

Botanical Values of the Tunnel Hill Quarry

(Serpentine Hill, Tasmania)

A Report prepared for

**Mr Tamas Kapitany
c/- Crystal World & Prehistoric Journeys
1672 Princes Highway
Oakleigh East
Victoria 3166**

15 January 2004

Richard Schahinger

**Consultant Botanist
20 Clutha Place, South Hobart, Tasmania 7004
E-mail: greenseed@bigpond.com**

1. Introduction

This report summarises the likely impact of proposed mining activities on the botanical values of the Tunnel Hill quarry and its immediate environs. The quarry lies close to Serpentine Hill, approximately 9 km northeast of Zeehan (see Figure 1). Mr Tamas Kapitany of 'Crystal World & Prehistoric Journeys' (Melbourne) has an exploration licence over the area (# EL 19/2002), and is proposing to undertake the following works within the quarry (as detailed in Figure 2):

- sampling of some large serpentinite boulders on the eastern margins of the quarry
- costeaning work in the central part of the quarry, the principal target being the mineral stichtite

The Serpentine Hill/Tunnel Hill area is well known for its botanical values, being the type locality for the threatened endemic shrubs *Epacris glabella* and *Micrantheum serpentinum*. *Epacris glabella* is listed as endangered on both the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) and the Tasmanian *Threatened Species Protection Act 1995* (TSPA), while *Micrantheum serpentinum* is listed as vulnerable on the TSPA. An additional TSPA listed species, the rare orchid *Orthoceras strictum*, is also known from the immediate area. Known locations of threatened plant species in the area are shown in Figure 1, based on data in the Tasmanian Parks and Wildlife Service's GTSpot database (accessible on the web at www.gisparks.tas.gov.au). Note that the Tunnel Hill quarry occurs on a wedge of Crown Land bounded to the east by the Murchison Highway and to the west by the Emu Bay Railway; the remainder of the land shown in Figure 1 is State Forest.

Under the Commonwealth's EPBC the proposed mining activities would require approval from the Commonwealth's Environment Minister if the activities will have, or are likely to have a *significant* impact on the listed species *Epacris glabella*. This report seeks to provide the data necessary for such an assessment to be made. (Refer to the following website: www.deh.gov.au/biodiversity/threatened and follow the links to 'Administrative Guidelines on Significance' for more information.) In addition, under the Tasmanian TSPA a permit would need to be issued by the Threatened Species Unit (part of the Tasmanian Department of Primary Industries, Water and Environment) if listed species were likely to be destroyed during the proposed activities.

2. Site Description & Survey Methodology

The Tunnel Hill quarry lies to the immediate west of the Murchison Highway, with two (ungated) access tracks to the quarry's northeast (detail in Figure 2). The quarry has an area of 0.4–0.5 ha, extending about 100 m in the north-south direction with a variable 'width' of 40–50 m. The quarry generally slopes away to the south-southeast from an altitude of c. 300 m asl, though there is also a depression in the far north of the quarry where water pools (as shown by the dark patch in Figure 2). An exposed serpentinite rock face forms the southwestern and southern border of the quarry, while a number of large serpentinite boulders have been massed together on the quarry's eastern and southeastern margins (labelled SB1, SB2 and SB3 in Figure 2). The area proposed for costeaning lies in the central part of the quarry (labelled COST in Figure 2).

The Tunnel Hill quarry, the ridge to its southwest and the southern and western slopes of Serpentine Hill were surveyed on 8 January 2004. A running list of plant species was made for the quarry itself, while the structure of 'typical' undisturbed vegetation close to the quarry was also noted. The locations of any threatened species were recorded with a Garmin 12XL GPS and their number noted, with grid references accurate to 5 m (map datum = AGD 1966). The survey included searching for symptoms of the introduced soil-borne plant pathogen *Phytophthora cinnamomi*, as well as the presence of any potentially invasive weeds. Plant nomenclature throughout follows the Tasmanian Herbarium (2003).

