospermum* (WOL)
- Dry *Eucalyptus nitida* forest and woodland (DNI)
- Western wet scrub (SWW)

Processing plant:

- Western wet scrub (SWW)

Tailings dam:

- Wet *Eucalyptus obliqua* forest over *Leptospermum* (WOL)
- Dry *Eucalyptus nitida* forest and woodland (DNI)
- Dry *Eucalyptus obliqua* woodland and forest (DOB)
- Western wet scrub (SWW)

Waste dump:

- Wet *Eucalyptus obliqua* forest over *Leptospermum* (WOL)
- Dry *Eucalyptus nitida* forest and woodland (DNI)
- Wet heathland (SHW)

Vegetation within the mining lease but outside the proposed current impact zone:

- Wet *Eucalyptus obliqua* forest over broad-leaf shrubs (WOB)
- Wet *Eucalyptus obliqua* forest over rainforest (WOR)
- Wet heathland (SHW)

Threatened Flora

Two threatened flora species were recorded in the study area;

- *Epacris curtisiae* (northwest heath) - rare TSPA
- *Prasophyllum pulchellum* (pretty leek orchid) - endangered TSPA/ critically endangered EPBCA

While the impact zones remain as in this proposal, there will be no impact to either of these species.

Threatened Fauna Habitat

Five threatened and one migratory fauna species are considered to have suitable habitat within the study area;

- Tasmanian devil (*Sarcophilus harrisii*) - Endangered TSPA, Endangered EPBCA
- Spotted-tailed quoll (*Dasyurus maculatus maculatus*) - Rare TSPA, Vulnerable EPBCA
- Wedge-tailed eagle (*Aquila audax* subsp. *fleayi*) - Endangered TSPA, Endangered EPBCA
- White-bellied sea-eagle (*Haliaeetus leucogaster*) - Vulnerable TSPA
- Azure kingfisher (*Alcedo azurea* subsp. *diemenensis*) - Endangered TSPA, Endangered EPBCA
- Satin fly catcher (*Myiagra cyanoleuca*) – Migratory EPBC

Tasmanian devil and spotted-tailed quoll

Populations found in the study area are considered to be important populations for the recovery of both of these species.

The potential presence of maternal dens and impact on the carrying capacity through the removal of 194ha of habitat triggers a number of the criteria listed (see Section 6.1), including criteria 2 and 4. Other possible impacts include increased roadkill which could have a significant impact on population viability.

Wedge-tailed eagle and white-bellied sea eagle

A helicopter based nest search of all potential habitat within 1 km of any proposed disturbance and no nests were located.

Azure kingfisher

As the Nelson Bay River is the only waterway within the mining lease - but outside the impact zone of the proposed mine - that contains potential habitat for the azure kingfisher, there is expected to be no impact on this species. Surveys failed to locate any birds.

Satin fly catcher

Within the study area they were only recorded outside the proposed impact zone. However, the SPRAT (Species Profile and Threats Database) indicates a very wide range for habitat preference though generally focused on riparian vegetation. Riparian habitat does occur within the waste dump footprint but no birds were recorded there albeit there were limitations to access. If occupied by birds it is unclear whether such habitat is suited to breeding.

Pathogens

Phytophthora cinnamomi

No symptomatic evidence of *Phytophthora* was observed anywhere within the mineral lease area. Management of *Phytophthora* should be specifically addressed to ensure its introduction and spread is minimised to limit impacts to heathland species notably *Epacris curtisiae* (northwest heath).

Legislative implications

Obligations under the RFA require the loss of a reserve that is listed for conservation in a commitment binding on the Government (RFA CAR reserve), to be offset by formal reservation elsewhere. An offset strategy will need to be developed for the loss of a portion of the Arthur Pieman Conservation Area if the mine is approved.

Environment Protection and Biodiversity Conservation Act 1999.

It is recommended that referral is made to the Commonwealth under this legislation for the impacts to the tasmanian devil and the spotted-tailed quoll.

An eagle nest survey is recommended to determine the presence of nests within the impact zone or within 500m of a nest or 1 km line of site.

Threatened Species Protection Act 1995

No known impacts of the mine and associated infrastructure impact directly on any species protected under this Act.

Weed Management Act 2000

A weed control strategy and works plan, including a monitoring program and good hygiene protocols, is required to maintain the current weed free status for both declared and environmental weeds.

Recommendations

- 1) The project should be referred under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, for the potential impact to tasmanian devil, spotted-tailed quoll and satin fly catcher populations.
- 2) A weed management strategy should be developed that focuses on maintaining the declared and environmental weed free status of the site. This will require both a strict hygiene element including wash down of all machinery and equipment coming onto the site and a monitoring aspect.
- 3) A *Phytophthora* quarantine protocol should be developed focusing on wash down of machinery and equipment coming on site.
- 4) An offset proposal should be developed for the replacement of reserved land in the CAR reserve system.
- 5) The risk of unnecessary and indirect impacts on vegetation outside the 'footprint' of the development should be minimised by following these protocols:
 - a) Clearly define the extent of clearance required for the project, and ensure that no additional clearance occurs.
 - b) The works area should be marked and all works, vehicles and materials should be confined to the works area.

CONTENTS

SUMMARY AND RECOMMENDATIONS	I
1. INTRODUCTION	1
1.1 BACKGROUND AND AIMS	1
1.2 THE STUDY AREA AND TENURE	2
Figure 1 – The location of the survey area.	2
2. BOTANICAL SURVEY AND FAUNA HABITAT ASSESSMENT	3
2.1 BACKGROUND RESEARCH	3
2.2 FLORA AND FAUNA HABITAT SURVEY METHODS	3
2.3 LIMITATIONS	4
2.4 ASSESSMENT OF CONSERVATION SIGNIFICANCE	4
3. THE BIOLOGICAL VALUES	5
3.1 VEGETATION COMMUNITIES	5
3.1.1 Vegetation of the deep pit/ open cut mine	5
3.1.2 Vegetation of the direct shipping pit	6
3.1.3 Vegetation of the processing plant	7
3.1.4 Vegetation of the tailings dam	7
3.1.5 Vegetation of the waste dump	7
3.1.5 Vegetation within the mining lease but outside the proposed impact zone	8
Figure 2 Distribution of vegetation communities	13
3.2 THREATENED FLORA SPECIES	14
3.3 TERRESTRIAL FAUNA HABITAT	18
Figure 3 Distribution of threatened flora and threatened fauna habitat	19
3.4 FAUNA OF CONSERVATION SIGNIFICANCE	20
3.5 INTRODUCED PLANT SPECIES	25
3.6 PLANT PATHOGENS	26
<i>Phytophthora cinnamomi</i>	26
4. ASSESSMENT OF IMPACT	27
4.1 DOWN STREAM IMPACTS OF TAILINGS	27
4.2 NATIVE VEGETATION AND FAUNA HABITAT	27
4.3 FLORA	27
4.4 THREATENED FAUNA HABITAT	27
4.5 PATHOGENS	31
5. MITIGATION	32
6. LEGISLATIVE IMPLICATIONS	33
6.1 COMMONWEALTH <i>ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999</i>	33
6.2 TASMANIAN <i>THREATENED SPECIES PROTECTION ACT 1995</i>	34
6.3 FOREST PRACTISES ACT 1985	34
6.4 REGIONAL FOREST AGREEMENT	34
6.5 TASMANIAN <i>LAND USE PLANNING AND APPROVALS ACT 1993</i>	35

6.6 TASMANIAN <i>WEED MANAGEMENT ACT 2001</i>	35
7. SUMMARY AND RECOMMENDATIONS	36
APPENDIX 1A - DEFINITIONS OF CONSERVATION VALUES OF PLANT AND ANIMAL SPECIES	42
APPENDIX 1B - DEFINITIONS OF CONSERVATION VALUES OF PLANT COMMUNITIES	43
APPENDIX 2 - LEGISLATIVE IMPLICATIONS OF THREATENED SPECIES	44
APPENDIX 3 - FLORA SPECIES LIST	46
APPENDIX 4 - COMMUNITY SPECIES LIST	54

ACKNOWLEDGMENTS

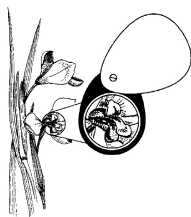
Client: Shree Minerals

Project Management: Philip Barker

Mapping: Sue Jungalwalla

Survey: Karen Ziegler and Kat Hopkins

Report: Philip Barker and Karen Ziegler



This work is protected under Australian Copyright law. © North Barker - Ecosystem Services, 2010. The report was written by North Barker Ecosystem Services under contract for Shree Minerals. The structure and format of this report cannot be used or reproduced by anyone for another purpose without the written permission of North Barker - Ecosystem Services.

1. INTRODUCTION

1.1 BACKGROUND AND AIMS

Shree Minerals has commissioned Pitt and Sherry to develop a Development Proposal and Environmental Management Plan (DPEMP) for the proposed Nelson Bay River Mine and associated infrastructure. The proposed Nelson Bay River site is located partly within the Arthur Pieman Protected area and partly on State Forest approximately four kilometres inland from Couta Rocks and Nelson Bay on the west coast of Tasmania. The closest township is Arthur River, adjacent to the mouth of the Arthur River.

Pitt and Sherry has engaged North Barker Ecosystem Services to undertake a flora and fauna habitat assessment to assess the natural values of the deep pit/ open cut mine and associated infrastructure sites including waste dump, tailings dam, processing plant and direct shipping pit within the study area. In addition the balance of the exploration lease was also surveyed to allow for infrastructure to be moved at a later date without requiring additional survey. This report presents the findings of the vegetation and habitat assessment.

Philip Milner Landscape Consultant Pty Ltd undertook a preliminary flora and fauna habitat assessment and constraints analysis in August 2008. This assessment extends the earlier work by targeting the survey effort within the areas proposed to be impacted directly by the mine and associated infrastructure. Additionally, areas outside of the proposed impact areas were surveyed to allow scope for moving operational areas at a later stage.

The natural values were surveyed in the following infrastructure areas;

1. The deep pit/ open cut mine.
2. The waste dump.
3. The proposed tailings dam.
4. The direct shipping pit from deep pit/ open cut mine to the processing plant.
5. The site road route from Wuthering Heights Road to the mine and associated mine infrastructure.

The assessment focuses on flora and fauna habitat values of high conservation significance. The preliminary survey was undertaken in August 2008. The targeted survey of the proposed mine and associated infrastructure occurred between the 16th and the 24th November 2010.

The aim of this report is to document the botanical values and terrestrial fauna values of the area to be impacted by the open cut mine and associated infrastructure sites including waste dump, direct shipping pit, tailings dam and processing plant, and recommend measures for mitigation and/or further survey. This report documents the results in accordance with the standard DPIPWEE brief for flora and fauna consultants.

1.2 THE STUDY AREA AND TENURE

The proposed Nelson Bay River Mine site is located partly within the Arthur Pieman Protected area and partly on State Forest approximately four kilometres inland from Couta Rocks and Nelson Bay on the west coast of Tasmania. The closest township is Arthur River, adjacent to the mouth of the Arthur River. It is situated in the Tasmanian King Island bioregion¹ (Figure 1).

The access road comes from Wuthering Heights Road, which is an all weather dirt road constructed for forestry purposes. This road system is gated to restrict unauthorised vehicular access. The standard of road drops sharply within the exploration area. The tracks within the exploration area have been used for accessing the area for the drilling program that has been undertaken in recent years. Access to the western portion of the study area was achieved by walking on slashed line through the heathlands which Parks has used as burning boundaries for control burns.

The study area is situated in the temperate climatic zone², and is classified as having no dry season with a mild summer. The rainfall is approximately 1058 mm per annum on average (based on the nearest reliable weather station at Marrawah a township north of the study area). The geology of the majority of the study area is metamorphosed quartzite.

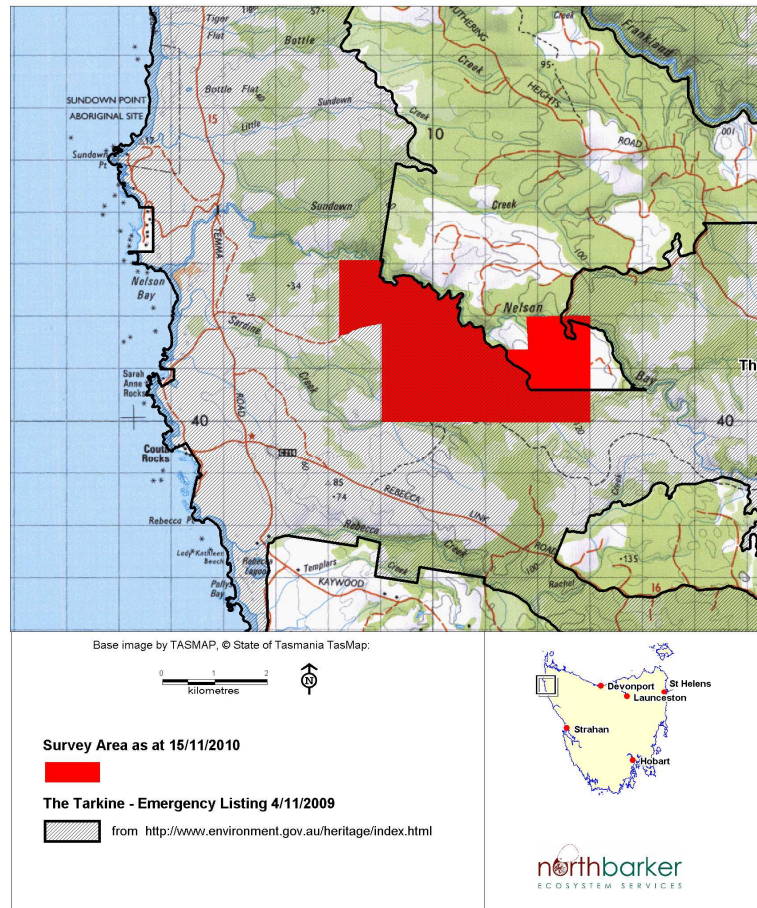


Figure 1 – The location of the survey area.

¹ IBRA 5, 1998

² Bureau of Meteorology Map of Climate Zones of Australia, 18/05/2001

2. BOTANICAL SURVEY AND FAUNA HABITAT ASSESSMENT

2.1 BACKGROUND RESEARCH

The following sources were used for biological records from the region:

- Natural Values Atlas ³ - DPIPWE database including biological records.
- Tasveg 2.0 Digital Data – As of September 2009 - This layer has been field truthed.
- EPBC search Tool⁴
- The Threatened Fauna Manuals⁵ - threatened species recorded from the Sundown & Temma map sheets (Tasmap, Tasmania 1:25 000 series).

2.2 FLORA AND FAUNA HABITAT SURVEY METHODS

Flora and Fauna Habitat

The detailed survey of the proposed mine and associated infrastructure occurred between the 16th and the 24th November 2010. A helicopter based eagle nest search was undertaken on 7th March 2011.

All types of vegetation and all perceivable habitats within it were investigated. Tasveg mapping (v2.0) was used to ensure that the variation in vegetation across the site was visited within each of the areas proposed to be impacted. Surveys were undertaken of the aquatic and riparian environment by walking down to the Nelson Bay River at eight points within the study area. The lower reaches of Nelson Bay River were also investigated to establish whether upstream passage was possible for various migratory fish species. All native and exotic vascular plant species encountered were recorded. All habitats were surveyed to describe the communities according to accepted floristic descriptions. The suitability of the habitat was considered for all threatened fauna species with potential to occur within the area. In particular, tasmanian devil dens, hollows suitable for masked owls, streams suitable to support azure kingfishers and nesting habitat for both goshawk and eagles were targeted for consideration.

Threatened Fauna

Surveys for threatened fauna were generally restricted to assessment of the suitability of habitat to support particular species, as well as observation of any evidence of their occurrence. Evidence of animals such as scats, feathers, bones and dens were noted, if observed.

Observations of any likely tasmanian devil dens such as large hollowed bases of myrtles or dry caverns made by fallen logs were inspected more closely for animal activity.

A specific survey was undertaken for azure kingfisher (*Ceyx azurea* subsp. *diemenensis*) along Nelson Bay River which was the only riparian area considered suitable for the species. The methods used were to watch and listen for 5 minutes at each site along the creek. Birds were also looked for as we walked along the creek incidental to the timed observations at likely locations.

³ GIS Unit, RMC, DPIPWE, NVA report 40737, 10th Nov. 2010

⁴ EPBC Act Protected Matters report, 15th Nov. 2010

⁵ Bryant & Jackson, 1999

2.3 LIMITATIONS

The flora survey of the mine and associated mine infrastructure areas was undertaken in mid November. It should be noted that no plant survey can guarantee that all vascular flora will be recorded during a single visit due to the limitations of the sampling strategy, seasonal and annual variation in abundance and the possible absence of fertile material for identification. In this case access limitations into thick scrub within the waste dump footprint limited sampling to cut lines entering the scrub up to 150 m from the margins. Ephemeral species that may have been overlooked include orchids, herbs and grasses that were not in flower at the time of survey. Additional species are likely to occur that may be recorded during repeated visits in different seasons over several years because of changing conditions. However, all significant species known or likely to occur in the vicinity of the study area are considered.

This study does not take into account non-vascular plants such as mosses and lichens.

Engineering requirements may require alterations to the locations of mine site infrastructure. Excluding the heathlands on the western side of the exploration lease any relocation of infrastructure would only carry a very low risk of encountering significant biodiversity values that have not been observed during the field survey.

2.4 ASSESSMENT OF CONSERVATION SIGNIFICANCE

Methods of assessing conservation status of vegetation communities and flora or fauna species are detailed in Appendix 1.

Vegetation types have been classified according to Tasveg 2.0⁶. The conservation status of a vegetation type relates to its current extent compared with the modelled extent prior to European settlement. This has allowed an estimate of the extent of loss to land clearing to be calculated. A recent amendment to the *Nature Conservation Act 2002* includes the listing of threatened native vegetation communities in accordance with their conservation status⁷.

Conservation status assessments at the regional level have not been undertaken for all vegetation. However, a regional analysis has been completed for forest communities for the Forest Conservation Fund⁸.

The State and Federal Governments are committed through the Regional Forest Agreements to achieving a Comprehensive Adequate and Representative (CAR) Reserve System (following JANIS criteria for reservation targets outlined in Appendix 1). Analysis of the reservation status of vegetation types in Tasmania (as per current Tasveg mapping) has also only been completed for forest communities as part of the Forest Conservation Fund⁹. No recent analysis exists for non forest vegetation.

The conservation significance of species is determined at a state and federal level by legislation (Tasmanian *Threatened Species Protection Act 1995* and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*), the implications of which are considered in the light of relevant legislation (Appendix 2).

