Appendix D – Flora and Fauna Study

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Appendix D1 – Fauna Survey Methodology

Appendix D1 - Fauna Survey Methodology

A number of survey techniques were employed, each targeted at a particular fauna group to provide an accurate and thorough description of the fauna species present within the areas of the kaolin mine. A detailed description of the survey techniques and survey effort are provided in the following sections.

1.1 Trapping

Trapping was conducted using small and medium sized Elliott and hair tube traps, the dimensions of each are shown in Table 1.1. All small traps were baited with a mixture of rolled oats, peanut butter and honey; all large traps were baited with raw chicken necks or wings. Each hair tube trap was fitted with "Scotch" double-sided adhesive tape (19 mm) to collect the hairs. Tapes used in the hair tube traps were analysed by Ms Barbara Triggs as either definite or probable.

Table 1.1 - Trap Specifications

Trap Type	Trap Size	Trap Dimensions
Elliott	Small	32 x 9 x 10 cm
Elliott	Medium	46 x 15 x 15 cm
Hair Tube	Small	10 cm (diameter)
Hair Tube	Medium	20 cm (diameter)

Traps were laid within the vegetation along tracks numbered 2 and 6 (refer to Figure 5.3), at a intervals of approximately 15 m. These two lines were chosen for the survey as they were representative of the entire study area, and encompassed the wet area and creeklines previously referred to. Both trap lines traversed north and south facing slopes, ridge tops and gullies. The small and large sized traps were placed in a regular pattern, as described in Table 1.2.

A total of 85 traps were employed over three nights from the 20 March to 22 March 2000, with a total trapping effort of 255 trap nights.

1.2 Spotlighting

Spotlighting was used primarily to target nocturnal arboreal species including both birds and mammals in areas where canopy structure was developed sufficiently to provide fauna habitat. Much of the forest was disturbed by the 1997 fires, and while regeneration is advancing, many areas are yet unable to support a diverse or abundant faunal assemblage.

Vehicle based spotlighting was conducted during the periods of mammal trapping, and lasted for approximately 3 hours each night, with the existing tracks traversing the area being sampled. Two 50 W hand-held spotlights were used during the surveys.

Table 1.2 - Trapping Patterns

Eastern Line / Track 6 (app. 800 m)		Western Line / Track 2 (app. 600 m)	
Trap Number	Trap Type	Trap Number	Trap Type
1	Large Elliot	1	Large Hair Tube
2	Small Hair Tube	2	Medium Elliot
3	Medium Elliot	3	Medium Elliot
4	Large Hair Tube	4	Medium Elliot
5	Medium Elliot	5	Large Elliot
6	Small Hair Tube	6	Medium Elliot
7	Medium Elliot	7	Small Hair Tube
8	Large Elliot	8	Medium Elliot
9	Medium Elliot	9	Small Hair Tube
10	Small Hair Tube	10	Large Hair Tube
11	Medium Elliot	11	Small Hair Tube
12	Large Hair Tube	12	Medium Elliot
13	Medium Elliot	13	Small Hair Tube
14	Small Hair Tube	14	Large Elliot
15	Medium Elliot	15	Small Hair Tube
16	Large Elliot	16	Medium Elliot
17	Medium Elliot	17	Small Hair Tube
18	Small Hair Tube	18	Medium Elliot
19	Medium Elliot	19	Large Hair Tube
20	Large Hair Tube	20	Medium Elliot
21	Medium Elliot	21	Small Hair Tube
22	Small Hair Tube	22	Medium Elliot
23	Medium Elliot	23	Large Elliot
24	Large Elliot	24	Medium Elliot
25	Medium Elliot	25	Small Hair Tube
26	Small Hair Tube	26	Medium Elliot
27	Medium Elliot	27	Large Hair Tube
28	Large Hair Tube	28	Medium Elliot
29	Medium Elliot	29	Small Hair Tube
30	Small Hair Tube	30	Medium Elliot
31	Medium Elliot	31	Large Elliot
32	Large Elliot	32	Medium Elliot
33	Medium Elliot	33	Small Hair Tube
34	Small Hair Tube	34	Medium Elliot
35	Medium Elliot	35	Medium Elliot
36	Large Hair Tube	36	Large Hair Tube
37	Medium Elliot		
38	Small Hair Tube		
39	Medium Elliot		
40	Large Elliot		
41	Medium Elliot		
42	Small Hair Tube		
43	Medium Elliot		
44	Large Hair Tube		
45	Medium Elliot		
46	Small Hair Tube		
47	Medium Elliot		
48	Small Hair Tube		
49	Small Hair Tube		