3. Results

The vegetation around the quarry is generally a shrubby *Eucalyptus nitida* woodland. In contrast, the greater proportion of the quarry floor is devoid of vegetation, with only the margins and the occasional 'inner' pocket being colonised by a range of shrubs and grasses. A list of species recorded in the quarry is provided in Appendix 1, along with a structural breakdown of the undisturbed vegetation on the ridgeline to the quarry's southwest. Among the plants found the quarry were the threatened *Epacris glabella* and *Micrantheum serpentinum*. The third of the anticipated threatened species, the horned orchid *Orthoceras strictum*, was not recorded despite the survey being undertaken during the species' main flowering period (Jones et al. 1999).

Descriptions of *Epacris glabella* and *Micrantheum serpentinum* are provided in the following sections, along with an assessment of the likely impact of the proposed activities on their status at the local and state level. A tabulated summary is provided in section 4.

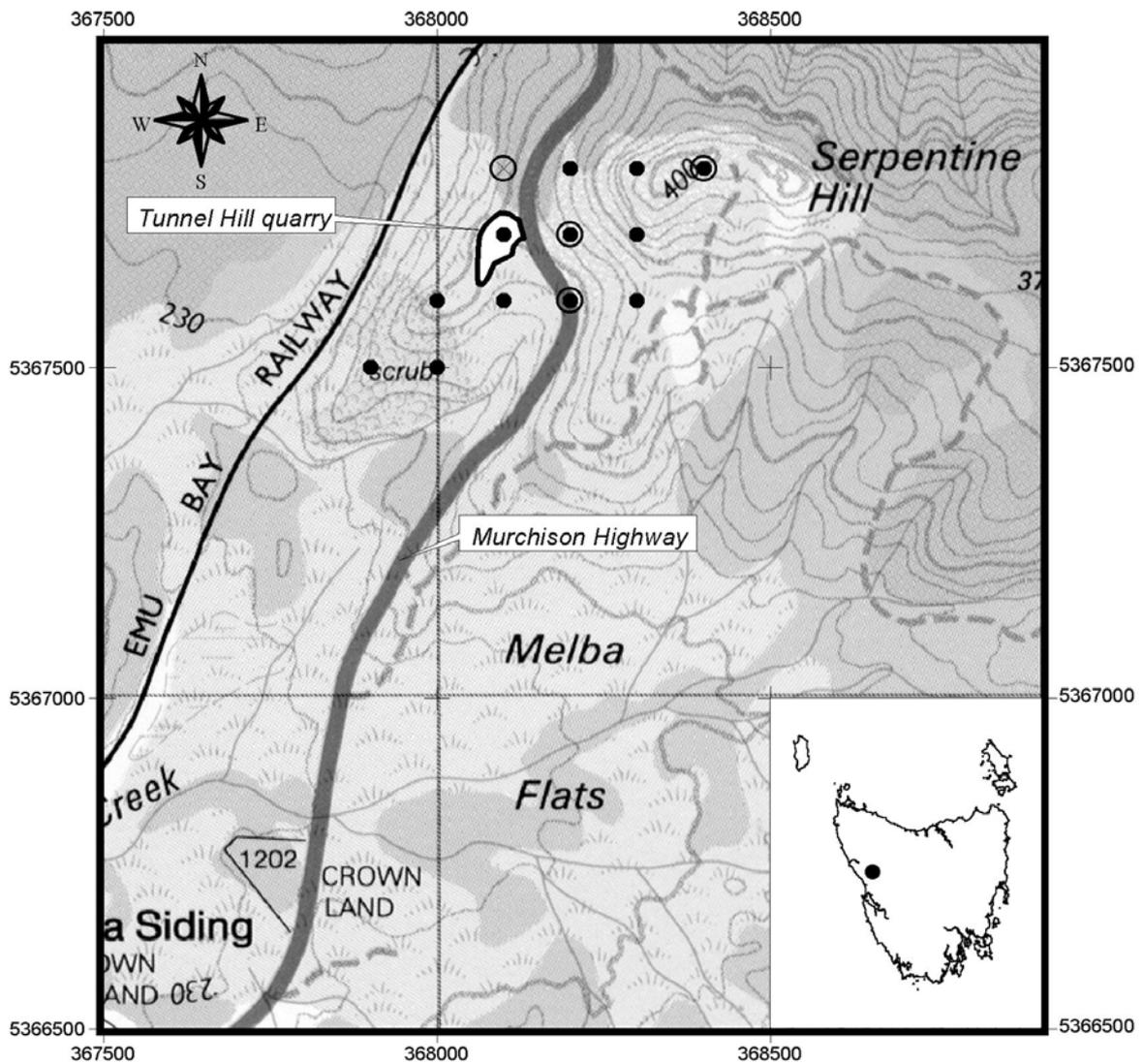


FIGURE 1. Location map showing the Tunnel Hill quarry, the site of the proposed mining activities (1:25,000 mapsheet = Dundas 3636; map datum = AGD 1966).

Threatened plant species locations as per the Tasmanian Parks & Wildlife Service's GTSpot database:

- = *Epacris glabella*, ○ = *Micrantheum serpentinum*, × = *Orthoceras strictum*.