⁶ Harris & Kitchener 2005

⁷ DPIW 2006

⁸ FCF 2007

⁹ FCF 2007

3. THE BIOLOGICAL VALUES

The distribution of vegetation and the impact upon it varies from region to region around Tasmania. The conservation status has been determined and presented at the State level and on a bioregional basis. A bioregion is an area that is similar in biological and physical characteristics throughout and hence the vegetation that occurs in it is generally characteristic of the region. Vegetation that is characteristic of a neighbouring or remote region but also occurs in the bioregion may be considered rare or threatened in one region but not in another. Consequently, the conservation status of any vegetation type may vary from bioregion to bioregion.

3.1 VEGETATION COMMUNITIES

General Description

All elements of the mine and associated infrastructure and the areas within the exploration lease outside the proposed impact area were surveyed during the recent visit. The vegetation surrounding the spur road off Wuthering Heights Road which is the access to the area has been logged and regenerated predominantly to native forest with small areas of eucalypt plantation of *Eucalyptus nitens*. Along the Nelson Bay River which forms much of the northern boundary of the exploration lease there is fire damaged *Eucalyptus obliqua* forest that is at the drier end of wet sclerophyll forest. For much of the water course the river is quite deeply incised creating a moister microhabitat. There is then a finger of predominantly wet heathy scrub that is dissected by the rough access track, from which mineral exploration tracks have been cut. The majority of the area that is designated to become the waste dump supports moderately tall *Eucalyptus obliqua* with extremely dense teatree understorey. The most westerly section is predominantly low wet heathland with variable proportions of graminoids and woody species depending on time since the last fire. Amongst and on the verges of the low wet heathland are areas of low *Eucalyptus nitida* woodland with shrubby or heathy understoreys depending on localised soil conditions.

Table 1 indicates the extent and reservation status for vegetation communities in the study area.

Figure 2 illustrates the extent of each vegetation community, modified from Tasveg version 2 (September 2009). The surveyed vegetation communities are significantly different from the current mapped by Tasveg.

In this section vegetation within separate parts of the study area is described under its relevant Tasveg mapping unit. Full community lists are given in Appendix 4.

3.1.1 Vegetation of the deep pit/ open cut mine

There are three distinct communities in this relatively small area. They are described below:

Wet *Eucalyptus obliqua* forest over *Leptospermum* (WOL)

On these soils in this area of the northwest of Tasmania where the vegetation would generally be expected to be forest dominated by *Eucalyptus nitida*, *Eucalyptus obliqua* are dominant. The trees are in general relatively short with a dense tall understorey. In this area the understorey is a mix of *Leptospermum* species and other shrubs, the dominants being *L. glaucescens*, *L. scoparium*, *Philotheca virgata*, *Monotoca glauca* and *Nematolepis squamea*. Due to the dense nature there are only occasional low shrubs, herbs and ferns, although these are relatively diverse.

Dry *Eucalyptus nitida* forest and woodland (DNI)

The dry *Eucalyptus nitida* woodland within the footprint of the deep pit/ open cut mine is a transitional community between the denser forest and the neighbouring scrub and heathland communities. In this location this community consists of regrowth *Eucalyptus nitida* trees that merge with a dense understorey particularly rich in myrtaceous species including *Leptospermum glaucescens*, *L. nitidum*, *Melaleuca squarrosa* and *M. squamea*. Other common shrubs include *Acacia mucronata*, *Bauera rubioides*, *Philotheca virgata* and *Banksia marginata*. Low shrubs are rich in the epacrid and the pea family in particular, and include *Bossiaea cinerea*, *Dillwynia glaberrima*, *Epacris impressa*, *Leucopogon collinus*, *Sprengelia incarnata* and *Aotus ericioides*. The height of the understorey is quite variable, ranging from approximately 2 to 8 m. Graminoids are frequent and intertwine with the shrubs to make an impressive thicket of under shrubs.

Western wet scrub (SWW)

This community has many species common to the Dry *Eucalyptus nitida* woodland described above, except with the eucalypts being only occasional or absent and the graminoids being more diverse and abundant. The drainage in this small area of western wet scrub is impeded and this is the most likely reason the eucalypts are absent and the reason herbs such as *Drosera* sp. and *Utricularia dichotoma* are so frequent. The community is an uneven scrub with *Leptospermum* sp., *Sprengelia incarnata*, *Philotheca virgata* and *Melaleuca* sp. dominating with *Acacia mucronata* being frequent. The graminoids are dominated by restionaceous species including *Baloskion tetraphyllum*, *Baumea* sp., *Eurychorda complanata*, *Hypolaena fastigiata* and other common species including *Xyris* sp., *Tetraria capillaris* and *Patersonia fragilis*. The ground cover typically includes the ferns and fern allies *Lindsaea linearis*, *Lycopodiella lateralis*, *Schizaea bifida* and *Selaginella uliginosa*.

This community has not been assessed for adequacy of reservation.

3.1.2 Vegetation of the direct shipping pit

The direct shipping pit contains the same three vegetation mapping communities as the deep pit/ open cut mine. It is comprised of WOL at the northern end and a mosaic of DNI and SWW throughout the remainder of this area.

Wet *Eucalyptus obliqua* forest over *Leptospermum* (WOL)

This community is as described for the deep pit/ open cut mine. It occurs immediately adjacent to the deep pit/ open cut mine on the eastern side.

Dry *Eucalyptus nitida* forest and woodland (DNI)

This community is as described for the deep pit/ open cut mine.

Western wet scrub (SWW)

This community is as described for the deep pit/ open cut mine.

3.1.3 Vegetation of the processing plant

Western wet scrub (SWW)

This community occupies the entire proposed processing plant area. It is generally as described in the deep pit/ open cut mine area except that there are only occasional patches of taller scrub which often includes *Banksia marginata*.

3.1.4 Vegetation of the tailings dam

Wet *Eucalyptus obliqua* forest over *Leptospermum* (WOL)

In this area the *Eucalyptus obliqua* are tall although there are many with seriously fire damaged crowns. The understorey is tall and dense with locally thick patches of *Gahnia grandis* and *Lepidosperma elatius*. In this area the understorey is dominated by *Leptospermum glaucescens*, *L. lanigerum*, *Melaleuca squarrosa*, *Philotheca virgata*, *Acacia mucronata*, *A. verticillata*, *Pomaderris apetala*, *Bauera rubioides*, *Monotoca glauca* and *Nematolepis squamea*. Due to the dense nature there are only occasional low shrubs, herbs and ferns, although they are relatively diverse.

Dry *Eucalyptus nitida* forest and woodland (DNI)

This community is the most extensive in the tailings dam area and is as described in the deep pit/ open cut mine area. The height and density of the *Eucalyptus nitida* is variable but the species composition is relatively consistent.

Dry *Eucalyptus obliqua* woodland and forest (DOB)

On the western edge of the proposed tailings dam there is a small patch of *Eucalyptus obliqua* woodland. It has a relatively open understorey with a graminoid and heath rich ground cover. Interestingly there is *Lepidosperma concavum* here which suggests better localised drainage and possibly better nutrient levels.

Western wet scrub (SWW)

This community occupies the eastern most edges of the tailings dam area and is as described in the proposed processing plant area.

3.1.5 Vegetation of the waste dump

Wet *Eucalyptus obliqua* forest over *Leptospermum* (WOL)

In this area the *Eucalyptus obliqua* over *Leptospermum* forest is as described for the tailings dam area.

Dry *Eucalyptus nitida* forest and woodland (DNI)

This community in the direct shipping pit is as described for the deep pit/ open cut mine. It forms a transitional community between the taller forest and the wet heathland to the west as is typical for this vegetation mapping unit.

Wet heathland (SHW)

There are three separate slivers of this otherwise extensive community within the proposed impact zone of the waste dump. The rare epacrid, *Epacris curtisiae* was not encountered within these slivers; however it was locally common and widespread in the wet scrubs. For a complete community description refer to the section outside the impact zone.

3.1.5 Vegetation within the mining lease but outside the proposed impact zone

Wet *Eucalyptus obliqua* forest over broad-leaf shrubs (WOB)

Eucalyptus obliqua forest over broad-leaf shrubs is widespread along most of the Nelson Bay River including the steeply incised banks and more extensively in the north eastern section of the mining lease that has been logged. In the unlogged forest along the river there is a fire damaged *Eucalyptus obliqua* layer with a tall understorey comprised of a mix of rainforest species and broad leaf shrubs and more sclerophyllous species commonly including *Eucryphia lucida*, *Nothofagus cunninghamii*, *Acacia mucronata*, *A. verticillata*, *Anopterus glandulosus*, *Leptospermum glaucescens*, *Oxylobium ellipticum*, *Pomaderris apetala*, *Prostanthera lasianthos* and *Zieria arborescens*. The lower shrubs include *Philotheca virgata*, *Pultenaea juniperina*, *Pimelea linifolia* and *Hibbertia empetrifolia*. Ferns and graminoids are a relatively minor proportion of the species composition.

The regeneration of this mapping community following logging and artificial regeneration is much more simplistic both structurally and in regard to species diversity.

Wet *Eucalyptus obliqua* forest over rainforest (WOR)

In the most north-eastern extremity of the study area surrounding the Nelson Bay River there is a small area of mixed forest that was burnt probably about 15 years ago. There are scattered mature *Eucalyptus obliqua* with an open understorey of rainforest species regenerating amongst broad leaf shrubs. The more common species include *Acacia melanoxylon*, *Atherosperma moschatum*, *Eucryphia lucida*, *Nothofagus cunninghamii*, *Anodopetalum biglandulosum*, *Pomaderris apetala* and *Olearia stellulata*. The ground ferns are dense in patches but of low diversity as are the herbs.

Wet heathland (SHW)

There is an extensive area of wet heathland on the western side of the mining lease area. It is in this area that there is an extensive population of rare (TSPA) heath *Epacris curtisiae* and a discrete population of the critically endangered (EPBCA) orchid *Prasophyllum pulchellum*. There are occasional emergent *Eucalyptus nitida* and *E. obliqua* and a rich diversity of shrub and graminoid species with ferns and fern allies typical of slow drainage and poor soils.

There is a mosaic of fire ages in the wet heathland which is a result of planned management fires (as demonstrated by the presence of slashed tracks that have been used as burning boundaries). Species composition does not alter hugely between the wet heaths burnt at different times apart from herbs including orchids that are more diverse and prolific in the sites burnt within the previous 4 years. In the earlier fire ages the graminoid proportion of the vegetation has greater biomass but as the community matures the shrubs become more dominant particularly the *Sprengelia incarnata*.

This area had been mapped by Tasveg as being buttongrass moorland, however there is only a very minor component of this species here. The more frequent graminoids include *Chordifex hookeri*, *Empodisma minus*, *Eurychorda complanata*, *Lepidosperma filiforme*, *Patersonia fragilis*, *Leptocarpus tenax* and *Xyris* sp. The more frequent shrubs include *Sprengelia incarnata*, *Melaleuca squamea*, *Aotus ericoides*, *Bauera rubioides*, *Bossiaea cinerea*, *Epacris curtisiae*, *Leucopogon collinus*, *Persoonia juniperina* and *Hibbertia procumbens*. Common herbs include *Drosera* sp., *Comesperma calymega*, *C. retusum*, *Sphaerolobium minus* and *Stackhousia viminea*. Frequent orchids include *Caladenia alata*, *Calochilus paludosus*, *Prasophyllum rostratum*, *Thelymitra aristata* and *T. juncifolia*. The ground cover typically includes the ferns and fern allies typical of poor drainage and low nutrient soils including

Gleichenia dicarpa, *Lindsaea linearis*, *Lycopodiella lateralis*, *Lycopodium deuterodensum*, *Schizaea bifida* and *Selaginella uliginosa*.

Table 1: Conservation and reservation status of the native vegetation communities in the study area.

Equivalent described floristic community ¹⁰¹¹	Equivalent Mapped Community ¹²	State Wide Conservation Status ¹³¹⁴	Bioregional Conservation Priority ¹⁵
Wet <i>Eucalyptus obliqua</i> forest over broadleaf shrubs			
OB1110 - <i>Eucalyptus obliqua</i> – <i>Anopterus glandulosus</i> - <i>Acacia verticillata</i> mixed forest	Wet <i>Eucalyptus obliqua</i> forest over broad leaf shrubs.	427 969* ha intact 138 590* ha reserved	63 134* ha intact 9 945* ha reserved Not threatened
OBo10 - <i>Eucalyptus obliqua</i> – <i>Olearia lirata</i> - <i>Pultenaea juniperina</i> wet sclerophyll forest	WOB 196.8 ha in study area	Not threatened Well reserved *analysis undertaken on WOU	Not adequately reserved *analysis undertaken on WOU
Wet <i>Eucalyptus obliqua</i> forest over tea tree			
	Wet <i>Eucalyptus obliqua</i> forest over <i>Leptospermum</i> WOL 198.4 ha in study area	427 969* ha intact 138 590* ha reserved Not threatened Well reserved *analysis undertaken on WOU	63 134* ha intact 9 945* ha reserved Not threatened Not adequately reserved *analysis undertaken on WOU

¹⁰ Kirkpatrick *et al* 1995.

¹¹ TasVeg 2003

¹² TasVeg 2003

¹³ Tasmanian Regional Forest Agreement

¹⁴ TasVeg Tenure Report 2006

¹⁵ Tasmanian Regional Forest Agreement

Equivalent described floristic community ¹⁰¹¹	Equivalent Mapped Community ¹²	State Wide Conservation Status ¹³¹⁴	Bioregional Conservation Priority ¹⁵
Wet <i>Eucalyptus obliqua</i> forest over rainforest			
	Wet <i>Eucalyptus obliqua</i> forest over rainforest WOR 5.8 ha in study area	427 969* ha intact 138 590* ha reserved Not threatened Well reserved *analysis undertaken on WOU	63 134* ha intact 9 945* ha reserved Not threatened Not adequately reserved *analysis undertaken on WOU
Dry <i>Eucalyptus nitida</i> forest and woodland			
	Dry <i>Eucalyptus nitida</i> forest and woodland DNI 210.6 ha in study area	52 895 ha intact 36 172 ha reserved Not threatened Well reserved	16 514 ha intact 5 808 ha reserved Not threatened Well reserved
Dry <i>Eucalyptus obliqua</i> woodland and forest			
	Dry <i>Eucalyptus obliqua</i> woodland and forest DOB 4.4 ha in study area	179 129 ha intact 56 641 ha reserved Not threatened Well reserved	9 298ha intact 1 863 ha reserved Not threatened Not adequately reserved
Western wet scrub			
	Western wet scrub SWW 75.2 ha in study area	Not assessed for conservation and reservation status	Not assessed for conservation and reservation status
Wet heathland			
<i>Sprengelia incarnata</i> – <i>Bauera rubioides</i> – <i>Lepidosperma filiforme</i> heath	Wet heathland SHW 242.4 ha in study area	Not assessed for conservation and reservation status	Not assessed for conservation and reservation status



Wet *Eucalyptus obliqua* forest over broad-leaf shrubs (WOB).



Wet *Eucalyptus obliqua* forest over broad-leaf shrubs (WOB) in the riparian zone of the Nelson Bay River.



Dry *Eucalyptus nitida* woodland over wet heathland (DNI).



Regenerating dry *Eucalyptus nitida* woodland (DNI) in foreground with wet *Eucalyptus obliqua* forest over *Leptospermum* (WOL) in background.



Western wet scrub in the vicinity of the proposed processing plant (SWW).



Wet heathland typical of western portion of study area (SHW).



Wet *Eucalyptus obliqua* forest over broad-leaf shrubs (WOB) regenerating after logging.



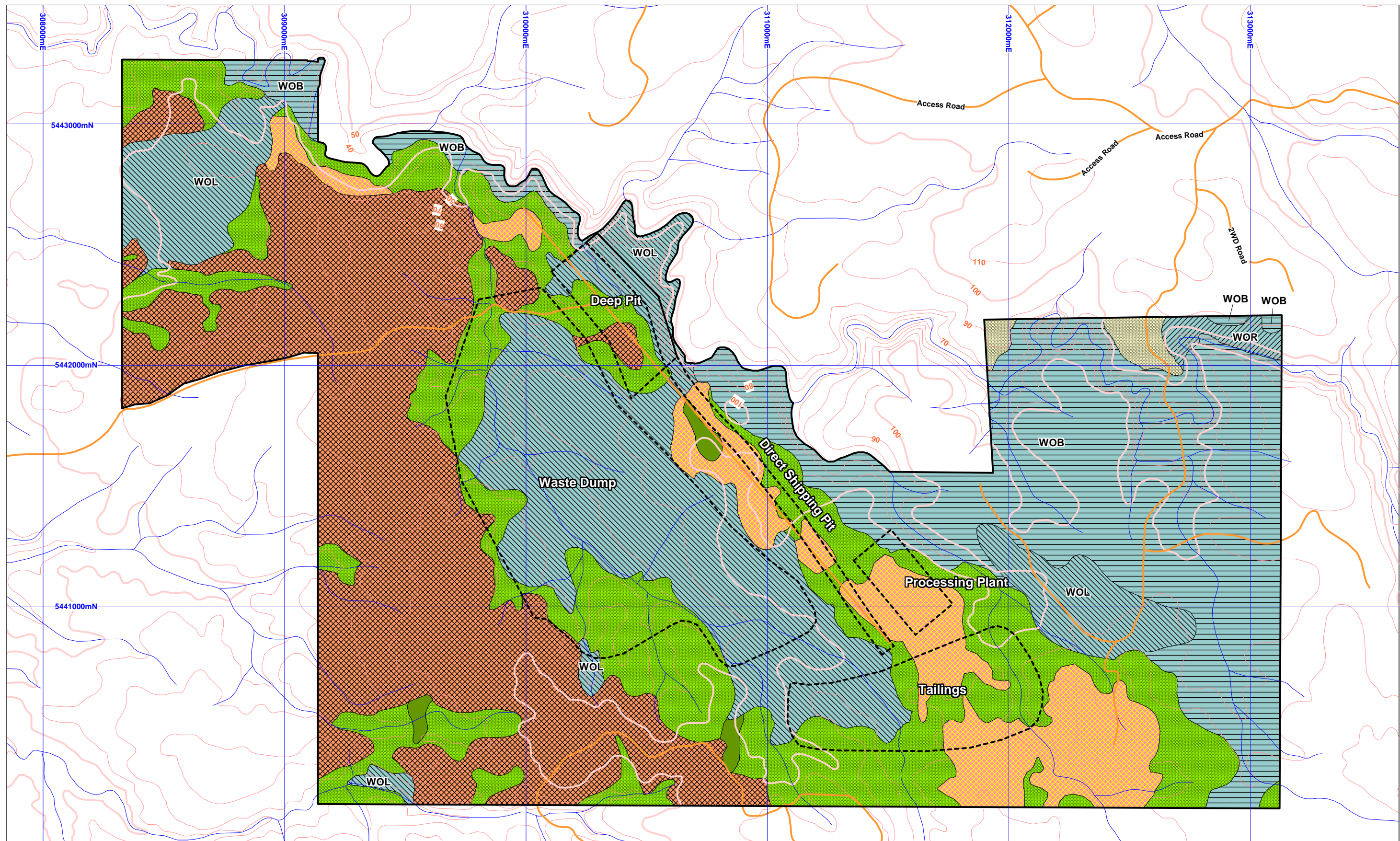
Wet *Eucalyptus obliqua* forest over *Leptospermum* (WOL) regenerating after logging.



Dry *Eucalyptus obliqua* of mallee form in small localised patches in the study area.



Wet *Eucalyptus obliqua* forest over *Leptospermum* (WOL) in the vicinity of the waste dump.



Vegetation Communities

(Using Tasveg 2.0 mapping units)

- DNI Eucalyptus nitida dry forest and woodland
- DOB Eucalyptus obliqua dry forest and woodland
- FPL Plantations for silviculture
- SHW Wet heathland
- SWW Western wet scrub
- WOB Eucalyptus obliqua forest with broad-leaf shrubs
- WOL Eucalyptus obliqua forest over Leptospermum
- WOR Eucalyptus obliqua forest over rainforest

Survey Area & Proposed Infrastructure

9/11/2010

- Infrastructure - as labelled
- Survey Area

The mapping has been undertaken using a hand held GPS and subjective interpretation. Consequently it should be considered indicative only.

Base data from theLIST, © State of Tasmania Datum: GDA94, AHD Grid: MGA Zone 55



0 250 500m
metres
(1:15 000 at A3)

Figure 2:

Vegetation Communities



PAS062 11/1/2011

3.2 THREATENED FLORA SPECIES

A total of 160 vascular plant species were recorded during the survey, including 12 endemic and only three introduced species, none of which are declared weeds. There was a paucity of aquatic flora as the creeks and rivers were generally small or fast flowing and very high in tannin which limits the penetration of light into the water and thus reduces the opportunity for aquatic flora growth. A full species list is given in Appendix 3.

Two threatened vascular plant species *Epacris curtisiae* – northwest heath (rare) and *Prasophyllum pulchellum* - pretty leek-orchid (endangered) listed under the schedules of the Tasmanian *Threatened Species Protection Act 1995* were recorded from the study area. *Prasophyllum pulchellum* - pretty leek-orchid is also listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* as critically endangered. Neither of these species were recorded from any of the proposed mine or associated infrastructure areas. Only if the configurations of the proposed mine layout and access routes change will there be a threat to these populations.

Table 2 lists threatened plant species previously recorded within a 5 km radius of the study area. Notes on the habitat and the likelihood of the species being in the study area are included. The previously recorded species *Epacris curtisiae* - northwest heath was encountered in significant numbers with widespread distribution associated with the wet heaths on the western side of the study area.

Table 2: Threatened Flora Species previously recorded in the vicinity (within 5km)¹⁶.

Species Name	Conservation Status ¹⁷		Previous records, preferred habitat and other observations. ¹⁸
	TSPA/ EPBCA	Potential to occur	
<i>Caladenia dienema</i> Windswept spider orchid	Endangered/-	LOW	Listed on EPBCA website. Known from coastal scrub and wind swept coastal grassland and heaths amongst stunted shrubs and sedges on moist to well-drained sand and clay loams. Peak flowering is late October to early November. Potential flowering is all of October and November. There are several recent records for this species from late 2008 and 2009 between Tiger Creek and Sundown Creek, and near Couta Rocks. A site known to support this species was visited and plants had finished flowering. A chance meeting with Janine Cranney suggested that flowering for the windswept orchid had been early this year although they have seen a solitary specimen on the 21 st of November in DOB at Callagans Scrub <i>pers. comm.</i> As the study area is considerably inland it is unlikely that this species occurs on the site although the grid reference for the one record may be incorrect as the location places it in thick woodland.
<i>Caladenia caudata</i> Tailed spider-orchid	Vulnerable / VULNERABLE	LOW (heathland)	Listed on EPBCA website but no records from far NW Tasmania, although known from Rocky Cape NP where there is similar habitat.
<i>Caladenia pusilla</i> Tiny fingers	Rare/ -	LOW	Is known to occur predominantly in heathland and moorland close to the coast on well-drained peaty and sandy soils. Flowering appears to be stimulated by fire with plants more common at sites burnt 3 to 5 years

¹⁶ Natural Values Report 15/11/2010, DPIW, report no. 40737

¹⁷ Tasmanian *Threatened Species Protection Act 1995* / *Environmental Protection and Biodiversity Conservation Act 1999*.

¹⁸ Tasmanian State Government 2008a,b,c

Species Name	Conservation Status ¹⁷		Previous records, preferred habitat and other observations. ¹⁸
	TSPA/ EPBCA	Potential to occur	
			previously. Peak flowering all of October and early November. Potential flowering is all of October and all of November. Perhaps the study area is too far inland to be good habitat. Not recorded during survey.
<i>Corunastylis brachystachya</i> Shortspike midge orchid	Endangered/ ENDANGERED	LOW	Listed on EPBCA website. This species is known presently from Rocky Cape National Park and near Stanley from heathland and heathy eucalypt woodland on well drained rocky sites and found most recently in March 2010 within 5km of the study area from two populations. The few records of this species suggest a peak flowering period in March, though there is potential to flower throughout February to April.
<i>Cullen microcephalum</i> Dusky scurfpea	Rare/ -	NONE	This species is known from well-drained rocky areas in the salt spray zone. There is no suitable habitat within the study area.
<i>Diuris lanceolata</i> Large golden moths	Endangered/ ENDANGERED	NONE	Listed on EPBCA website. This species is known in coastal scrub and wind swept coastal grassland and heaths amongst stunted shrubs and sedges on moist to well-drained sandy and clay loam, and occasionally on rock outcrops. Peak flowering is November but potentially may extend through December and January. Targeted surveys in the summer of 2008/2009 located extant populations near Sundown Point and near Rebecca Lagoon. This species is unlikely to extend as far inland as the study area.
<i>Epacris curtisiae</i> Northwest heath	Rare/-	PRESENT	This species is endemic to Tasmania with its stronghold in the NW, and it occurs in peaty soils or undulating terrain in association with heathlands, graminoid heaths and buttongrass scrub in the northwest. It occurs in altitudes below 300 m. There are many records in the vicinity of the study area, though it is significant that the records from the current survey extend across the northerly extent of the distribution.
<i>Lotus australis</i> Australian trefoil	Rare/ -	NONE	In Tasmania <i>Lotus australis</i> has been described as being “local on sandy coasts” and has been recorded around the coast north from Macquarie Harbour to Bicheno with few records from offshore islands. Habitat is described as <i>Poa</i> tussock grassland, low coastal shrubbery and on dunes. The author has seen species on sandy loams derived from basalt on Trefoil Island. This species has colourful pink flowers and characteristic ‘birdsfoot’ clusters of seed capsules. The study area does not contain suitable habitat.
<i>Phyllangium divergens</i> Wiry mitrewort	Vulnerable -	NONE	This is a small annual herb which inhabits open coastal, periodically inundated areas often on sand or clay overlying rock. It is predominantly known from eastern Tasmania though recent surveys in 2008 & 2009 have identified this plant as widespread and locally abundant in the Arthur-Pieman CA. It flowers in October to November. The study area does not have suitable habitat.
<i>Prasophyllum favonium</i> Western leek orchid	Endangered/ CRITICALLY ENDANGERED	MODERATE	Listed on EPBCA website. A species of windswept wet heaths that likes fire. It potentially flowers from the start of October to early December, with a peak in early November. There are records from recent surveys in late 2008 near Couta Rocks and the Heemskirk Road. The wet heathland on the western boundary has the greatest potential to contain this species although it was not recorded during this survey.

Species Name	Conservation Status ¹⁷		Previous records, preferred habitat and other observations. ¹⁸
	TSPA/ EPBCA	Potential to occur	
<i>Prasophyllum pulchellum</i> Pretty leek orchid	Endangered/ CRITICALLY ENDANGERED	PRESENT	Listed on EPBCA website and there are 6 records from nearby at the same location over 4 years. The population that was found in the study area is in wet heathland at the edge of a slashed track. The time since last fire is about four years. There are 20 plants flowering in an area of 3 square metres.
<i>Prasophyllum secutum</i> Northern leek orchid	Endangered/ ENDANGERED	NONE	Listed on EPBCA website. Known to occur in grassy dune swales. Rosette and flower production is dependent on a fire in the preceding season. There is potential for this species to flower between October to December, with a peak in November. There are no grassy dune swales within the study area.
<i>Pterostylis rubenachii</i> Arthur River greenhood	Endangered/ ENDANGERED	NONE	Listed on EPBCA website. This species is only known from the Arthur River area from dry sandy slopes of sparsely vegetated stabilised sand dunes and in the vastly different environment of permanently wet/moist scrubby and sedgy coastal heath converted to semi improved pasture by slashing and cattle grazing. Potentially flowers from October to November, with the peak flowering period in early November. No similar habitat in the study area.
<i>Spyridium vexilliferum</i> var. <i>vexilliferum</i> Helicopter bush	Rare/ -	LOW	Locally frequent in the Couta Rocks area – this population is considered to be one of the key populations in Tasmania. The species is found in sandy heaths and rocky outcrops. It is unlikely that this species would occur in the predominantly wet heaths of the study area.
<i>Xerochrysum bicolor</i> Eastcoast everlasting	Rare/ -	LOW	Known from vastly different habitats of heathlands near the coast or in alpine situations. In coastal situations it is known more commonly from the east. There are some west coast records however it is unlikely to be in the denser wet heaths away from the coast as found in the study area.

***Epacris curtisiae* – northwest heath**

Epacris curtisiae - northwest heath, listed as rare on the Tasmanian *Threatened Species Protection Act 1995* is a Tasmanian endemic. It occurs in heathland and moorland in a localised area mainly confined to the Dempster Plains, Frankland River catchment and western slopes of the Norfolk Range between the Arthur and Pieman Rivers. A survey of populations of *Epacris curtisiae* in 2009 to determine the impact of the proposed Tarkine Road¹⁹ found that some of the populations were found to be large and estimated to number in the tens of thousands with others much smaller.

In the study area at Nelson Bay River the population of *Epacris curtisiae* in the wet heathland on the western edge of the mineral exploration lease is very extensive and contains large numbers of plants. An estimate would put the population between 1 to 2 million plants spread across the heathland on the western side of the study area. The density varies considerably but there is generally at least 1 plant per 10 square metres

¹⁹ North Barker Ecosystem Services (13 May 2010) Tarkine Drive North West Tasmania

and can be up to 8 for mature plants and even higher where plants are regenerating from seed after fire. There are both seedlings and coppice growth of plants after fire from about four years ago. The extent that has been mapped (see Figure 3) is the core area but it is likely that other populations also occur in other areas of wet heath out of this core population.

Epacris curtisiae is thought to be sensitive to *Phytophthora cinnamomi* as seen from symptomatic evidence during the survey in 2009 of the Tarkine Road. Along the Tarkine Road *Phytophthora cinnamomi* symptoms were evident at a number of sites. This evidence mainly took the form of dying *Sprengelia incarnata* plants, and at one site there was also dying *Banksia marginata*. There was no symptomatic evidence of *Phytophthora cinnamomi* at all within the study area.

Currently, the heathland where the northwest heath occurs is outside the impact zone. Therefore there is no immediate threat to this population. It is also apparent after using a slashed track of the Rebecca road that the population also extends to the south at least another 2 km because plants were recorded along the entire route between the study area and the Rebecca Road. Unless the impact zone is to change there is no immediate work required to refine a population estimate for this species within the study area.



Epacris curtisiae (northwest heath) in wet heathland in western portion of study

***Prasophyllum pulchellum* – pretty leek orchid**

Prasophyllum pulchellum - pretty leek orchid, listed as endangered under the schedules of the TSPA and as critically endangered under the EPBCA, was recorded in the southern end of the wet heathland on the western side of the study area. The population is composed of 20 plants that were in various stages of flowering. In most plants the flowers were spent although some were still flowering strongly. The small discrete population was beside a track in an area that machinery had turned around on. A fire was estimated to have burnt the heath approximately four years ago. This population occurs on the 1:25,000 Sundown sheet and is a new addition to known populations in the Arthur-Pieman region on the Balfour and Bluff 1:25,000 map sheets.

Prasophyllum pulchellum is endemic to Tasmania from widely scattered localities in the west, northwest and south of the state, generally in coastal areas.²⁰ Given the small compact nature of the subpopulations of this species it is highly likely that other patches occur, perhaps even within the study area. However, as the wet heathland on the western side of the study area is outside the impact zone there is no immediate threat to the population or potential habitat within the mining lease.

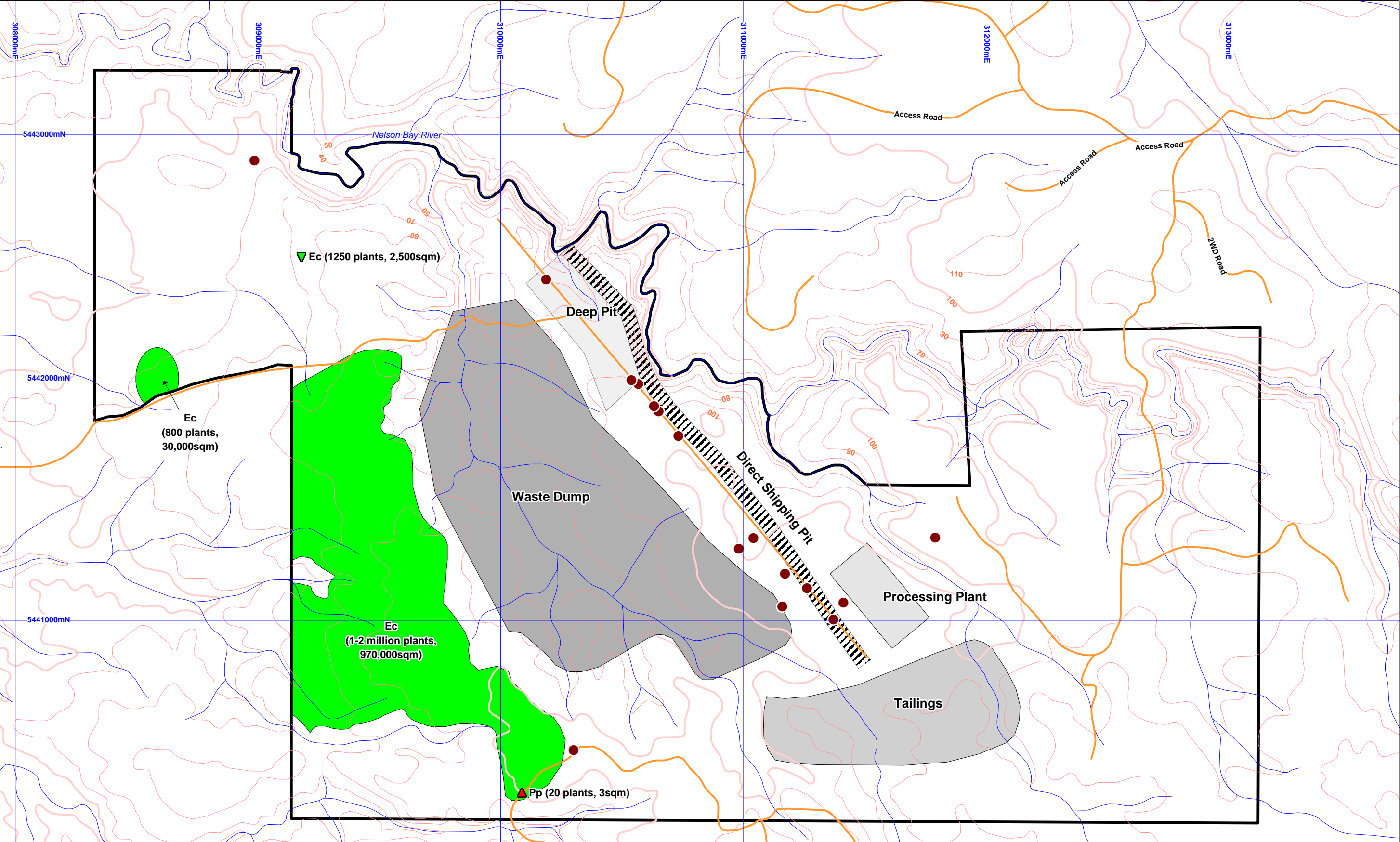


Prasophyllum pulchellum (pretty leek orchid)

3.3 TERRESTRIAL FAUNA HABITAT

The study area contains a diverse range of habitats including low heathlands, dense wet scrub, dry sclerophyll forest and wet sclerophyll forest with fire damaged old growth and considerable riparian habitat within an altitudinal range from approximately 20 m asl to about 120 m asl. The complexity of structure across the different habitat types provides suitable habitat for a range of bush birds and mammals. The presence of old growth eucalypt trees means there is potential for nesting and roosting habitat for hollow using fauna and eagles. Logs on the ground in the eucalypt woodlands and forests are potential habitat for mammals and invertebrates. Deep litter in the mature wet sclerophyll forest is favourable for invertebrates.

²⁰ Threatened Species section (2010) *Listing Statement for Prasophyllum pulchellum (pretty leek orchid)*. Department of Primary Industries, Parks, water and Environment, Tasmania.



Threatened Flora (Status: TSPA/EPBCA)

See map for number of plants

- Ec Epacris curtisiae (r/-)
- Pp Prasophyllum pulchellum (e/EN)
- Ec Epacris curtisiae (r/-)

Threatened Fauna Habitat

- Sarcophilus harrisii (tasmanian devil) (e/En) - scats present

Survey Area & Proposed Infrastructure
9/11/2010

- Deep Pit
- Direct Shipping Pit
- Processing Plant
- Tailings
- Waste Dump
- Survey Area

Base data from theLIST, © State of Tasmania Datum: GDA94, AHD Grid: MGA Zone 55

0 250 500m
metres
(1:15 000 at A3)

Figure 3:
Threatened Flora
&
Threatened Fauna Habitat

northbarker
ECOSYSTEM SERVICES

PAS062 11/1/2011

3.4 FAUNA OF CONSERVATION SIGNIFICANCE

The desk top study returned records of threatened fauna species previously recorded from within 5 km of the study area. The table below details these species, followed by a discussion of those species likely to occur and be potentially impacted upon.