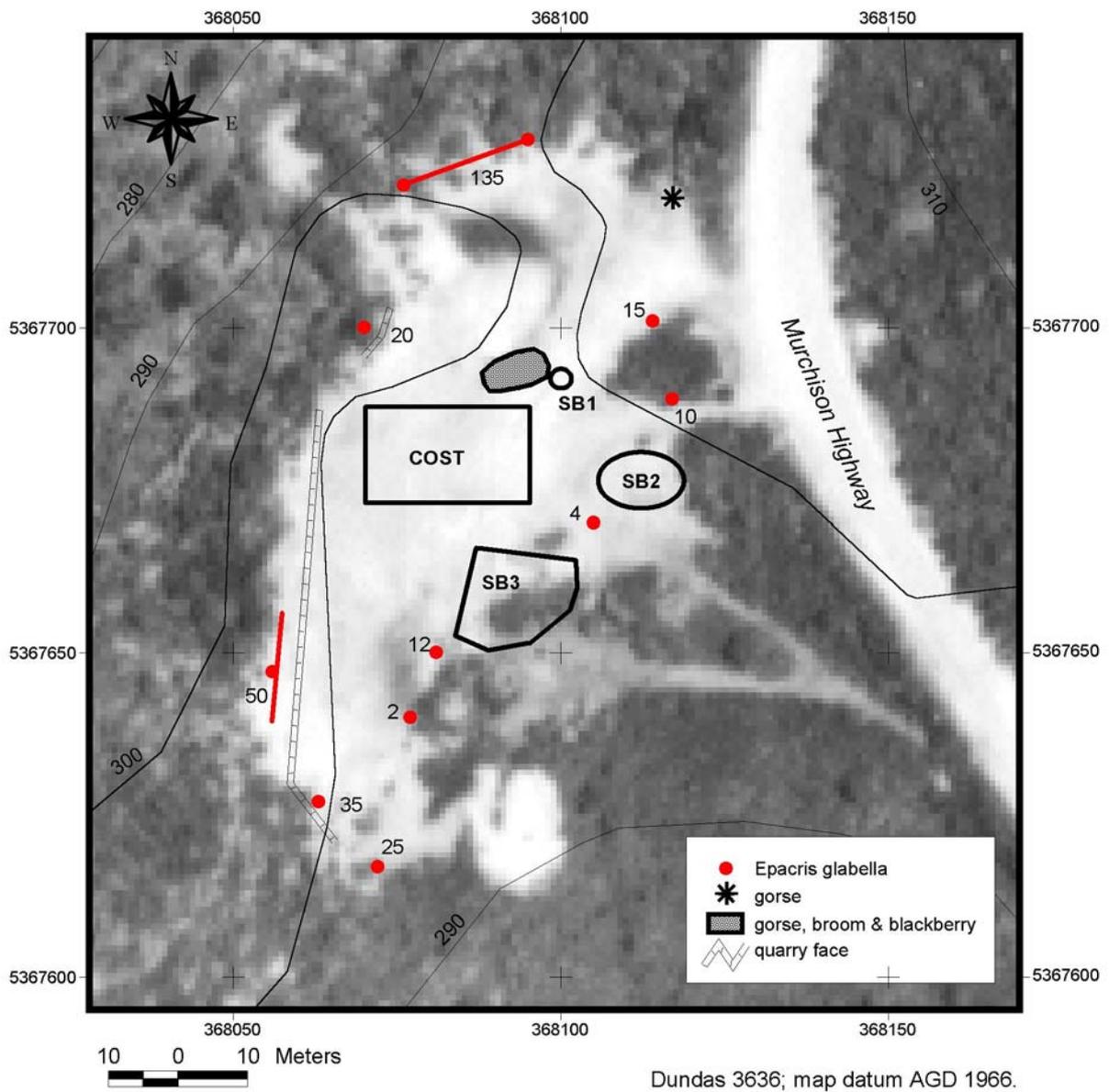


FIGURE 2. The Tunnel Hill quarry (1991 aerial photograph; contour interval 10 m). SB1, SB2 and SB3 = areas with serpentine boulders; COST = area proposed for costeaning.

The number of mature *Epacris glabella* plants recorded within and at the margins of the quarry is shown; note that *Micrantheum serpentinum* is found in good numbers at all margins of the quarry (see section 3.2).

3.1 *Epacris glabella* (Funnel heath)

Conservation Status:

Tasmanian *Threatened Species Protection Act 1995*

endangered

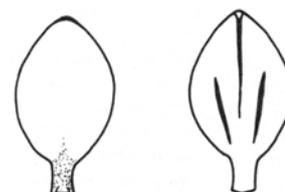
Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

endangered

Epacris glabella is an erect shrub up to 2 m high in the Epacridaceae family. Its leaves are half-spreading, while the leaf blade is obovate to broadly-elliptical to ovate, 3.5–7 mm long by 2–3.5 mm wide, flat, thick, shiny and devoid of hairs; the leaf apex may be acute or obtuse with a very short incurved tip. The white flowers appear in spring and are solitary in the leaf axils; the corolla tube is funnel-shaped, 2.5–3.5 mm long, and the five lobes are ovate, 3–5 mm long; the stamens and style are exerted well beyond the tube. (Jarman & Mihaich 1991.)



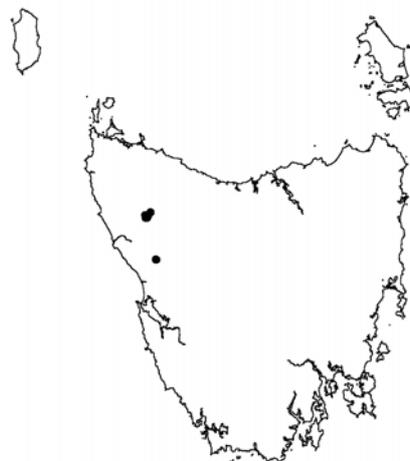