Table 3: Fauna species of conservation significance previously recorded, or which may potentially occur in suitable habitat within 5 km of the property^{21 22}.

Species	Status TSPA/EPBCA	Likelihood of occurrence	Preferred Habitat ²³ and Observations ²⁴
BIRDS			
Azure kingfisher <i>Ceyx azurea</i> subsp. <i>diemenensis</i>	Endangered/ Endangered	LOW	Inhabits tree-lined waterways, lakes, ponds and other wetlands with dense streamside vegetation, in particular in western and north-western Tasmania ²⁵ . It is historically also known from eastern Tasmania. No known nest sites or records occur within 5km of the study area. Suitable habitat is considered to be marginal. The most likely waterway is Nelson Bay River that has relatively fast moving water with still deep sections but the banks are generally unsuitable for nesting as they are predominantly sheer rock rather than sediments. Visual and auditory searches did not locate any azure kingfishers.
Grey goshawk <i>Accipiter novae-hollandiae</i>	Endangered/-	LOW	Inhabits large tracts of open wet mixed forest and rainforest particularly favouring mature blackwood. No known nest sites or records occur within 5km of the study area. No prime nesting habitat (mature blackwood) occurs within the study area. This species will forage in the study area particularly in the riparian areas and perhaps in the mature WOL & WOB.
Swift Parrot <i>Lathamus discolor</i>	Endangered/ Endangered	VERY LOW – only as fly over	Requires tree hollows for nesting and feeds on nectar of blue gum (<i>E. globulus</i>) and black gum (<i>E. ovata</i>) flowers. There are no records of this species within 5km of the study area. The survey area is not considered suitable nesting habitat, though it may provide foraging habitat during the species annual migration from and back to the Australian mainland. May be a temporary visitor to the site for short periods of time as a fly over area.
Orange-bellied Parrot <i>Neophema chrysogaster</i>	Endangered/ Critically Endangered	VERY LOW	The wet heaths may provide foraging habitat while the birds are migrating between Tasmania and the Australian mainland.
Satin Flycatcher <i>Myiagra</i>	migratory	PRESENT	EPBCA listed migratory species. This species was seen foraging at several locations in the riparian areas along the Nelson Bay River. It may be more widespread.

²¹ Natural Values Report 10/11/2010, no. 40737

²² EPBC Act Protected Matters Report 15/11/2010

²³ Bryant & Jackson (1999)

²⁴ Natural Values Report Natural Values Report 10/11/2010, no. 40737

²⁵ Higgins (1999)

Species	Status TSPA/EPBCA	Likelihood of occurrence	Preferred Habitat ²³ and Observations ²⁴
<i>cyanoleuca</i>			<p>In Tasmania, they are widespread in the east, mostly west to a line joining Ulverstone and South Cape, though they are recorded farther west along the northern coast and in the north-west, and are very occasionally recorded at scattered sites near the western coast (e.g. Temma, Strahan and Port Davey) (Blakers et al. 1984; Green & McGarvie 1971).</p> <p>Satin Flycatchers mainly inhabit eucalypt forests, often near wetlands or watercourses. They are migratory, moving north in autumn to spend winter in northern Australia and Papua New Guinea. They return south in spring to spend summer in south-eastern Australia (Blakers et al. 1984).</p>
Wedge-tailed eagle <i>Aquila audax</i> subsp. <i>fleayi</i>	Endangered/ Endangered	LOW	<p>Requires large eucalypt trees in sheltered locations for nesting and is highly sensitive to disturbance during the breeding season. One nest record of this species has been recorded within 5km of the study area – approximately 2 km to the northeast.</p> <p>Most of the mature eucalypts within the study area have been badly fire damaged. The deeply incised Nelson Bay River has some potential nesting trees as does the area of forest in the proposed waste dump. A helicopter search failed to locate any nests in these locations. The survey area is very likely to be utilised for foraging.</p>
White-bellied Sea-eagle <i>Haliaeetus</i> <i>leucogaster</i>	Vulnerable/-	LOW	<p>This species nests and forages mainly near the coast but will also live near large rivers and inland lakes, often moving on a seasonal basis. The nearby coast is considered habitat for this species. No records of this species have been recorded within 5km of the study area.</p> <p>The helicopter search was extended to more exposed sites supporting suitable nest trees for this species but failed to locate any nests.</p>
Tasmanian Masked Owl <i>Tyto</i> <i>novaeollandiae</i> subsp. <i>castanops</i>	Endangered / Vulnerable	LOW	<p>Preferred habitat is lowland dry forest and woodlands. Nests in large hollow bearing trees. The wet forest that has been burnt has some evidence of large hollows which may provide nesting habitat.</p>
MAMMALS			
Spotted-tailed quoll <i>Dasyurus</i> <i>maculatus</i> ssp. <i>maculatus</i>	Rare/ Vulnerable	PRESENT	<p>This naturally rare forest-dweller most commonly inhabits rainforest, wet forest and blackwood swamp forest. It forages and hunts on farmland, pasture and heathland travelling up to 20 km at night, and shelters in logs, rocks or thick vegetation.</p> <p>There are several records of this species within 5km of the study area. It is present as evidenced by the scat as shown in attached photo.</p>
Tasmanian devil <i>Sarcophilus</i> <i>harrisii</i>	Endangered/ Endangered	PRESENT	<p>Inhabits a range of forest types often within extensive tracts of remnant native vegetation. Numerous records of this species have been recorded within 5km of the study area and scats were located at a latrine site on the exploration tracks.</p>

Species	Status TSPA/EPBCA	Likelihood of occurrence	Preferred Habitat ²³ and Observations ²⁴
FISH			
Australian grayling <i>Prototroctes maraena</i>	Vulnerable/ Vulnerable	NONE	Inhabits the middle and lower reaches of rivers and streams that open to the sea. The survey area is above a significant waterfall of more than 2 metres and so it is not likely that this species could move upstream. Refer to photo in this section.
Eastern dwarf galaxias <i>Galaxiella pusilla</i>	Vulnerable/ Vulnerable	VERY LOW	The dwarf galaxias lives in still or slow-flowing waters such as ponds, swamps, drains and backwaters of streams, often containing dense aquatic or emergent plants. Water bodies may be permanent, or temporary waters connected to permanent water. It is thought that dwarf galaxias may be able to take refuge in crayfish burrows if pools dry up, or aestivate in small depressions in mud or under rocks (Humphries 1983 cited in Chilcott and Humphries 1996, Beck 1985). Known Tasmanian sites appear to be associated with Holocene sand, gravel and alluvium deposits (Chilcott and Humphries 1996). ²⁶ As the study area is well outside any known locations it is unlikely that the species occurs.
AMPHIBIANS			
Striped marsh frog <i>Limnodynastes peroni</i>	Endangered/-	VERY LOW	General Habitat is considered to be moist vegetated areas – in wetlands and open forest with a breeding requirement of permanent still water with emergent marginal vegetation. While the site is moist there were no swamps or ponds encountered within the study area.
Green and Gold Frog <i>Litoria raniformis</i>	Vulnerable/ Vulnerable	NONE	Requires permanent still or slow moving water bodies with emergent broadleaf vegetation. The aquatic environments within the study area are not suitable.
INVERTEBRATES			
Marrawah Skipper <i>Oreisplanus munionga tax. larana</i>	Endangered/-	NONE	This species is dependent on the dual presence of <i>Melaleuca ericifolia</i> swamp forest and <i>Carex sp.</i> These do not occur in the study area.

²⁶ Threatened Species Section (2006). Recovery Plan: Tasmanian Galaxiidae 2006-2010. Department of Primary Industries, Water, Hobart.

Threatened fauna for which the habitat could be significant

Tasmanian devil (*Sarcophilus harrisii*)

This species is a recent addition to both the *TSPA* and *EPBCA* following the significant impact of Devil Facial Tumour disease (DFTD) on the population.

The tasmanian devil is primarily a carrion-eater which is generally nocturnal. During the day it will retire to a cave/den, hollow log or thick scrub. At night it forages over a range of 10 to 20 hectares. The animals are solitary but not territorial and foraging ranges may overlap considerably²⁷.

This species is not currently threatened by habitat loss and has proven to be tolerant of habitat modification by breeding successfully in human domestic environments such as under houses and sheds etc. However, due to the reduction in numbers caused by DFTD increasing importance is placed upon the protection of maternal dens so that breeding opportunities and success are maximised.

The study area supports devils as evidenced by scats found throughout the study area particularly in latrines on the tracks that were built associated with mineral exploration.

The mature eucalypt forest has the greatest potential to support dens in the hollows at the bases of large eucalypts or in shelters created under fallen logs, however none were seen. Rocky outcrops were seen on the steep banks in the riparian zone along the Nelson Bay River although no dens or potential shelters were associated with these.

Spotted-tailed quoll (*Dasyurus maculatus maculatus*)

Spotted-tailed quoll have been recorded from within five km of the study area²⁸. The spotted-tailed quoll occurs throughout Tasmania and also in eastern Australia. On the mainland their numbers have declined and Tasmania is now their stronghold. The spotted-tailed quoll is most abundant in areas containing rainforest, wet forest and blackwood swamp forest.

Home ranges extend to more than 1,500 ha of continuous suitable habitat for a male and a little less for a female spotted-tailed quoll. Population densities are likely to be in the order of one individual per 4 km², with female ranges largely exclusive and male ranges overlapping. Continuous habitat patches (denning and hunting) totalling more than 15,000 ha may be required to sustain a minimum viable population of 50 spotted-tailed quoll based on an exclusive home range of 300 ha²⁹.

Priority habitat for the species is generally described as lowland, high-rainfall forest across the north of Tasmania³⁰. They are known to have a large home range and to occur in rainforest³¹. Highest quality habitat is fertile extensive un-fragmented lowland wet forest vegetation. There are currently estimated to be 3000-4000 animals in Tasmania with a density of about 1 animal per 3 km² in core habitat³².

²⁷ The Australian Museum 1983.

²⁸ Natural Values Report 15/11/2010, DPIW, report no. 40737

²⁹ PLUC 1996

³⁰ Mallick 2003

³¹ Tasmania's Threatened fauna handbook, Bryant & Jackson, 1999

³² Meander Dam Mitigation Strategy for spotted-tailed quoll (North Barker 2003).

A scat found during the field survey confirms the presence of spotted-tailed quolls in the study area. All aspects of the mine and associated infrastructure areas are therefore likely to be part of a home range for this species.



A scat from a spotted tailed quoll on an exploration track



A tasmanian devil scat with echidna quills evident

Wedge-tailed eagle (*Aquila audax subsp. fleayi*)

The wedge-tailed eagle is listed as endangered under the TSPA and the EPBCA. It is Australia's only *Aquila* species and *A. a. fleayi* is an endemic subspecies of Tasmania. Adults are resident, highly territorial and have very large home ranges. Although considered to be widespread but uncommon at the time of European settlement the breeding success has decreased to a point where it is now considered that fewer than 100 pairs are successful at breeding each year.

Wedge-tailed eagles nest in old growth native forests and the species is dependent on forest for nesting. The eagles choose old growth trees in relatively sheltered sites for locating their nests. Territories can contain up to five alternate nests usually close to each other but may be up to 1 km apart where habitat is locally restricted. Wedge-tailed eagles prey and scavenge on a wide variety of fauna including fish, reptiles, birds and mammals. The greatest single threat to the species is the continuing decline in breeding success as a result of disturbance of breeding birds and loss of nesting habitat. An unnaturally high mortality as a result of persecution (illegal shooting, trapping and poisoning), electrocution and collision (with vehicles, fences and wires) may also limit breeding success³³.

There is limited potential nesting habitat within the waste dump area and the northern section of the tailings dam within mature but fire damaged mature eucalypts. Elsewhere in the mining lease but outside the impact zone there is also potential for nesting habitat in the narrow gully along the Nelson Bay River.

White-bellied sea-eagle (*Haliaeetus leucogaster*)

White-bellied sea-eagles nest and forage near the coast as well as near inland rivers and lakes. They nest in large sheltered trees, usually eucalypts, generally within 5 km of open water. They are sensitive to disturbance during the breeding season, which occurs between August and January. They perch in a prominent place to hunt fish, eels or birds from the water, or small vertebrates or carrion on land. Their nesting requirements are similar to that of wedge-tailed eagle, though these eagles appear

³³ Bell & Mooney (1998) Wedge-tail Eagle Recovery Plan 1998-2003

somewhat less susceptible to disturbance that may cause abandonment of the nest during breeding.

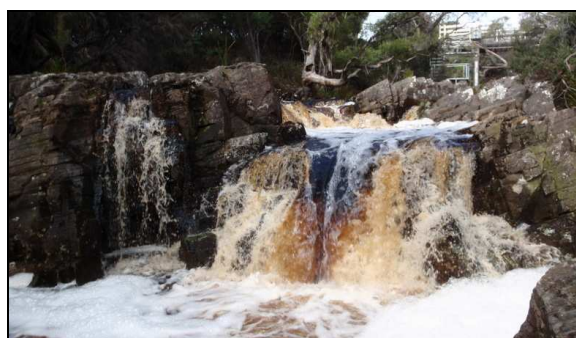
There is limited potential for suitable nesting habitat within the waste dump area and the northern section of the tailings dam within mature but fire damaged mature eucalypts. Elsewhere in the mining lease but outside the impact zone there is also potential for nesting habitat in the narrow gully along the Nelson Bay River.

Azure kingfisher (*Alcedo azurea subsp. diemenensis*)

Nelson Bay River is the only waterway within the mining lease - but outside the impact zone of the proposed mine - that contains potential habitat for the azure kingfisher. The habitat is marginal because while there are open still stretches of water with moderately deep pools the stream bank is predominantly bedrock that the birds could not burrow into to nest. Auditory and visual checks along the creek failed to locate any birds.



Nelson Bay River at a bend in the river with deep and relatively slow water.



A 2m plus water fall near the Temma Road on the Nelson Bay River that would stop the movement of Australian grayling upstream to spawn within the study area.

Migratory fauna listed on EPBC Protected Matters Tool

Satin fly catcher (*Myiagra cyanoleuca*)

This species was seen foraging at several locations in the riparian areas along the Nelson Bay River. In Tasmania, they are widespread in the east, mostly west of a line joining Ulverstone and South Cape, though they are recorded farther west along the northern coast and in the north-west, and are very occasionally recorded at scattered sites near the western coast (e.g. Temma, Strahan and Port Davey) (Blakers et al. 1984; Green & McGarvie 1971).

Satin Flycatchers mainly inhabit eucalypt forests, often near wetlands or watercourses. Satin Flycatchers are migratory, moving north in autumn to spend winter in northern Australia and Papua New Guinea. They return south in spring to spend summer in south-eastern Australia (Blakers et al. 1984). Within the study area they were only recorded outside the proposed impact zone. Riparian habitat does occur within the waste dump footprint but no birds were recorded there.

3.5 INTRODUCED PLANT SPECIES

No declared weed species were recorded during the current field survey.

Other introduced species recorded from the study area were herbaceous and in limited numbers with their impact being insignificant. Introduced plants are included in Appendix 3.

3.6 PLANT PATHOGENS

Phytophthora cinnamomi

Commonly known as root rot or dieback, *Phytophthora* is a soil borne fungal pathogen that invades the roots of plants and starves them of nutrients and water. Heath communities are the most susceptible to infection with a consequent serious loss of species diversity. It is generally spread by the transportation of soil on vehicles, construction machinery and walking boots. The establishment and spread of *Phytophthora* is favoured in areas that receive above 600 mm of rainfall per annum and are below about 800 m altitude. Within this suitable climatic envelope some soil types are more conducive to the establishment and spread of *Phytophthora* than others. Conducive soils are generally the low nutrient types that support heathy communities. The combination of these biophysical factors results in patches of susceptible communities on conducive sites across the landscape.

No symptomatic evidence of *Phytophthora* was observed anywhere within the mining lease area.

The vegetation of the infrastructure areas is variable in terms of the potential establishment of *Phytophthora cinnamomi* both in terms of favourable conditions and vegetation susceptibility. The wet heathland, the western wet scrub and the dry eucalypt communities with heathy understorey contain vegetation susceptible to *Phytophthora cinnamomi* and have favourable conditions for its spread. The wet shrubby eucalypt communities contain less susceptible species and are less conducive to the spread of the soil borne pathogen.

The rare species located in great abundance in the western portion of the study area, *Epacris curtisiae* is thought to be sensitive to *Phytophthora cinnamomi* as seen from symptomatic evidence observed during the survey of the Tarkine Road in 2009.

4. ASSESSMENT OF IMPACT

The majority of the study area is included in the Tarkine emergency heritage listing of 4/11/2009.

4.1 DOWN STREAM IMPACTS OF TAILINGS

As the proposed tailings dam is not an in-stream dam, down stream impacts should be negligible. The only threat is the possibility of seepage to the surrounding land and therefore entering the catchment through soil water movement.

4.2 NATIVE VEGETATION AND FAUNA HABITAT

None of the proposed elements of the Shree Minerals Mine contain vegetation communities that are considered threatened. The development of the open cut mine, waste dump, the direct shipping pit and processing plant and inundation of land by the tailings dam will destroy all terrestrial vegetation and associated fauna habitat. The aquatic and riparian habitat associated with the Nelson Bay River is outside the impact zone and therefore should not be impacted.

Presently site access is proposed via Wuthering Heights Road which is supported as it is already built and goes through regrowth forest of low conservation value.

The present proposed mine layout avoids disturbance of the wet heathland in the western portion of the study area that has the highest concentration of conservation values i.e. threatened flora.

4.3 FLORA

Threatened Flora

As the two threatened flora species *Epacris curtisiae* - northwest heath and *Prasophyllum pulchellum* - pretty leek-orchid are both outside the proposed impact zones associated with the infrastructure of the mine there should be no impact to threatened vascular flora species. If the layout to the proposed mine and access is revised the location of threatened flora will need to be considered.

4.4 THREATENED FAUNA HABITAT

Wedge-tailed eagle and White-bellied sea eagle

Direct impact is anticipated to mature eucalypts that have the potential to be used as nest trees within the proposed waste dump and along the northerly edge of the tailings dam. However, as the bulk of the trees have been severely fire damaged and the crowns are generally dead the value of the nesting habitat has been degraded.

Within the mining lease but outside the present proposed impact zone another potential nesting area is in the riparian forest along the banks of the Nelson Bay River. Once again the quality of the nesting habitat has been reduced by severe fire damage to the crowns of the mature eucalypts trees.

No potential nesting habitat is considered to occur with the deep pit/ open cut mine, the direct shipping pit, the processing plant and the southern side of the tailings dam. This assessment is on the basis of the sites being exposed to wind and having either no eucalypt trees or no mature eucalypts taller than 27m.