Epacris glabella is restricted to Cambrian serpentinite in two areas of northwestern Tasmania, one c. 4 km SSW of Renison Bell (= Serpentine Hill) and another between Savage River and Luina. It occurs in hilly terrain in either heathland/scrub or *Eucalyptus nitida* dry sclerophyll woodland (Jarman & Mihaich 1991; Keith 1998), with an altitude range of 270–490 m asl.



Around the Tunnel Hill quarry *Epacris glabella* may co-occur with *Epacris impressa*; the latter species has relatively narrow recurved leaves that taper to a sharp point, while its flowers — which may vary in colour from white to various shades of pink to red — have a long corolla tube and short lobes.

Population parameters for *Epacris glabella* in Tasmania were estimated by Keith (1997 & 1998) as follows (with full figures provided in Appendix 2):

number of populations:	4
number of mature individuals:	30,915 (= lower bound)
linear extent:	47 km
extent of occurrence:	145.5 km ²
area of occupancy:	16.1 ha



Reservation status: three of the four populations representing c. 99% of the plants known in Tasmania occur in the Savage River area; one of these populations is within the Savage River Regional Reserve (with c. 24,000 mature individuals; refer to Appendix 2 for details), while all three are within a designated *Phytophthora* management area (Schahinger et al. 2003).

The Serpentine Hill population — with < 1% of the plants known in Tasmania — occurs on crown land to the west of the Murchison Highway (i.e., around the Tunnel Hill quarry), and on State Forest to the east of the highway, with about half the State Forest subpopulation within a ‘flora’ special management zone (Allison Woolley, pers. comm.; Orr & Gerrand 1998).

Keith (1997) estimated that there were between 28 and 231 mature *Epacris glabella* individuals to the west of the Murchison Highway in the Tunnel Hill area, with between 81 and 4,937 to the east around Serpentine Hill. Thus the lower bound for the Serpentine Hill population is just 109 (representing a 90% confidence limit). However, a direct count of mature *Epacris glabella* plants within and at the margins of the quarry during the current survey revealed more than 300 (as shown in Figure 2), with another 20–30 immature plants. This apparent discrepancy may reflect in part the changes in the population since Keith’s 1996 surveys — with active colonisation of disturbed areas at the quarry’s margins — but in part would also appear to reflect the conservative nature of the original figures.

Impact of proposed activities: it is estimated that four *Epacris glabella* plants that have colonised the quarry floor between the serpentinite boulder patches SB2 and SB3 would be affected by the proposed activities, with an additional twelve plants just to the south of SB3 also at risk (refer to Figure 2). The other 290 plants recorded in and around the quarry should not be directly disturbed by the proposed activities.

3.2 *Micrantheum serpentinum* (Serpentine micrantheum)

Conservation Status:

Tasmanian *Threatened Species Protection Act 1995*

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

vulnerable
not listed

Micrantheum serpentinum is a sprawling to erect shrub to 3 m high in the Euphorbiaceae (or spurge) family. Leaves are oblong to narrowly ovate to narrowly obovate, *in groups of three at alternately arranged nodes* along the branchlets; the leaf blades are typically 5–9 mm long by 1.5–3.3 mm wide, dark subglossy green above and paler below, the tip rounded. Flowers occur from September to November and are solitary in the axils of the upper leaves; male and female flowers occur on the same plant and are yellowish to greenish yellow in colour, sometimes tinged with red. (Orchard 1991; pers. obs.)



Micrantheum serpentinum is thought to occur in Tasmania only on Cambrian serpentinite, typically in rocky hillside shrubberies at altitudes of 170–480 m asl. Orchard (1991) described the species as being ‘locally abundant but very restricted by its substrate requirement’. The species is slightly more widespread than *Epacris glabella* — occurring also at Serpentine Ridge c. 9 km NNW of Renison Bell — and when present is usually much more abundant than the Epacrid.

Population parameters for *Micrantheum serpentinum* in Tasmania are as follows:

number of populations:	8–9
number of mature individuals:	>50,000??
linear extent:	48 km
extent of occurrence:	245km ²
area of occupancy:	c. 50 ha?



Reservation status: *Micrantheum serpentinum* is known from the Heazlewood River Conservation Area, the Meredith Range Regional Reserve, and the Savage River Regional Reserve, although there are no reliable estimates of population size at any of these sites. The Heazlewood population was described as being ‘widespread on serpentinite’ (North et al. 1998). The total number of mature plants given above is entirely speculative, being based solely on the observed densities around Serpentine Hill and a very rough estimate of the total area of occupancy. It is beyond the scope of the present study to address this issue further.

Orchard’s ‘local abundance’ comment has been borne out by the current survey of the Tunnel Hill quarry surrounds and the southern and western slopes of Serpentine Hill, where the species was found to dominate the shrub layer. It occurs in good numbers all around the quarry, and indeed, is the most common coloniser of the quarry itself, typically adopting a low spreading habit.