Potential for nesting habitat within 500 m or 1 km line of sight of the mine areas is currently low as the forest to the northeast has been logged and regenerated or planted to eucalypt plantation.

Current database records indicate that there are no known locations of existing nests within 1 km line of sight from proposed works. The nearest known eagle nest is approximately 1.8km to the north east of the study area (nest id.971500).

A helicopter based search of potential nest trees in the areas described above failed to locate any nests.

Tasmanian devil

The entire mine area is potential foraging habitat and all forested environments offer some denning opportunities in the large dry hollows of large eucalypt trees. The devil may range over 15 km in search of food. Although not territorial they do have a home range.

The numbers of dens present, if any, within the mine impact area and hence the scale of impact is not known.

Because they are not territorial it is possible that a female devil that is displaced by the mine and associated infrastructure of its den site could occupy an alternative den site and survive and breed.

A significant amount of native vegetation (194ha) is proposed for clearance under the current mining proposal. This quantity of vegetation removal will affect the carrying capacity of the vegetation in the area to support devils. Therefore there will be an impact on devils, however at this stage of the project and without further surveys and monitoring this is very difficult to quantify.

The clearance of vegetation will be staged throughout the life of the mine which is likely to be measured in decades. Devils may therefore recolonise the area during the life of the mine.

Devil Facial Tumour Disease (DFTD) has had a significant impact on the tasmanian devil population in Tasmania, and is the single most significant cause of mortality for the species. The retention of naturally occurring disease free populations is a key factor in ensuring the long term survival of the species in the wild. Any activity that may increase the risk of accelerating the spread of DFTD into areas currently disease free may be considered as having a significant impact to the species. The study area has long been an area of forestry and mineral prospecting and tracks have existed for at least the last two decades. Because the area already has been “opened up” and subjected to levels of human activity, the mine proposal is unlikely to accelerate the spread of DFTD into the area.

Healthy populations of Tasmanian devil are able to withstand what may appear to be devastating mortality rates from roadkill. Roadkill rates peak in summer, impacting on young animals just out of the den and migrating males which may have been driven out by dominant adults. Roadkill however has been shown to have a significant impact on small isolated populations (e.g. Cradle Valley) and also on depleted populations such as those affected by DFTD³⁴. Traffic volumes and possibly speed levels will increase in the event of the mine development going ahead. Significant increases in traffic volumes and/or speed levels are likely to increase the incidences of roadkill.

³⁴ Jones 2000

The current distribution of DFTD in Tasmania shows that the north-west, west and south-west are considered to be free of infected devils (see Figure4). The nearest known occurrence of DFTD is over 100km to the east of the study area. While the study area continues to have a healthy population of tasmanian devils, roadkill is not likely to have a significant impact on the population. However, if DFTD ever becomes established in the area, the increase in traffic that would be associated with the mine development could further reduce the viability of the Tasmanian devil population if the effects of roadkill and DFTD are combined.

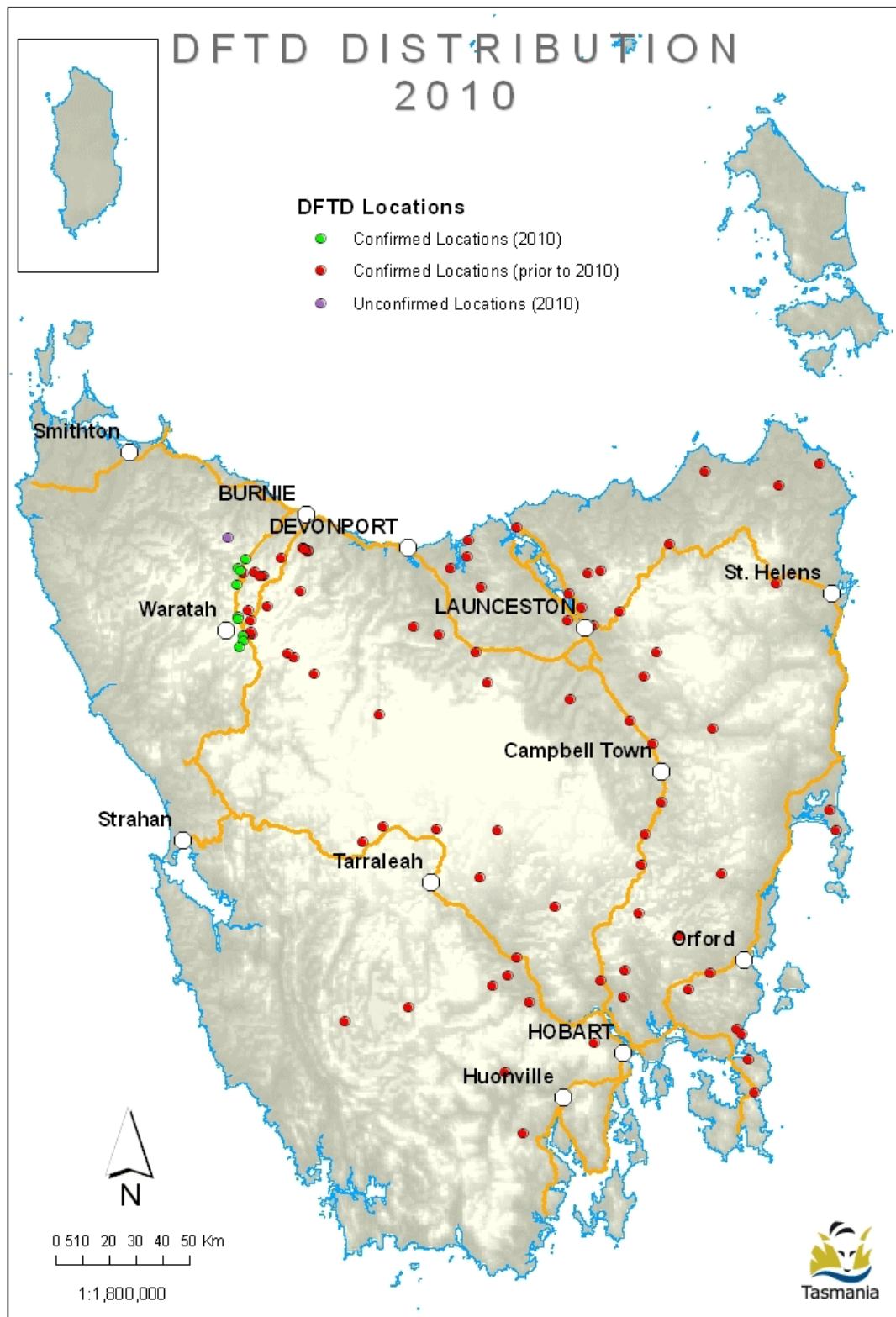


Figure 4: The distribution of DFTD ³⁵

Figure 4 presents all DFTD observation records including live sightings, roadkill and evidence such as footprints, latrines and scats. The western region of Tasmania is currently the only DFTD free part of Tasmania.

³⁵ Save The Tasmanian Devil website (www.tassiedevil.com.au) (12/01/2011)

Spotted-tailed quoll

An area of up to 194ha of habitat will be lost to clearance and inundation. The quality of the foraging habitat is likely to be similar throughout the proposed impact areas although denning opportunities are likely to be greater in the mature forest in the large dry hollows of eucalypts or under fallen logs. The habitat surrounding the mine area is suitable for the spotted-tailed quoll and so movement of the quoll across the region will not be hindered.

A significant amount of native vegetation (194ha) is proposed for clearance under the current mining proposal. This quantity of vegetation removal will affect the carrying capacity of the vegetation in the area to support spotted-tailed quolls. Therefore there will be an impact on spotted-tailed quolls, however at this stage of the project and without further surveys and monitoring this is very difficult to quantify.

As for the tasmanian devil, increases in vehicle traffic volume and speed levels are also likely to increase the incidences of roadkill on the spotted-tailed quoll. There are no specific studies detailing the impacts of roadkill on spotted-tailed quoll populations, however given the low density of animals (one individual per 4 km²) it is likely to be highly significant.

Azure kingfisher

As the Nelson Bay River is the only waterway within the mining lease - but outside the impact zone of the proposed mine - that contains potential habitat for the azure kingfisher, there is expected to be no impact on this species. Surveys failed to locate any birds.

Satin fly catcher (*Myiagra cyanoleuca*)

Within the study area they were only recorded outside the proposed impact zone. However, the SPRAT (Species Profile and Threats Database) indicates a very wide range for habitat preference though generally focused on riparian vegetation. Riparian habitat does occur within the waste dump footprint but no birds were recorded there although there were limitations to access. If occupied by birds it is unclear whether such habitat is suited to breeding.

4.5 PATHOGENS

Phytophthora cinnamomi

There was no symptomatic evidence of *Phytophthora cinnamomi* seen in the study area. However as the western wet scrub, wet heathland and dry eucalypt forest with a heathy understorey are susceptible to the soil borne pathogen it will be important to ensure soil hygiene measures mitigate against the inadvertent introduction of *Phytophthora cinnamomi*. The threatened flora species *Epacris curtisiae* - northwest heath would be particularly susceptible to *Phytophthora cinnamomi*.

The movement of machinery and vehicles in general presents an increased risk of moving *Phytophthora* to communities at risk. However, the implementation of simple strategies such as machinery wash down prior to bringing machinery on-site will reduce this risk.

5. MITIGATION

A direct impact such as inundation and clearance is difficult to directly mitigate as it destroys all terrestrial habitat and modifies aquatic habitats.

The risk of unnecessary and indirect impacts on vegetation outside the ‘footprint’ of the development could be minimised by following these protocols:

1. Clearly define the extent of clearance required for the project, and ensure that no additional clearance occurs.
2. The works area should be marked and all works, vehicles and materials should be confined to the works area.

As part of the study area is in Arthur – Pieman Protected Area which is a conservation Area under the management of The Tasmanian Parks and Wildlife Service there are obligations under the RFA relevant to management of the CAR reserve system that require the extent of reserved land to be maintained. To achieve this, an alternative area of land will need to be formally reserved to replace the loss of the reserved land. The area should support similar vegetation, habitat and flora as the impacted parts of the study area.

Typically, further targeted surveys of the mine impact area would be recommended to determine the presence of tasmanian devil dens and whether or not they are active, and hence the possible level of impact. However, due to the nature of the vegetation on site, which is very dense and almost impenetrable to humans in parts, it needs to be noted that such a survey will be very difficult, will only cover a small proportion of the mine impact area, and may be potentially inconclusive. Furthermore as the clearance for the mine is likely to be staged over many years as the mine progresses, a full survey of the impact area now will not take into account future movement of devils within the area and into the area from outside. Consequently it is recommended that as each stage of the mine goes ahead, pre-clearance assessments of that stage be carried out for devils and devil dens. This needs to be carried out by a qualified ecologist.

Before any clearance goes ahead, a devil management plan should be prepared. The devil management plan needs to cover mine site interactions with devils and what needs to occur when devils/dens may be impacted, and the mitigation measures that are needed.

With respect to roadkill and its effects on devils in particular, information on the impacts to traffic volume and character (road speeds and time of day) resulting from mine construction and activity is required. Significant increases in traffic levels may necessitate the need for a mitigation plan to manage traffic and minimise roadkill.

Concurrent with the development of the mine, an ongoing monitoring program could be established to monitor roadkill and devil activity and den use.

No mitigation actions are recommended for potential eagle nest habitat.

A weed and pathogen management strategy will need to be developed and implemented to ensure that the mine and associated infrastructure sites and adjacent vegetation do not become infested with weeds or have *Phytophthora cinnamomi* introduced. The strategy should be based on monitoring for new weed infestations and wash down protocols to minimise the risk of introducing seed in soil that may adhere to machinery.

6. LEGISLATIVE IMPLICATIONS

Independent legal advice should be sought if there is any intention to disturb the relevant values. The final implications of the following legislation will depend upon the nature of any proposed development and attempts to mitigate or offset impacts.

6.1 COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

Under this Act, a proposed action that is likely to have a significant impact on a matter of national environmental significance is considered to be a controlled action. Controlled actions require approval from the Australian Government Minister for the Environment, Water, Heritage and the Arts.

Flora

No implications under this Act while the impact zones remain as in this proposal. *Prasophyllum pulchellum* - pretty leek-orchid (endangered) listed under the EPBCA schedules as critically endangered currently occurs outside the impact zone. No habitat for this species occurs within the impact zone.

Fauna

Tasmanian devil (endangered)
Spotted-tailed quoll (vulnerable)
Satin fly catcher (migratory)

The proposal will require approval if the action has, will have, or is likely to have a significant impact on an endangered threatened species or an important population of a vulnerable threatened species.

The proposal is likely to have a significant impact on an endangered or vulnerable species if there is a real chance or possibility that it will;

1. lead to a long-term decrease in the size of a population of an endangered species, or important population of a vulnerable species,
2. reduce the area of occupancy of a population of an endangered species, or important population of a vulnerable species,
3. fragment an existing important population into two or more populations,
4. adversely affect habitat critical to the survival of a species,
5. disrupt the breeding cycle of a population of an endangered species, or important population of a vulnerable species,
6. modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline,
7. result in invasive species that are harmful to a vulnerable species becoming established in the endangered or vulnerable species habitat,
8. introduce disease that may cause the species to decline, or
9. interfere substantially with the recovery of the species.

The proposal is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will;

10. substantially modify, destroy or isolate an area of important habitat,
11. result in an invasive species that is harmful ... becoming established in an area of important habitat,
12. seriously disrupt the lifecycle of an ecologically significant portion of the population.

All populations of the tasmanian devil are important to its recovery. For the spotted-tailed quoll, priority habitat for the species is generally described as lowland, high-rainfall forest across the north of Tasmania. The study area falls within this range, which also makes this an important population for the recovery of the spotted-tailed quoll.

As discussed in Section 4 there are real and potential impacts to the tasmanian devil and the spotted-tailed quoll that could have a significant impact on both species. The potential presence of maternal dens and impact on the carrying capacity through the removal of 194ha of habitat triggers a number of the criteria listed above, including criteria 2 and 4.

The satin fly catcher population in Tasmania is at the limit of the distribution and as such is important. There may be a risk that criteria 10 is met.

It is recommended that referral is made to the Commonwealth under this legislation for the impacts to the tasmanian devil, the spotted-tailed quoll and the satin fly catcher.

6.2 TASMANIAN THREATENED SPECIES PROTECTION ACT 1995

Flora

No implications under this Act as long as the proposed impact zones remain the same and the two threatened vascular plant species *Epacris curtisiae* - northwest heath (rare) and *Prasophyllum pulchellum* - pretty leek-orchid (endangered) listed under the schedules of the TSPA remain outside the impact zone.

Fauna

In the definitions of the TSPA “take” does not usually extend to the disturbance of foraging habitat but does include nests and dens. However no dens for either the tasmanian devil or spotted tailed quoll were found during the current survey.

6.3 FOREST PRACTICES ACT 1985

Where a Development Proposal and Environmental Management Plan or similar planning document is approved a Forest Practices Plan (FPP) is not required. Such a plan would need to protect the environment to the extent that an FPP would through the application of the Forest Practices Code where relevant.

6.4 REGIONAL FOREST AGREEMENT

This agreement requires that the area protected in CAR reserves be maintained. Any loss of a formal reserve must therefore be replaced by the reservation of an alternative area. An offset strategy will need to be developed for the loss of a portion of the Arthur Pieman Conservation Area if the mine is approved.

6.5 TASMANIAN *LAND USE PLANNING AND APPROVALS ACT 1993*

LUPA states that ‘in determining an application for a permit, a planning authority must (amongst other things) seek out the objectives set out in Schedule 1.’³⁶

Schedule 1 includes ‘The objectives of the Resource Management and Planning System of Tasmania’ which are (amongst other things):

‘To promote sustainable development of natural and physical resources and the maintenance of ecological processes and genetic diversity’

Sustainable development includes ‘avoiding, remedying or mitigating any adverse effects of activities on the environment’³⁷.

Over and above threatened species and forest clearance issues it should be incumbent on the proponent to demonstrate that the works will include measures to fulfil this aim by:

- incorporating measures to control environmental weeds
- maintain water quality through the proper management of erosion and drainage.

6.6 TASMANIAN *WEED MANAGEMENT ACT 2001*

There are no declared weeds within the mineral lease that would be subject to the provisions of the *Tasmanian Weed Management Act 1999*. This Act states that landowners and managers must take all reasonable measures to control the impact and spread of declared weeds, particularly to prevent the spread into the habitat of threatened species, threatened communities and reserves. The absence of declared weeds within the proposed development area puts the emphasis on preventing the establishment of any declared weeds within the mining lease.

³⁶ section 51(2) (b) – Part 4 Enforcement of Planning Control – Division 2 Development Control LUPA 1993

³⁷ pp56 LUPA 1993

7. SUMMARY AND RECOMMENDATIONS

Vegetation Communities

None of the vegetation communities within the mining lease are threatened. The native vegetation communities recorded within the specific infrastructure areas identified are:

Deep pit/ open cut mine:

- Wet *Eucalyptus obliqua* forest over *Leptospermum* (WOL)
- Dry *Eucalyptus nitida* forest and woodland (DNI)
- Western wet scrub (SWW)

Direct shipping pit:

- Wet *Eucalyptus obliqua* forest over *Leptospermum* (WOL)
- Dry *Eucalyptus nitida* forest and woodland (DNI)
- Western wet scrub (SWW)

Processing plant:

- Western wet scrub (SWW)

Tailings dam:

- Wet *Eucalyptus obliqua* forest over *Leptospermum* (WOL)
- Dry *Eucalyptus nitida* forest and woodland (DNI)
- Dry *Eucalyptus obliqua* woodland and forest (DOB)
- Western wet scrub (SWW)

Waste dump:

- Wet *Eucalyptus obliqua* forest over *Leptospermum* (WOL)
- Dry *Eucalyptus nitida* forest and woodland (DNI)
- Wet heathland (SHW)

Vegetation within the mining lease but outside the proposed current impact zone:

- Wet *Eucalyptus obliqua* forest over broad-leaf shrubs (WOB)
- Wet *Eucalyptus obliqua* forest over rainforest (WOR)
- Wet heathland (SHW)

Threatened Flora

Two threatened flora species were recorded in the study area;

- *Epacris curtisiae* (northwest heath) - rare TSPA
- *Prasophyllum pulchellum* (pretty leek orchid) - endangered TSPA/ critically endangered EPBCA

While the impact zones remain as in this proposal, there will be no impact to either of these species.