Impact of proposed activities: the *Micrantheum serpentinum* population around Serpentine & Tunnel Hills is considered likely to occupy an area of at least 10–15 ha, with the total number of mature individuals well in excess of 10,000 (assuming a ‘conservative’ plant density of 1 per 10 m²). The proposed removal of the serpentinite boulders on the southeastern margins of the Tunnel Hill quarry has the potential to directly impact about 100–150 plants, while the costeaning at the centre of the quarry would have no impact.

3.3 Associated Threats: Weed & Disease Spread

Any machinery entering or operating within the Tunnel Hill quarry runs the risk of introducing or spreading weeds and diseases that may impact upon the long-term viability of the *Epacris glabella* and *Micrantheum serpentinum* populations in the immediate and surrounding area.

Gorse (*Ulex europaeus*), English broom (*Cytisus scoparius*) and blackberry (*Rubus fruticosus*) are already present within the quarry itself, with a dense 10 by 5 m infestation to the immediate northeast of the proposed

costeaining area (as shown in Figure 2). Gorse also occurs at the northern margins of the quarry, and is common along the sides of the nearby Murchison Highway.

The introduced soil-borne plant pathogen *Phytophthora cinnamomi* is also known from the immediate area, with infestations dating back to at least the early 1970s when its presence in Tasmania was first recognised (Podger et al., 1990a and b). Recorded infestations are strongly associated with lines of transport and past mining activities (Figure 3).

Epacris glabella is known to be moderately susceptible to *Phytophthora* (Barker 1994) — indeed, this is one of the reasons behind its endangered status — and has been included in the Forest Epacrids Recovery Plan (Keith 1998) and *Phytophthora* Management Plans (Barker 1994; Schahinger et al. 2003). As noted earlier, the three Savage River populations are within a *Phytophthora* Management Area; any mining activities proposed in the area are subject to site-specific management prescriptions to be determined by the Mineral Exploration Working Group in consultation with DPIWE's Nature Conservation Branch.

The other threatened plant species recorded within the Tunnel Hill quarry area — *Micrantheum serpentinum* — is not considered to be susceptible to *Phytophthora*.

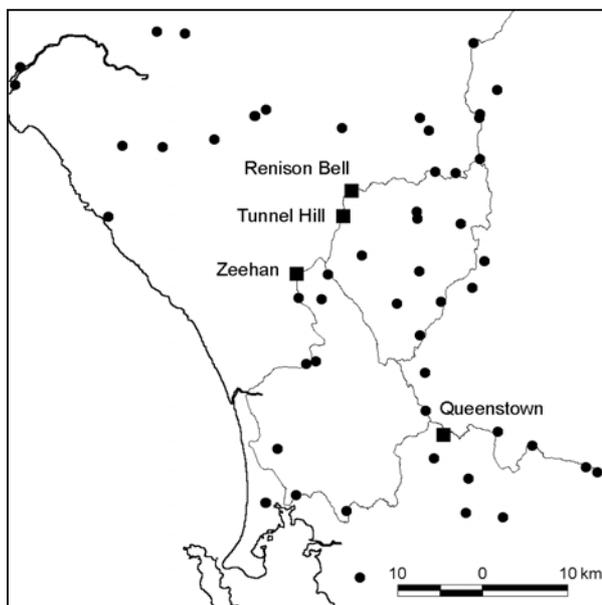


FIGURE 3. *Phytophthora cinnamomi* isolations from Tasmania's central west coast (●; derived from the PWS's GTSpot database, January 2004)

Phytophthora Status of the Tunnel Hill Quarry: clear symptoms of *Phytophthora* were not observed during the current surveys of the quarry and its immediate surrounds, although the leaves of a few large Banksias at the southern end of the quarry were showing some 'colour'. It would be surprising if *Phytophthora* were absent from the quarry given the past levels of activity and the open access of the quarry to a major highway. However, in the absence of proof to the contrary the quarry should be considered clean, and appropriate hygiene procedures should be adopted for any mining activities within the quarry (e.g., Bacon 1999; Tasmanian Government 2003).