Threatened Fauna Habitat

Five threatened fauna and one migratory species are considered to have suitable habitat within the study area;

- Tasmanian devil (*Sarcophilus harrisii*) - Endangered TSPA, Endangered EPBCA
- Spotted-tailed quoll (*Dasyurus maculatus maculatus*) - Rare TSPA, Vulnerable EPBCA
- Wedge-tailed eagle (*Aquila audax* subsp. *fleayi*) - Endangered TSPA, Endangered EPBCA
- White-bellied sea-eagle (*Haliaeetus leucogaster*) - Vulnerable TSPA
- Azure kingfisher (*Alcedo azurea* subsp. *diemenensis*) - Endangered TSPA, Endangered EPBCA
- Satin fly catcher (*Myiagra cyanoleuca*) – Migratory EPBC

Tasmanian devil and spotted-tailed quoll

Populations found in the study area are considered to be important populations for the recovery of both of these species.

The potential presence of maternal dens and impact on the carrying capacity through the removal of 194ha of habitat triggers a number of the criteria listed above (see Section 6.1), including criteria 2 and 4. Other possible impacts include increased roadkill which could have a significant impact on population viability.

Wedge-tailed eagle and white-bellied sea eagle

A helicopter based nest search of all potential habitat within 1 km of any proposed disturbance and no nests were located.

Azure kingfisher

As the Nelson Bay River is the only waterway within the mining lease - but outside the impact zone of the proposed mine - that contains potential habitat for the azure kingfisher, there is expected to be no impact on this species. Surveys failed to locate any birds.

Satin fly catcher

Within the study area they were only recorded outside the proposed impact zone. However, the SPRAT (Species Profile and Threats Database) indicates a very wide range for habitat preference though generally focused on riparian vegetation. Riparian habitat does occur within the waste dump footprint but no birds were recorded there although there were limitations to access. If occupied by birds it is unclear whether such habitat is suited to breeding.

Pathogens

Phytophthora cinnamomi

No symptomatic evidence of *Phytophthora* was observed anywhere within the mineral lease area. Management of *Phytophthora* should be specifically addressed to ensure its introduction and spread is minimised to limit impacts to heathland species notably *Epacris curtisiae* (northwest heath).

Legislative implications

Obligations under the RFA requires the loss of a reserve that is listed for conservation in a commitment binding on the Government (RFA CAR reserve), to be offset by formal reservation elsewhere. An offset strategy will need to be developed for the loss of a portion of the Arthur Pieman Conservation Area if the mine is approved.

Environment Protection and Biodiversity Conservation Act 1999.

It is recommended that referral is made to the Commonwealth under this legislation for the impacts to the tasmanian devil, the spotted-tailed quoll and the satin flycatcher.

An eagle nest survey is recommended to determine the presence of nests within the impact zone or within 500m of a nest or 1 km line of site.

Threatened Species Protection Act 1995

No known impacts of the mine and associated infrastructure impact directly on any species protected under this Act.

Weed Management Act 2000

A weed control strategy and works plan, including a monitoring program and good hygiene protocols, is required to maintain the current weed free status for both declared and environmental weeds.

Recommendations

1. The project should be referred under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, for the potential impact to tasmanian devil, spotted-tailed quoll and satin fly catcher populations.
2. A weed management strategy should be developed that focuses on maintaining the declared and environmental weed free status of the site. This will require both a strict hygiene element including wash down of all machinery and equipment coming onto the site and a monitoring aspect.
3. A *Phytophthora* quarantine protocol should be developed focusing on wash down of machinery and equipment coming on site.
4. An offset proposal should be developed for the replacement of reserved land in the CAR reserve system.
5. The risk of unnecessary and indirect impacts on vegetation outside the 'footprint' of the development should be minimised by following these protocols:
 - a. Clearly define the extent of clearance required for the project, and ensure that no additional clearance occurs.
 - b. The works area should be marked and all works, vehicles and materials should be confined to the works area.

References

- Bell, P. J. & Mooney, N. J. (1998). *Wedge-tailed Eagle Recovery Plan 1998-2003*. Department of Primary Industries, Water and Environment.
- Bryant, S. & Jackson, J. (1999). *Tasmania's Threatened Fauna Handbook: what, where and how to protect*. Threatened Species Unit, Parks & Wildlife Service, Hobart.
- Buchanan, A.M. (1999). *A Census of the Vascular Plants of Tasmania & Index to The Student's Flora of Tasmania*. Third Edition. Tasmanian Herbarium Occasional Publication No. 6, Hobart.
- Commonwealth of Australia & State of Tasmania (1997). *Tasmanian Regional Forest Agreement*.
- Commonwealth of Australia (1999). *Environment Protection and Biodiversity Conservation Act 1999. No. 91, 1999*.
- Curtis, W.M. (1963). *The Student's Flora of Tasmania, Part 2*. University of Tasmania.
- DPIW 2006 Tasveg 1.0 tenure analysis.
- DPIPWE 15th November 2010 *Natural Values Atlas Report – 40798*. Tasmania.
- Flora Advisory Committee (1994). *Native Higher Plant Taxa Which Are Rare Or Threatened In Tasmania*. Parks & Wildlife Service, Hobart.
- Kirkpatrick, J.B., Barker, P., Brown, M.J., Harris, S., and Mackie, R. (1995). *The Reservation Status of Tasmanian Vascular Plant Communities*. Wildlife Scientific Report 95/4. Parks and Wildlife Service, Hobart.
- Kirkpatrick, J.B., Peacock, R.J., Cullen, P.J. and Neyland, M.G. (1988). *The Wet Eucalypt Forests of Tasmania*. Tasmanian Conservation Trust, Hobart.
- Littlejohn, M. (2003). *Frogs of Tasmania*. University of Tasmania, Tasmania, Australia.
- Mallick, S (2003). Meander Dam Mitigation Strategy for the Spotted-tailed Quoll (*Dasyurus maculatus*). North Barker Ecosystem Services, for the Rivers and Water Supply Commission, Tasmania.
- North Barker Ecosystem Services (13 May 2010) *Tarkine Drive North West Tasmania*.
- Epacris curtisiae* Survey Addendum to Vegetation Survey and Fauna Habitat Assessment.
- North, A.J., Johnson, K., Ziegler, K., Duncan, F. K Hopkins, D, Ziegeler, D., Watts, S. (1998). *Flora of Recommended Areas for Protection and Forest Reserves in Tasmania*. Forestry Tasmania / Forest Practices Board / Parks & Wildlife Service, Hobart.
- PLUC (1996). *Environment and Heritage Report. Background Report Part C Vol I-V*. For Tasmanian - Commonwealth Regional Forest Agreement. Tasmanian Public Land Use Commission, Hobart.

PLUC (1996a). *Supplement to Environment and Heritage Report. Background Report Part C Vol V*. For Tasmanian - Commonwealth Regional Forest Agreement. Tasmanian Public Land Use Commission, Hobart.

Tasmanian State Government (1995). *Threatened Species Protection Act 1995*. No.83 of 1995. Government Printer, Hobart, Tasmania.

Threatened Species Section (2006). *Recovery Plan: Tasmanian Galaxiidae 2006-2010*. Department of Primary Industries and Water, Hobart.

Threatened Species Section (2010). *Listing Statement for Prasophyllum pulchellum (pretty leek orchid)*. Department of Primary Industries, Parks, Water and Environment, Tasmania.

Vertebrate Advisory Committee. (1994). *Native Vertebrates which are Rare or Threatened in Tasmania. Edition 1. Species at Risk, Tasmania - Vertebrates*. Parks and Wildlife Service, Tasmania.

APPENDIX 1A - DEFINITIONS OF CONSERVATION VALUES OF PLANT AND ANIMAL SPECIES

SPECIES OF NATIONAL SIGNIFICANCE

Listed in Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

The *EPBC Act* has six categories of threat status for species:

1. **Extinct** - If at a particular time there is no reasonable doubt that the last member of the species has died
2. **Extinct in the wild** - If it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or If it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form
3. **Critically endangered** - If at a particular time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria
4. **Endangered** - If it is not critically endangered; and it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria
5. **Vulnerable** - If at a particular time it is not critically endangered or endangered; and it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria
6. **Conservation dependent** - If, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years

SPECIES OF STATE SIGNIFICANCE

Listed in Tasmanian *Threatened Species Protection Act 1995 (TSP Act)*

Threatened flora and fauna species in Tasmania are listed in Schedules 3 (extinct or endangered), 4 (vulnerable) or 5 (rare). These three categories are defined in Section 15 of the Act.

1. **Extinct** - If no occurrence of the taxon in the wild can be confirmed during the past 50 years.
2. **Endangered** - If it is in danger of extinction because long-term survival is unlikely while the factors causing it to be endangered continue operating.
3. **Vulnerable** - If it is likely to become an endangered taxon while the factors causing it to be vulnerable continue operating.
4. **Rare** - If it has a small population in Tasmania that is not endangered or vulnerable but is at risk."

Species that have been nominated and approved by the Scientific Advisory Committee for listing in the Act

SPECIES OF REGIONAL OR GENERAL SIGNIFICANCE

The following definitions are from three publications: Flora Advisory Committee 1994, Vertebrate Advisory Committee 1994, Invertebrate Advisory Committee 1994

Flora only - Species listed as rare but not necessarily 'at risk' (**r3**)

Fauna only – Species requiring monitoring (**m**)

Both – Species of unknown risk status (**k**) in Tasmania, or thought to be uncommon within region, or a species having a declining range or populations within the area.

Species considered to be outside its normal range or of an unusual form as determined and justified in the body of the report.

Species identified in regional studies as being of conservation significance that are not listed in current legislation.

Species that have been recognised but have not been formally described in a published journal that are thought to be significant as determined and justified in the body of the report.

Plant species that are not known to be reserved. To be so it must be known to exist in at least one secure Reserve. Secure reserves include reserves and parks requiring the approval of both Houses of Parliament for their revocation. They include: National Parks, Aboriginal Sites, Historic Sites, Nature Reserves, State Reserves, Game Reserves, Forest Reserves, Wellington Park, and insecure reserves in the World Heritage Area which is protected by international agreement under the World Heritage Convention.

APPENDIX 1B - DEFINITIONS OF CONSERVATION VALUES OF PLANT COMMUNITIES

PLANT COMMUNITY RESERVATION STATUS

Representativeness (Kirkpatrick *et al*, 1995 and North *et al*, 1998)

- **Well Reserved** - A viable area of a community is found within two or more reserves, or two or more viable areas are well separated within one reserve, or if all its known occurrences are within viable, secure reserves.
- **Poorly Reserved** - A community is found in one or more reserves, but it does not satisfy one of the conditions required to be considered well reserved.
- **Unreserved** - A community which is not known from any reserve.

For this assessment, **reserves** include those areas considered to have the highest security of tenure.

CONSERVATION STATUS OF FOREST COMMUNITIES

The conservation status of communities was assessed based on the following criteria (PLUC 1996):

Rare communities

- **R1** - total area generally less than 10 000 ha
- **R2** - total area generally less than 1 000 ha
- **R3** - patch sizes generally less than 100 ha

Vulnerable communities

- **V1** - approaching greater than 70 % depletion
- **V2** - where threatening processes have caused **either** loss or significant decline in species that play a major role within the ecosystem **or** have caused a significant alteration to the ecosystem process

Endangered communities

- **E1** - distribution has contracted to less than 10 % of pre-1750 range
- **E2** - less than 10 % of pre-1750 area remains
- **E3** - 90 % of area is in small patches and is subject to threatening processes

REGIONAL CONSERVATION STATUS OF FOREST COMMUNITIES

The RFA Private Land Program and CARSAG have determined the conservation priority of forest communities using the Interim Bioregions (Version 5) of Tasmania. Communities have been placed into three categories of significance applying the Conservation status defined above for each community at a bioregional level and also considering 'old growth' values. This is useful for a range of users such as local government for natural resource management strategies, catchment planning, Bushcare, TASVEG 2000, community groups and land owners.

- Category 1 (**HIGH**) – Endangered communities, Vulnerable and Rare communities (old growth only)
- Category 2 (**MODERATE**) – Vulnerable and Rare communities; and other forest communities (old growth only)
- Category 3 (**LOW**) – Other forest communities.

In addition select communities have been ascribed higher priorities at a case by case basis where CARSAG have determined that the particular circumstances of a community require it to be of greater significance than the above method applies (CARSAG 2000)

CONSERVATION STATUS OF NON-FOREST COMMUNITIES

The conservation status of non-forest communities is currently being considered as part of the Tasmanian Vegetation Management Strategy (VMS) 1998 and will be determined on completion of the TASVEG 2000 Statewide vegetation mapping project. Interim Regional conservation priorities have been determined for the VMS (Tasmanian Vegetation Management Strategy 2000).

APPENDIX 2 - LEGISLATIVE IMPLICATIONS OF THREATENED SPECIES

Tasmanian State Legislation Affecting Threatened Species

Threatened Species Protection Act 1995

Threatened flora and fauna species in Tasmania are listed in Schedules 3 (endangered) and 4 (vulnerable) of the Threatened Species Protection Act, 1995. Rare species that are considered to be 'at risk' are listed in Schedule 5 of the Act. These three categories are defined in Section 15 of the Act.

1. "An extant taxon of native flora or fauna may be listed as **endangered** if it is in danger of extinction because long-term survival is unlikely while the factors causing it to be endangered continue operating.
2. A taxon of native flora or fauna may be listed as **vulnerable** if it is likely to become an endangered taxon while the factors causing it to be vulnerable continue operating.
3. A taxon of native flora or fauna may be listed as **rare** if it has a small population in Tasmania that is not endangered or vulnerable but is at risk."

The Act provides mechanisms for protecting these species from threatening processes, the implementation of 'recovery plans', 'threat abatement plans', 'land management plans', public authority agreements', and 'interim protection orders'.

Section 51 (a) of the TSPA states that: "A person must not knowingly, without a permit - take, trade in, keep or process any listed flora or fauna". The Act defines 'take' as including: "kill, injure, catch, damage, destroy and collect. A land manager is therefore required to obtain a permit from the Tasmanian Department of Primary Industries, Parks, Water and Environment (DPIPWE) to carry out management that may adversely affect any of the species listed in the Act.

Commonwealth of Australia Legislation Affecting Threatened Species

Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act establishes a process for assessing actions that are likely to have impacts of *national environmental significance*. Such impacts include World Heritage Areas, RAMSAR Wetland sites of international importance, migratory species protected under international agreements, nuclear actions, the Commonwealth marine environment and **nationally threatened species and communities**.

Threatened species are defined in several categories:

1. Extinct

- If at a particular time there is no reasonable doubt that the last member of the species has died

2. Extinct in the wild

- If it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or
- If it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form

3. Critically endangered

- If at a particular time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria

4. Endangered

- If it is not critically endangered; and it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria

5. Vulnerable

- If at a particular time it is not critically endangered or endangered; and it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria

6. Conservation dependent

- If, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years

An action that is likely to affect species that are listed in any of the above categories may require ministerial approval unless the Commonwealth Environment Minister has granted an exemption. The Act establishes a **referral process** to Environment Australia to determine whether an action requires a formal **approval** and thus would be required to proceed through the **assessment and approval process**.

A referral must provide sufficient information to allow the Minister to make a decision. The Minister is then required to make a decision within 20 business days of the referral. The Minister may decide an approval is not necessary if the action is taken in a specified manner. The action may not require approval but may require a **permit** if undertaken on Commonwealth land. If an approval is required then an **environmental assessment** must be carried out. In such instances the environmental assessment approach will be determined by the Minister and may vary from preliminary documentation to a full public inquiry depending on the scale and complexity of the impact.

APPENDIX 3 - FLORA SPECIES LIST**PAS062****Status codes:****ORIGIN**

i - introduced

d - declared weed WM Act

en - endemic to Tasmania

t - within Australia, occurs only in Tas.

NATIONAL SCHEDULE

EPBC Act 1999

CR - critically endangered

EN - endangered

VU - vulnerable

STATE SCHEDULE

TSP Act 1995

e - endangered

v - vulnerable

r - rare

Sites:

1	WOB - E310681, N5442009	17/11/2010	Karen Ziegler
2	DOB heathy - E310598, N5441971	17/11/2010	Karen Ziegler
3	SHW Sprengelia incarnata wet heathland - E308598, N5441943	18/11/2010	Karen Ziegler
4	DOB heathy - E308585, N5442105	18/11/2010	Karen Ziegler
5	SHW Wet heath - additional species - E308598, N5441943	18/11/2010	Karen Ziegler
6	DNI - E309160, N5442777	18/11/2010	Katriona Hopkins
7	DNI additional spp - E309160, N5442777	18/11/2010	Katriona Hopkins
8	WOB - E311812, N5441410	19/11/2010	Katriona Hopkins
9	WOB additional spp - E311812, N5441410	19/11/2010	Katriona Hopkins
10	WOB additional spp riparian zone - E311675, N5441288	19/11/2010	Katriona Hopkins
11	SWW - E311485, N5441183	19/11/2010	Katriona Hopkins
12	WOL - E311300, N5440830	19/11/2010	Katriona Hopkins
13	DNI additional spp - E311407, N5440885	19/11/2010	Katriona Hopkins
14	DNI - E311590, N5440699	19/11/2010	Katriona Hopkins
15	SWW - E311762, N5440816	19/11/2010	Katriona Hopkins
16	WOL - E311381, N5440650	19/11/2010	Katriona Hopkins
17	WOL additional spp riparian zone - E311409, N5440664	19/11/2010	Katriona Hopkins
18	WOL - E311521, N5440801	19/11/2010	Katriona Hopkins
19	SWW - E311655, N5440974	19/11/2010	Katriona Hopkins
20	WOL - E311271, N5440915	20/11/2010	Katriona Hopkins
21	DNI additional spp - E311271, N5440915	20/11/2010	Katriona Hopkins
22	SWW - E311494, N5441021	20/11/2010	Katriona Hopkins
23	WOL - E311163, N5440980	20/11/2010	Katriona Hopkins
24	DNI additional spp - E311163, N5440980	20/11/2010	Katriona Hopkins
25	SWW additional spp - E311327, N5441058	20/11/2010	Katriona Hopkins
26	DOB additional species - E310681, N5442009	18/11/2010	Karen Ziegler
27	SWW - E310473, N5442076	19/11/2010	Karen Ziegler
28	WOL - E310528, N5441682	20/11/2010	Karen Ziegler
29	SHW Wet Heath - E310727, N5441840	20/11/2010	Karen Ziegler
30	WOB - E310929, N5441917	20/11/2010	Karen Ziegler
31	SHW - E310176, N5440520	22/11/2010	Karen Ziegler
32	WOL - E311147, N5441035	20/11/2010	Katriona Hopkins
33	SWW additional spp - E311263, N5441135	20/11/2010	Katriona Hopkins
34	WOL additional spp - E310946, N5441280	20/11/2010	Katriona Hopkins
35	DOB - E310859, N5441463	20/11/2010	Katriona Hopkins
36	DOB - E310741, N5441493	20/11/2010	Katriona Hopkins
37	DNI heathy understorey - E310046, N5441035	22/11/2010	Karen Ziegler
38	WOL - E310056, N5441103	22/11/2010	Karen Ziegler
39	DNI additional species - E310046, N5441035	22/11/2010	Karen Ziegler
40	SHW additional species - E310176, N5440520	22/11/2010	Karen Ziegler
41	SHW - E310302, N5440468	22/11/2010	Katriona Hopkins
42	DNI - E310610, N5440976	22/11/2010	Katriona Hopkins
43	DNI additional spp riparian area - E310637, N5440987	22/11/2010	Katriona Hopkins
44	DOB - E310798, N5440376	22/11/2010	Katriona Hopkins
45	FPL (E nitens) - E312557, N5442147	21/11/2010	Katriona Hopkins
46	WOR (regenerating forest after fire) - E312691, N5442209	21/11/2010	Katriona Hopkins
47	WOL post-logging regen - E312431, N5440851	21/11/2010	Katriona Hopkins
48	WOB - E312457, N5442040	21/11/2010	Katriona Hopkins