4. Summary: potential impact upon the status of listed plant species in the Tunnel Hill quarry

	TSPA	EPBC	No of populations in Tasmania & no. of mature plants	No. of mature plants in the Tunnel-Serpentine Hill population	No. of mature plants directly affected by the proposed mining activities
<i>Epacris glabella</i>	endangered	endangered	4 (31,000+)*	109–5168*	4–16
<i>Micrantheum serpentinum</i>	vulnerable	–	8 (50,000+**)	c. 10,000	100–150
Potential threats associated with the proposed mining activities					
<i>Epacris glabella</i>	Introduction and/or spread of the soil-borne plant pathogen <i>Phytophthora cinnamomi</i> ; spread of gorse, broom and blackberry already present in quarry				
<i>Micrantheum serpentinum</i>	Spread of gorse, broom and blackberry already present in quarry				

* figures are based on the 1996 surveys of Keith (1997), though note that the present survey revealed about 300 mature plants around the margins of the Tunnel Hill quarry itself (as shown in Figure 2)

** speculative figure only (see section 3.2).

5. References

- Bacon, C. A. (1999). *Mineral Exploration Code of Practice (Fourth Edition)*. Mineral Resources Tasmania: Hobart.
- Barker, P. C. J. (1994). *Phytophthora cinnamomi: The susceptibility and management of selected Tasmanian rare species*. Forestry Tasmania and Australian Nature Conservation Agency.
- Jarman, S.J., and Mihaich, C. M. (1991). Additions to the Epacridaceae in Tasmania. In Banks, M. R. et al. (Eds), *Aspects of Tasmanian Botany – A Tribute to Winifred Curtis*. Royal Society of Tasmania, Hobart: 99–103.
- Jones, D., Wapstra, H., Tonelli, P., and Harris, S. (1999). *The Orchids of Tasmania*. Melbourne University Press.
- Keith, D. (1997). *The Distribution and Population Status of Rare Tasmanian Forest Epacrids*. Nature Conservation Branch, Tasmanian Parks and Wildlife Service, Hobart.
- Keith, D. (1998). *Recovery Plan: Tasmanian Forest Epacrids 1999–2004*. Tasmanian Parks and Wildlife Service, Hobart.
- North, A., Johnson, K., Ziegler, K., Duncan, F., Hopkins, K., Ziegeler, D., and Watts, S. (1998). *Flora of Recommended Areas for Protection and Forest Reserves in Tasmania. Reserve reports: Volume 6, West and Southwest IBRA Region*. Forest Practices Board, Forestry Tasmania, and Parks and Wildlife Service, Tasmania.
- Orchard, A. E. (1991). A new species of *Micrantheum* (Euphorbiaceae) from Tasmania. In Banks, M. R. et al. (Eds), *Aspects of Tasmanian Botany – A Tribute to Winifred Curtis*. Royal Society of Tasmania, Hobart: 59–64.
- Orr, S. and Gerrand, A. M. (1998). Management Decision Classification: A system for zoning land managed by Forestry Tasmania. *Tasforests* 10: 1–14.
- Podger, F.D., Mummery, D.C., Palzer, C.R., and Brown, M.J. (1990a). Bioclimatic analysis of the distribution of damage to native plants in Tasmania by *Phytophthora cinnamomi*. *Australian Journal of Ecology* 15:281–289.
- Podger, F., Palzer, C, and Wardlaw, T. (1990b). A guide to the Tasmanian distribution of *Phytophthora cinnamomi* and its effects on native vegetation. *Tasforests* 2:13–20.
- Schahinger, R., Rudman, T. and Wardlaw, T. (2003). *Conservation of Tasmanian Plant Species & Communities threatened by Phytophthora cinnamomi. Strategic Regional Plan for Tasmania*. Technical Report 03/03, Nature Conservation Branch, Department of Primary Industries, Water and Environment, Hobart.
- Tasmanian Government (2003). *Washdown Guidelines*. Department of Primary Industries, Water and Environment, Hobart (in prep.)
- Tasmanian Herbarium (2003). *Census of Vascular Plants*. Tasmanian Herbarium, Hobart, viewed 17 October 2003, <<http://www.tmag.tas.gov.au/Herbarium/TasVascPlants.pdf>>