Site	Name	Common name	Status
DICOTYLEDONAE			
APIACEAE			
26 45 46	<i>Hydrocotyle hirta</i>	hairy pennywort	
1	<i>Xanthosia pilosa</i>	woolly crossherb	
11	<i>Xanthosia tasmanica</i>	small crossherb	
ASTERACEAE			
26 46	<i>Cassinia aculeata</i>	dollybush	
26	<i>Cirsium vulgare</i>	spear thistle	i
4	<i>Coronidium scorpioides</i>	curling everlasting	
1 4 46	<i>Euchiton</i> sp.	cudweed	
23 45	<i>Hypochoeris radicata</i>	rough catsear	i
1	<i>Olearia lirata</i>	forest daisybush	
45 46	<i>Olearia stellulata</i>	sawleaf daisybush	
8	<i>Senecio glomeratus</i>	shortfruit purple fireweed	
ATHEROSPERMATACEAE			
46	<i>Atherosperma moschatum</i> subsp. <i>moschatum</i>		
sassafras			
CASUARINACEAE			
1 2 3 4 6 13	<i>Allocasuarina monilifera</i>	necklace sheoak	en
25 29 35 36			
37 41 44			
CUNONIACEAE			
46	<i>Anodopetalum biglandulosum</i>	horizontal	en
1 2 3 4 6 8	<i>Bauera rubioides</i>	wiry bauera	
12 14 15 16			
20 23 25 27			
28 29 31 32			
35 36 37 38			
41 42 46			
DILLENIACEAE			
1 8 12 14 16	<i>Hibbertia empetrifolia</i> subsp. <i>empetrifolia</i>	scrambling guineaflower	
20 23 26 28			
30 32 35 38			
45 48			
3 15 19 31	<i>Hibbertia procumbens</i>	spreading guineaflower	
41	<i>Hibbertia prostrata</i>	prostrate guineaflower	
31	<i>Hibbertia</i> sp.	guinea-flower	
DROSERACEAE			
1 5 11 31 41	<i>Drosera binata</i>	forked sundew	
1 2 4 6 11	<i>Drosera peltata</i>	pale sundew	
13 15 16 19			
20 25 27 35			
36 42 44 47			
2 5 11 19 31	<i>Drosera pygmaea</i>	dwarf sundew	
33 37			

EPACRIDACEAE

2 26 37	<i>Astroloma humifusum</i>	native cranberry	
3 31	<i>Epacris curtisiae</i>	northwest heath	en r
1 5 6 9 16	<i>Epacris impressa</i>	common heath	
26 30 32 37			
41 42 47			
2 5 19 31 33	<i>Epacris lanuginosa</i>	swamp heath	
42			
31	<i>Epacris obtusifolia</i>	bluntleaf heath	
1 3 4 11 12	<i>Leucopogon australis</i>	spike beardheath	
14 15 16 18			
19 21 34 44			
1 3 6 11 13	<i>Leucopogon collinus</i>	white beardheath	
15 18 19 22			
27 29 37 42			
4 6 8 12 14	<i>Monotoca glauca</i>	goldey wood	
16 18 20 24			
27 28 30 32			
2 3 4 6 11	<i>Sprengelia incarnata</i>	pink swampheath	
13 15 19 21			
22 27 29 31			
35 37 41 43			
44			

ESCALLONIACEAE

1	<i>Anopterus glandulosus</i>	tasmanian laurel	en
---	------------------------------	------------------	----

EUCRYPHIACEAE

1 46	<i>Eucryphia lucida</i>	leatherwood	en
------	-------------------------	-------------	----

EUPHORBIACEAE

1 5 9 11 13	<i>Amperea xiphoclada</i> var. <i>xiphoclada</i>	broom spurge	
19 20 24			

FABACEAE

2 3 4 6 11	<i>Aotus ericoides</i>	golden pea	
15 18 19 21			
24 25 29 35			
36 37 41 42			
2 6 11 12 14	<i>Bossiaea cinerea</i>	showy bossia	
15 16 18 19			
20 23 24 29			
30 36 38 42			
4	<i>Bossiaea prostrata</i>	creeping bossia	
3 6 21 31 37	<i>Dillwynia glaberrima</i>	smooth parrotpea	
41			
5 6 31	<i>Gompholobium huegelii</i>	common wedgepea	
26 30	<i>Oxylobium ellipticum</i>	golden shaggypea	
4 13 47	<i>Pultenaea daphnoides</i> var. <i>obcordata</i>	heartleaf bushpea	
1 4 12 14 16	<i>Pultenaea juniperina</i>	prickly beauty	
18 20 23 25			
27 28 29 30			
33 35 36 38			
41 42 44 48			
2 5 31 36 37	<i>Sphaerolobium minus</i>	eastern globepea	
41 42 44			

FAGACEAE

9 46	<i>Nothofagus cunninghamii</i>	myrtle beech	
	GERANIACEAE		
26	<i>Pelargonium australe</i>	southern storksbill	
	HALORAGACEAE		
39	<i>Gonocarpus micranthus</i> subsp. <i>micranthus</i>	creeping raspwort	
6 37	<i>Gonocarpus tetragynus</i>	common raspwort	
1 8 12 23 32 44 45	<i>Gonocarpus teucrioides</i>	forest raspwort	
	LAMIACEAE		
1	<i>Prostanthera lasianthos</i> var. <i>lasianthos</i>	christmas mintbush	
	LAURACEAE		
3 6 31 42	<i>Cassytha glabella</i>	slender dodderlaurel	
1 2 4 5 11 12 16 18 19 20 23 25 27 29 32 36 38	<i>Cassytha pubescens</i>	downy dodderlaurel	
	LENTIBULARIACEAE		
19 25 27 36	<i>Utricularia dichotoma</i>	fairies aprons	
	MIMOSACEAE		
25 35 48	<i>Acacia genistifolia</i>	spreading wattle	
4	<i>Acacia longifolia</i> subsp. <i>sophorae</i>	coast wattle	
1 46	<i>Acacia melanoxylon</i>	blackwood	
1 4 9 11 12 14 16 25 27 29 32 43 45 47 48	<i>Acacia mucronata</i>	variable sallow wattle	
1 26 44	<i>Acacia myrtifolia</i>	redstem wattle	
3 6	<i>Acacia suaveolens</i>	sweet wattle	
1 8 12 14 16 18 20 23 28 30 32 35 36 38 45 47 48	<i>Acacia verticillata</i>	prickly mimosa	
17	<i>Acacia verticillata</i> subsp. <i>verticillata</i>	prickly moses	
	MYRTACEAE		
2 4 5 6 11 13 14 15 19 20 22 32 37 41 42	<i>Eucalyptus nitida</i>	western peppermint	en
1 2 4 6 8 12 14 16 18 20 23 25 28 29 30 32 35 36 44 46 47 48	<i>Eucalyptus obliqua</i>	stringybark	
5	<i>Euryomyrtus ramosissima</i>	heath-myrtle	
1 2 6 9 11 13 14 15 16 18 19 20 22 23 27 29 30 32 35 36 38 42 48	<i>Leptospermum glaucescens</i>	smoky teatree	en
41 45 47 48	<i>Leptospermum lanigerum</i>	woolly teatree	
3 14 19 20 23 31 37 41 48	<i>Leptospermum nitidum</i>	shiny teatree	en

1 2 3 4 6 8 11 12 14 15 19 20 22 23 27 29 31 32 35 37 38 41 42 44 45 46 47 48	<i>Leptospermum scoparium</i>	common tea-tree	
1 4 7 11 13 15 19 21 22 27 29 36 37 41	<i>Melaleuca squamea</i>	swamp honeymyrtle	
1 2 3 5 7 9 11 12 15 17 19 21 22 23 27 28 29 31 32 36 38 41 42 47	<i>Melaleuca squarrosa</i>	scented paperbark	
PITTOSPORACEAE			
8 16 26 30 32 46 48	<i>Billardiera mutabilis</i>	green appleberry	
5 31 37 41 44	<i>Rhytidosporum procumbens</i>	starry appleberry	
POLYGALACEAE			
5 40 41 42	<i>Comesperma calymega</i>	bluespike milkwort	
5 31 41	<i>Comesperma retusum</i>	mountain milkwort	
1 26 35	<i>Comesperma volubile</i>	blue lovecreeper	
PROTEACEAE			
1 2 3 4 6 11 13 14 15 16 18 19 20 22 23 27 29 31 32 35 36 37 38 42 44	<i>Banksia marginata</i>	silver banksia	
1 21 25 26 33 35 36 38 39 44	<i>Lomatia tinctoria</i>	guitarplant	en
2 3 6 11 15 27 29 34 43	<i>Persoonia juniperina</i>	prickly geebung	
RHAMNACEAE			
1 8 30 45 46 47 48	<i>Pomaderris apetala</i>	common dogwood	
1 26	<i>Pomaderris pilifera</i>	hairy dogwood	
RUBIACEAE			
1 26	<i>Galium australe</i>	tangled bedstraw	
RUTACEAE			
8 26 28 47 48	<i>Nematolepis squamea</i>	satinwood	
1 3 6 9 27 31 37 41 47	<i>Philotheca virgata</i>	twiggy waxflower	
1 8 23 28 30 32	<i>Zieria arborescens</i>	stinkwood	
SANTALACEAE			
4 7 25	<i>Leptomeria drupacea</i>	erect currantbush	

STACKHOUSIACEAE

5 19 31 39 *Stackhousia viminea* yellow candles
41 42

STYLIDIACEAE

3 37 *Stylidium graminifolium* narrowleaf triggerplant

THYMELAEACEAE

1 4 7 8 11 *Pimelea linifolia subsp. linifolia* slender riceflower
12 16 23 28
32 38 47

TREMANDRACEAE

18 35 36 *Tetratheca labillardierei* glandular pinkbells
1 26 31 *Tetratheca pilosa* hairy pinkbells

VIOLACEAE

4 8 23 33 44 *Viola hederacea* ivyleaf violet
45

MONOCOTYLEDONAE

CENTROLEPIDACEAE

45 *Centrolepis strigosa* hairy centrolepis, bristlewort

CYPERACEAE

7 25 41 *Baumea sp.* twig rush
2 11 *Baumea tetragona* square twigsedge
1 2 4 8 11 *Gahnia grandis* cutting grass
12 14 16 18
20 22 23 27
28 29 32 35
36 38 42 44
45 47

3 15 19 31 *Gymnoschoenus sphaerocephalus* buttongrass
41

10 *Isolepis sp.* club rush
2 3 4 6 37 *Lepidosperma concavum* sand swordsedg
44

1 23 28 30 *Lepidosperma elatius* tall swordsedg
32 38 43 45
47 48

3 4 6 13 15 *Lepidosperma filiforme* common rapiersedge
19 21 37

8 12 *Lepidosperma laterale* variable swordsedg
18 *Lepidosperma sp.* sword sedg
2 6 8 11 15 *Schoenus sp.* bogsedge
18 19 21 36
41 42 44

3 6 11 27 29 *Tetraria capillaris* hair sedg
31 37

IRIDACEAE

4 *Diplarrena moraea* white flag-iris
1 2 6 11 13 *Patersonia fragilis* short purpleflag
15 19 21 22
27 31 35 36
37 41 42 44

JUNCACEAE

10 12 17 25 *Luzula sp.* luzula
45

LILIACEAE

31 37	<i>Blandfordia punicea</i>	christmas bells	en
26	<i>Dianella revoluta</i>	spreading flaxlily	
1 16 18 23 32	<i>Dianella tasmanica</i>	forest flaxlily	
9 12 16 20 24 30 32	<i>Drymophila cyanocarpa</i>	turquoise berry	

ORCHIDACEAE

9 26 48	<i>Acianthus caudatus</i>	mayfly orchid	
1 14 16 18 23 30 32 35 38 43 45 48	<i>Acianthus sp.</i>	mosquito orchid	
4 35 39 41 43 47 48	<i>Caladenia alata</i>	fairy fingers	
26 39	<i>Caladenia carnea</i>	pink fingers	
9 28	<i>Caladenia fuscata</i>	dusky fingers	
15	<i>Caladenia mentiens</i>	lesser fingers	
45	<i>Caladenia sp.</i>	spider-orchid	
3 27 31 37 41 42	<i>Calochilus paludosus</i>	strap beard-orchid	
10 45 48	<i>Chiloglottis cornuta</i>	green bird-orchid	
12 21 23	<i>Chiloglottis sp.</i>	bird orchid	
46	<i>Corybas sp.</i>	helmet orchid	
27 37	<i>Cryptostylis subulata</i>	large tongue-orchid	
3	<i>Microtis sp.</i>	onion orchid	
40	<i>Prasophyllum pulchellum</i>	pretty leek-orchid	CR e
40	<i>Prasophyllum rostratum</i>	slaty leek-orchid	en
29	<i>Prasophyllum sp.</i>	leek orchid	
8 26 46 48	<i>Pterostylis nutans</i>	nodding greenhood	
9 46	<i>Pterostylis sp.</i>	greenhood	
3 31	<i>Thelymitra aristata</i>	great sun-orchid	
5 39	<i>Thelymitra juncifolia</i>	large-spotted sun-orchid	
41 42 45 48	<i>Thelymitra sp.</i>	sun-orchid	

POACEAE

40	<i>Austrodanthonia sp.</i>	wallabygrass	
1 2 3 4 6 9 10 13 21 23 27 30 31 32 35 36 37 41 43 44	<i>Ehrharta sp.</i>	ricegrass	
8	<i>Poa annua</i>	winter grass	i

RESTIONACEAE

1 10 11 12 17 43	<i>Baloskion tetraphyllum subsp. tetraphyllum</i>	tassel cordrush	
1	<i>Calorophus elongatus</i>	long roperush	
3 6 31	<i>Chordifex hookeri</i>	woolly buttonrush	en
3 4 11 19 23 27 31 37 41	<i>Empodisma minus</i>	spreading roperush	
2 3 11 27 37	<i>Eurychorda complanata</i>	flat cordrush	
5 6 15 19 41	<i>Hypolaena fastigiata</i>	tassel roperush	
3 11 15 19 22 31 41	<i>Leptocarpus tenax</i>	slender twinerush	
15	<i>Restio sp.</i>	rush	

XYRIDACEAE

31	<i>Xyris gracilis</i>	yelloweye
3 27	<i>Xyris operculata</i>	tall yelloweye
1 2 10 11 15	<i>Xyris sp.</i>	yelloweye
19 22 41		

PTERIDOPHYTA

ASPIDACEAE

17	<i>Rumohra adiantiformis</i>	leathery shieldfern
----	------------------------------	---------------------

BLECHNACEAE

1 17	<i>Blechnum nudum</i>	fishbone waterfern
1 8 10 12 17	<i>Blechnum wattsii</i>	hard waterfern
23 28 38 39		
47		

DENNSTAEDTIACEAE

9 17 45 46	<i>Histiopteris incisa</i>	batswing fern
45	<i>Hypolepis rugosula</i>	ruddy groundfern
1 4 6 8 11	<i>Pteridium esculentum</i>	bracken
12 14 16 18		
20 23 30 32		
36 38 44 45		
46 47		

GLEICHENIACEAE

4 11 12 37	<i>Gleichenia dicarpa</i>	pouched corallfern
38 41		
1 10 17 23	<i>Gleichenia microphylla</i>	scrambling corallfern
45		
1 9 45	<i>Sticherus tener</i>	silky fanfern

LINDSAEACEAE

3 4 6 16 21	<i>Lindsaea linearis</i>	screw fern
24 27 29 36		
37 44		

LYCOPODIACEAE

2 5 11	<i>Lycopodiella lateralis</i>	slender clubmoss
1 2 3 34 37	<i>Lycopodium deuterodensum</i>	conifer clubmoss
43		

OSMUNDACEAE

1 39	<i>Todea barbara</i>	southern kingfern
------	----------------------	-------------------

SCHIZAEACEAE

3 27	<i>Schizaea bifida</i>	forked combfern
------	------------------------	-----------------

SELAGINELLACEAE

2 3 6 11 15	<i>Selaginella uliginosa</i>	swamp spikemoss
19 21 22 27		
29 31 37 41		
42 44		