Appendix 1. Vegetation in the Tunnel Hill area

(1) Shrubby *Eucalyptus nitida* woodland (ridgeline to southwest of the Tunnel Hill quarry)

Layer	Cover	Plant species (underlined = dominant; in brackets = occasional)
Small trees	< 5%	<i>Eucalyptus nitida</i>
Tall shrubs	30%	<i>Acacia mucronata</i> , <i>Leptospermum scoparium</i> , <i>Phebalium squameum</i> ssp. <i>retusum</i> (<i>Spyridium gunnii</i>)
Shrubs	50%	<i>Banksia marginata</i> , <i>Epacris glabella</i> , <i>Hakea epiglottis</i> , <i>Leptospermum glaucescens</i> , <i>Micrantheum serpentinum</i> , <i>Notelaea ligustrina</i> , <i>Pultenaea juniperina</i> (<i>Bauera rubioides</i> , <i>Epacris impressa</i> , <i>Lomatia tinctoria</i> , <i>Pultenaea gunnii</i>)
Undershubs	< 2%	<i>Comesperma volubile</i> , <i>Pimelea linifolia</i> , <i>Viola hederacea</i>
Grasses & graminoids	< 5%	<i>Ehrharta</i> sp., <i>Gahnia grandis</i> , <i>Lepidosperma laterale</i>
Surface rock	70–80%	

(2) Plants colonising the Tunnel Hill quarry (* = introduced & naturalised in Tasmania)

Small trees	<i>Eucalyptus nitida</i>
Shrubs	<i>Acacia mucronata</i> , <i>Acacia verticillata</i> , <i>Banksia marginata</i> , <i>Cenarrhenes nitida</i> , <i>Comesperma retusum</i> , <i>Cytisus scoparium</i> *, <i>Epacris glabella</i> , <i>Hakea epiglottis</i> , <i>Leptomeria drupacea</i> , <i>Leptospermum scoparium</i> , <i>Micrantheum serpentinum</i> , <i>Olearia stellulata</i> , <i>Ozothamnus thyrsoides</i> , <i>Spyridium gunnii</i> , <i>Ulex europaeus</i> *
Grasses & graminoids	<i>Agrostis avenacea</i> , <i>Agrostis stolonifera</i> *, <i>Austrodanthonia pilosa</i> , <i>Gahnia grandis</i> , <i>Holcus lanatus</i> *, <i>Poa labillardierei</i>

Appendix 2. *Epacris glabella* Populations in Tasmania

Four populations of *Epacris glabella* are known in Tasmania, three in the area between Savage River and Luina, and one at Serpentine Hill just south of Renison Bell (Keith 1997 & 1998). Keith (1997) separated the Serpentine Hill population into two subpopulations (EGL1a and b), 'a' being centred around the Tunnel Hill quarry to the west of the Murchison Highway, and 'b' around Serpentine Hill itself to the highway's east. The status of the populations in 1996 is given below (from Tables 14 and 15 of Keith 1997, with the tenure updated).

Location	Popul- ation	Mature population size			%Repro- ductive	Area Occupied (m ²)	Tenure
		Lower bound	Mean estimate	Upper bound			
Serpentine Hill (west of hwy)	EGL1a	28	140	231	58	400	Crown land
Serpentine Hill (east of hwy)	EGL1b	81	2,228	4,937	53	16,000	State Forest
Brassey Hill	EGL2	6,822	51,318	116,826	88	78,000	State forest
Gabbro Hill	EGL3a	1,494	4,968	9,851	83	1,200	Regional Reserve
19 Mile Creek	EGL3b	22,481	132,119	295,759	91	65,000	Regional Reserve
Bronzite Hill	EGL4	9	14	32	53	100	Regional Reserve
Total		30,915	190,785	427,636		161,000	

The considerable range in individual population numbers is a consequence of Keith's sampling strategy in which plant numbers were derived from plant densities measured at a number of 1 by 1 m quadrats and an estimate of the area of occupancy; the greater the area sampled the less the uncertainty in numbers.