APPENDIX 4 - COMMUNITY SPECIES LIST

Communities for Project: PAS062

Sites: SHW Sprengelia incarnata wet heath,

Trees:	<i>Allocasuarina monilifera</i> , <i>Eucalyptus nitida</i> , <i>Eucalyptus obliqua</i>
Tall Shrubs:	<i>Acacia mucronata</i> , <i>Banksia marginata</i> , <i>Leptospermum glaucescens</i> , <i>Leptospermum lanigerum</i> , <i>Leptospermum nitidum</i> , <i>Leptospermum scoparium</i> , <i>Melaleuca squarrosa</i>
Shrubs:	<i>Acacia suaveolens</i> , <i>Amperea xiphoclada</i> var. <i>xiphoclada</i> , <i>Bauera rubioides</i> , <i>Bossiaea cinerea</i> , <i>Dillwynia glaberrima</i> , <i>Epacris curtisiae</i> , <i>Epacris impressa</i> , <i>Epacris lanuginosa</i> , <i>Euryomyrtus ramosissima</i> , <i>Leucopogon australis</i> , <i>Leucopogon collinus</i> , <i>Melaleuca squamea</i> , <i>Persoonia juniperina</i> , <i>Philotheca virgata</i> , <i>Pultenaea juniperina</i> , <i>Sprengelia incarnata</i>
Low Shrubs:	<i>Aotus ericoides</i> , <i>Hibbertia procumbens</i> , <i>Hibbertia prostrata</i>
Herbs:	<i>Caladenia alata</i> , <i>Calochilus paludosus</i> , <i>Comesperma calymega</i> , <i>Comesperma retusum</i> , <i>Drosera binata</i> , <i>Drosera pygmaea</i> , <i>Gompholobium huegelii</i> , <i>Microtis</i> sp., <i>Prasophyllum pulchellum</i> , <i>Prasophyllum rostratum</i> , <i>Prasophyllum</i> sp., <i>Rhytidosporea procumbens</i> , <i>Sphaerolobium minus</i> , <i>Stackhousia viminea</i> , <i>Stylidium graminifolium</i> , <i>Thelymitra aristata</i> , <i>Thelymitra juncifolia</i> , <i>Thelymitra</i> sp.
Graminoids:	<i>Baumea</i> sp., <i>Chordifex hookeri</i> , <i>Empodisma minus</i> , <i>Eurychorda complanata</i> , <i>Gahnia grandis</i> , <i>Gymnoschoenus sphaerocephalus</i> , <i>Hypolaena fastigiata</i> , <i>Lepidosperma concavum</i> , <i>Lepidosperma filiforme</i> , <i>Leptocarpus tenax</i> , <i>Patersonia fragilis</i> , <i>Schoenus</i> sp., <i>Tetraria capillaris</i> , <i>Xyris operculata</i> , <i>Xyris</i> sp.
Grasses:	<i>Austrodanthonia</i> sp., <i>Ehrharta</i> sp.
Ferns:	<i>Gleichenia dicarpa</i> , <i>Lindsaea linearis</i> , <i>Lycopodiella lateralis</i> , <i>Lycopodium deuterodensum</i> , <i>Schizaea bifida</i> , <i>Selaginella uliginosa</i>
Climbers:	<i>Cassytha glabella</i> , <i>Cassytha pubescens</i>

Sites: SWW – Western wet scrub

Trees:	<i>Allocasuarina monilifera</i> , <i>Eucalyptus nitida</i> , <i>Eucalyptus obliqua</i>
Tall Shrubs:	<i>Acacia mucronata</i> , <i>Banksia marginata</i> , <i>Leptospermum glaucescens</i> , <i>Leptospermum nitidum</i> , <i>Leptospermum scoparium</i> , <i>Melaleuca squarrosa</i> , <i>Monotoca glauca</i>
Shrubs:	<i>Acacia genistifolia</i> , <i>Amperea xiphoclada</i> var. <i>xiphoclada</i> , <i>Bauera rubioides</i> , <i>Bossiaea cinerea</i> , <i>Epacris lanuginosa</i> , <i>Leptomeria drupacea</i> , <i>Leucopogon australis</i> , <i>Leucopogon collinus</i> , <i>Lomatia tinctoria</i> , <i>Melaleuca squamea</i> , <i>Persoonia juniperina</i> , <i>Philotheca virgata</i> , <i>Pimelea linifolia</i> subsp. <i>linifolia</i> , <i>Pultenaea juniperina</i> , <i>Sprengelia incarnata</i>
Low Shrubs:	<i>Aotus ericoides</i> , <i>Hibbertia procumbens</i>
Herbs:	<i>Caladenia mentiens</i> , <i>Calochilus paludosus</i> , <i>Cryptostylis subulata</i> , <i>Drosera binata</i> , <i>Drosera peltata</i> , <i>Drosera pygmaea</i> , <i>Stackhousia viminea</i> , <i>Utricularia dichotoma</i> , <i>Viola hederacea</i> , <i>Xanthosia tasmanica</i>
Graminoids:	<i>Baloskion tetraphyllum</i> subsp. <i>tetraphyllum</i> , <i>Baumea</i> sp., <i>Baumea tetragona</i> , <i>Empodisma minus</i> , <i>Eurychorda complanata</i> , <i>Gahnia grandis</i> , <i>Gymnoschoenus sphaerocephalus</i> , <i>Hypolaena fastigiata</i> , <i>Lepidosperma filiforme</i> , <i>Leptocarpus tenax</i> , <i>Luzula</i> sp., <i>Patersonia fragilis</i> , <i>Restio</i> sp., <i>Schoenus</i> sp., <i>Tetraria capillaris</i> , <i>Xyris operculata</i> , <i>Xyris</i> sp.
Grasses:	<i>Ehrharta</i> sp.
Ferns:	<i>Gleichenia dicarpa</i> , <i>Lindsaea linearis</i> , <i>Lycopodiella lateralis</i> , <i>Pteridium esculentum</i> , <i>Schizaea bifida</i> , <i>Selaginella uliginosa</i>
Climbers:	<i>Cassytha pubescens</i>

Sites: DNI – Dry *Eucalyptus nitida* forest, DNI heathy, DNI additional spp riparian area

Trees:	<i>Allocasuarina monilifera</i> , <i>Eucalyptus nitida</i> , <i>Eucalyptus obliqua</i>
Tall Shrubs:	<i>Acacia mucronata</i> , <i>Acacia verticillata</i> , <i>Banksia marginata</i> , <i>Leptospermum glaucescens</i> , <i>Leptospermum nitidum</i> , <i>Leptospermum scoparium</i> , <i>Melaleuca squarrosa</i> , <i>Monotoca glauca</i> , <i>Pultenaea daphnoides</i> var. <i>obcordata</i>
Shrubs:	<i>Acacia suaveolens</i> , <i>Amperea xiphoclada</i> var. <i>xiphoclada</i> , <i>Bauera rubioides</i> , <i>Bossiaea cinerea</i> , <i>Dillwynia glaberrima</i> , <i>Epacris impressa</i> , <i>Epacris lanuginosa</i> , <i>Leptomeria drupacea</i> , <i>Leucopogon australis</i> , <i>Leucopogon collinus</i> , <i>Lomatia tinctoria</i> , <i>Melaleuca squamea</i> , <i>Persoonia juniperina</i> , <i>Philotheca virgata</i> , <i>Pimelea linifolia</i> subsp. <i>linifolia</i> , <i>Pultenaea juniperina</i> , <i>Sprengelia incarnata</i>
Low Shrubs:	<i>Aotus ericoides</i> , <i>Astroloma humifusum</i> , <i>Hibbertia empetrifolia</i> subsp. <i>empetrifolia</i>
Herbs:	<i>Acianthus</i> sp., <i>Blandfordia punicea</i> , <i>Caladenia alata</i> , <i>Caladenia carnea</i> , <i>Calochilus paludosus</i> , <i>Chiloglottis</i> sp., <i>Comesperma calymega</i> , <i>Cryptostylis subulata</i> , <i>Drosera peltata</i> , <i>Drosera pygmaea</i> , <i>Drymophila cyanocarpa</i> , <i>Gompholobium huegelii</i> , <i>Gonocarpus micranthus</i> subsp. <i>micranthus</i> , <i>Gonocarpus tetragynus</i> , <i>Rhytidosporum procumbens</i> , <i>Sphaerolobium minus</i> , <i>Stackhousia viminea</i> , <i>Stylidium graminifolium</i> , <i>Thelymitra juncifolia</i> , <i>Thelymitra</i> sp.
Graminoids:	<i>Baloskion tetraphyllum</i> subsp. <i>tetraphyllum</i> , <i>Baumea</i> sp., <i>Chordifex hookeri</i> , <i>Empodisma minus</i> , <i>Eurychorda complanata</i> , <i>Gahnia grandis</i> , <i>Hypolaena fastigiata</i> , <i>Lepidosperma concavum</i> , <i>Lepidosperma elatius</i> , <i>Lepidosperma filiforme</i> , <i>Patersonia fragilis</i> , <i>Schoenus</i> sp., <i>Tetraria capillaris</i>
Grasses:	<i>Ehrharta</i> sp.
Ferns:	<i>Blechnum watsii</i> , <i>Gleichenia dicarpa</i> , <i>Lindsaea linearis</i> , <i>Lycopodium deuterodensum</i> , <i>Pteridium esculentum</i> , <i>Selaginella uliginosa</i> , <i>Todea barbara</i>
Climbers:	<i>Cassytha glabella</i>

Sites: DOB – Dry *Eucalyptus obliqua* forest, DOB heathy,

Trees:	<i>Allocasuarina monilifera</i> , <i>Eucalyptus nitida</i> , <i>Eucalyptus obliqua</i>
Tall Shrubs:	<i>Acacia mucronata</i> , <i>Acacia verticillata</i> , <i>Banksia marginata</i> , <i>Leptospermum glaucescens</i> , <i>Leptospermum scoparium</i> , <i>Melaleuca squarrosa</i> , <i>Monotoca glauca</i> , <i>Nematolepis squamea</i> , <i>Oxylobium ellipticum</i> , <i>Pultenaea daphnoides</i> var. <i>obcordata</i>
Shrubs:	<i>Acacia genistifolia</i> , <i>Acacia longifolia</i> subsp. <i>sophorae</i> , <i>Bauera rubioides</i> , <i>Bossiaea cinerea</i> , <i>Bossiaea prostrata</i> , <i>Cassinia aculeata</i> , <i>Epacris impressa</i> , <i>Epacris lanuginosa</i> , <i>Leptomeria drupacea</i> , <i>Leucopogon australis</i> , <i>Lomatia tinctoria</i> , <i>Melaleuca squamea</i> , <i>Persoonia juniperina</i> , <i>Pimelea linifolia</i> subsp. <i>linifolia</i> , <i>Pomaderris pilifera</i> , <i>Pultenaea juniperina</i> , <i>Sprengelia incarnata</i>
Low Shrubs:	<i>Acacia myrtifolia</i> , <i>Aotus ericoides</i> , <i>Astroloma humifusum</i> , <i>Hibbertia empetrifolia</i> subsp. <i>empetrifolia</i> , <i>Tetradlea labillardierei</i> , <i>Tetradlea pilosa</i>
Herbs:	<i>Acianthus caudatus</i> , <i>Acianthus</i> sp., <i>Caladenia alata</i> , <i>Caladenia carnea</i> , <i>Coronidium scorpioides</i> , <i>Dianella revoluta</i> , <i>Drosera peltata</i> , <i>Drosera pygmaea</i> , <i>Euchiton</i> sp., <i>Galium australe</i> , <i>Gonocarpus teucroides</i> , <i>Hydrocotyle hirta</i> , <i>Pelargonium australe</i> , <i>Pterostylis nutans</i> , <i>Rhytidosporum procumbens</i> , <i>Sphaerolobium minus</i> , <i>Utricularia dichotoma</i> , <i>Viola hederacea</i>
Graminoids:	<i>Baumea tetragona</i> , <i>Diplarrena moraea</i> , <i>Empodisma minus</i> , <i>Eurychorda complanata</i> , <i>Gahnia grandis</i> , <i>Lepidosperma concavum</i> , <i>Lepidosperma filiforme</i> , <i>Patersonia fragilis</i> , <i>Schoenus</i> sp., <i>Xyris</i> sp.
Grasses:	<i>Ehrharta</i> sp.
Ferns:	<i>Gleichenia dicarpa</i> , <i>Lindsaea linearis</i> , <i>Lycopodiella lateralis</i> , <i>Lycopodium deuterodensum</i> , <i>Pteridium esculentum</i> , <i>Selaginella uliginosa</i>
Climbers:	<i>Billardiera mutabilis</i> , <i>Cassytha pubescens</i> , <i>Comesperma volubile</i>
Weeds:	<i>Cirsium vulgare</i>

Sites: WOL - Wet *Eucalyptus obliqua* forest over *Leptospermum*, WOL post-logging regen

Trees:	<i>Eucalyptus nitida</i> , <i>Eucalyptus obliqua</i>
Tall Shrubs:	<i>Acacia mucronata</i> , <i>Acacia verticillata</i> , <i>Acacia verticillata</i> subsp. <i>verticillata</i> , <i>Banksia marginata</i> , <i>Leptospermum glaucescens</i> , <i>Leptospermum lanigerum</i> , <i>Leptospermum nitidum</i> , <i>Leptospermum scoparium</i> , <i>Melaleuca squarrosa</i> , <i>Monotoca glauca</i> , <i>Nematolepis squamea</i> , <i>Pomaderris apetala</i> , <i>Pultenaea daphnoides</i> var. <i>obcordata</i> , <i>Zieria arborescens</i>
Shrubs:	<i>Amperea xiphoclada</i> var. <i>xiphoclada</i> , <i>Bauera rubioides</i> , <i>Bossiaea cinerea</i> , <i>Epacris impressa</i> , <i>Leucopogon australis</i> , <i>Leucopogon collinus</i> , <i>Lomatia tinctoria</i> , <i>Persoonia juniperina</i> , <i>Philotheca virgata</i> , <i>Pimelea linifolia</i> subsp. <i>linifolia</i> , <i>Pultenaea juniperina</i>
Low Shrubs:	<i>Aotus ericoides</i> , <i>Hibbertia empetrifolia</i> subsp. <i>empetrifolia</i> , <i>Tetratheca labillardierei</i>
Herbs:	<i>Acianthus</i> sp., <i>Caladenia alata</i> , <i>Caladenia fuscata</i> , <i>Chiloglottis</i> sp., <i>Dianella tasmanica</i> , <i>Drosera peltata</i> , <i>Drymophila cyanocarpa</i> , <i>Gonocarpus teucroides</i> , <i>Viola hederacea</i>
Graminoids:	<i>Baloskion tetraphyllum</i> subsp. <i>tetraphyllum</i> , <i>Empodisma minus</i> , <i>Gahnia grandis</i> , <i>Lepidosperma elatius</i> , <i>Lepidosperma laterale</i> , <i>Lepidosperma</i> sp., <i>Luzula</i> sp., <i>Schoenus</i> sp.
Grasses:	<i>Ehrharta</i> sp.
Ferns:	<i>Blechnum nudum</i> , <i>Blechnum wattsii</i> , <i>Gleichenia dicarpa</i> , <i>Gleichenia microphylla</i> , <i>Histiopteris incisa</i> , <i>Lindsaea linearis</i> , <i>Lycopodium deuterodensum</i> , <i>Pteridium esculentum</i> , <i>Rumohra adiantiformis</i>
Climbers:	<i>Billardiera mutabilis</i> , <i>Cassytha pubescens</i>
Weeds:	<i>Hypochoeris radicata</i>

Sites: WOB – Wet *Eucalyptus obliqua* forest over broad-leaf shrubs

Trees:	<i>Acacia melanoxylon</i> , <i>Allocasuarina monilifera</i> , <i>Eucalyptus obliqua</i> , <i>Eucryphia lucida</i> , <i>Nothofagus cunninghamii</i>
Tall Shrubs:	<i>Acacia mucronata</i> , <i>Acacia verticillata</i> , <i>Anopterus glandulosus</i> , <i>Banksia marginata</i> , <i>Leptospermum glaucescens</i> , <i>Leptospermum lanigerum</i> , <i>Leptospermum nitidum</i> , <i>Leptospermum scoparium</i> , <i>Melaleuca squarrosa</i> , <i>Monotoca glauca</i> , <i>Nematolepis squamea</i> , <i>Oxylobium ellipticum</i> , <i>Pomaderris apetala</i> , <i>Prostanthera lasianthos</i> var. <i>lasianthos</i> , <i>Zieria arborescens</i>
Shrubs:	<i>Acacia genistifolia</i> , <i>Amperea xiphoclada</i> var. <i>xiphoclada</i> , <i>Bauera rubioides</i> , <i>Bossiaea cinerea</i> , <i>Epacris impressa</i> , <i>Leucopogon australis</i> , <i>Leucopogon collinus</i> , <i>Lomatia tinctoria</i> , <i>Melaleuca squamea</i> , <i>Olearia lirata</i> , <i>Philotheca virgata</i> , <i>Pimelea linifolia</i> subsp. <i>linifolia</i> , <i>Pomaderris pilifera</i> , <i>Pultenaea juniperina</i>
Low Shrubs:	<i>Acacia myrtifolia</i> , <i>Hibbertia empetrifolia</i> subsp. <i>empetrifolia</i> , <i>Tetratheca pilosa</i>
Herbs:	<i>Acianthus caudatus</i> , <i>Acianthus</i> sp., <i>Caladenia alata</i> , <i>Caladenia fuscata</i> , <i>Chiloglottis cornuta</i> , <i>Dianella tasmanica</i> , <i>Drosera binata</i> , <i>Drosera peltata</i> , <i>Drymophila cyanocarpa</i> , <i>Euchiton</i> sp., <i>Galium australe</i> , <i>Gonocarpus teucroides</i> , <i>Isolepis</i> sp., <i>Pterostylis nutans</i> , <i>Pterostylis</i> sp., <i>Senecio glomeratus</i> , <i>Thelymitra</i> sp., <i>Viola hederacea</i> , <i>Xanthosia pilosa</i>
Graminoids:	<i>Baloskion tetraphyllum</i> subsp. <i>tetraphyllum</i> , <i>Calorophus elongatus</i> , <i>Gahnia grandis</i> , <i>Lepidosperma elatius</i> , <i>Lepidosperma laterale</i> , <i>Luzula</i> sp., <i>Patersonia fragilis</i> , <i>Schoenus</i> sp., <i>Xyris</i> sp.
Grasses:	<i>Ehrharta</i> sp.
Ferns:	<i>Blechnum nudum</i> , <i>Blechnum wattsii</i> , <i>Gleichenia microphylla</i> , <i>Histiopteris incisa</i> , <i>Lycopodium deuterodensum</i> , <i>Pteridium esculentum</i> , <i>Sticherus tener</i> , <i>Todea barbara</i>
Climbers:	<i>Billardiera mutabilis</i> , <i>Cassytha pubescens</i> , <i>Comesperma volubile</i>
Weeds:	<i>Poa annua</i>

Sites: WOR (regenerating forest after fire)

Trees:	<i>Acacia melanoxylon</i> , <i>Atherosperma moschatum</i> subsp. <i>moschatum</i> , <i>Eucalyptus obliqua</i> , <i>Eucryphia lucida</i> , <i>Nothofagus cunninghamii</i>
Tall Shrubs:	<i>Anodopetalum biglandulosum</i> , <i>Leptospermum scoparium</i> , <i>Pomaderris apetala</i>
Shrubs:	<i>Bauera rubioides</i> , <i>Cassinia aculeata</i> , <i>Olearia stellulata</i>
Herbs:	<i>Corybas</i> sp., <i>Euchiton</i> sp., <i>Hydrocotyle hirta</i> , <i>Pterostylis nutans</i> , <i>Pterostylis</i> sp.
Ferns:	<i>Histiopteris incisa</i> , <i>Pteridium esculentum</i>
Climbers:	<i>Billardiera mutabilis</i>