1.3 Call Back Tapes

Nocturnal birds and mammals are often only detected when they vocalise to mark their territory or attract a mate. This behaviour can be utilised to elicit a response from species which otherwise may not be detected. The tapes consist of recordings of the species and may contain a number of different call types, which are often successful in provoking a return call from members of the species if present in the area. The broadcasting of calls may also attract members of the species to the area in search of a mate, thereby enabling them to be directly observed through subsequent spotlighting of the area.

Call back tapes were used to conduct targeted searches for rare and endangered species of mammals and nocturnal birds that have previously been found in the area. Targeted species are listed below in Table 1.3. Calls were broadcast from the ridge top in a central location, where the calls would be heard from all areas on the study site.

Upon arriving at the survey site the survey team remained still and quiet for up to ten minutes to allow natural activities of the wildlife to resume before surveys begun. Calls of each species were played individually for a period of 3 minutes, which was then followed by a 2 minute period of silence to detect any return calls from the species. Spotlighting was then conducted in the area on completion of call back surveys in a further attempt to observe the species.

Table 1.3 - Species Surveyed through Call Back Tapes

Common Name	Scientific Name
Powerful Owl	*Ninox strenua*
Barking Owl	*Ninox connivens*
Masked Owl	*Tyto novaehollandiae*
Sooty Owl	*Tyto tenebricosa*
Marbled Frogmouth	*Podargus ocellatus*
Southern Boobook	*Ninox novaeseelandiae*
Barn Owl	*Tyto alba*
Grass Owl	*Tyto capensis*
White-throated Nightjar	*Eurostopodus mystacalis*
Koala	*Phascolarctos cinereus*
Yellow-bellied Glider	*Petaurus australis*
Sugar Glider	*Petaurus breviceps*
Squirrel Glider	*Petaurus norfolcensis*

1.4 Spotlighting

Bird surveys were conducted at three locations within the study area, as shown on Figure 5.3. Bird surveys were conducted within the first 2 hours of sunrise and included the visual and aural detection of birds. Bird surveys lasted for 20 minutes at each site. Specific bird surveys were supplemented by incidental observations. Nocturnal bird species were surveyed through spotlighting and the use of specific call back tapes, as previously described.

1.5 Spotlighting

Three sights were selected within the area and active searches for herpetofauna conducted during the warmest part of the day around noon. Searches lasted for 20 minutes at each site and involved inspection of tracks, large rocks and leaf litter, as well as lifting and rolling of logs and rocks. Specific surveys were supplemented by incidental observation.

1.6 Incidental Sightings

All incidental sightings of fauna while conducting fieldwork were recorded. These included direct visual sightings and indirect evidence such as scats, diggings and burrows etc.

Appendix D2 – Floristic Species List

Appendix D2 - Floristic Species List

Table 2.1 - Floristic Species List

Scientific Name	Common Name	Corkery & Co (1993)	Current Survey
Acacia decora	Western Golden Wattle	✔	
Acacia longifolia	Sydney Golden Wattle	✔	✔
Acacia myrtifolia	Myrtle Wattle	✔	
Acacia obtusifolia		✔	
Acacia parramattensis	Black Wattle	✔	
Acacia terminalis		✔	✔
Acacia ulcifolia	Prickly Moses		✔
Amperia xiphoclada	Broom Spurge	✔	✔
Amphipogon strictus	Greybeard Grass	✔	
Anisopogon avenaceus	Oat Spear Grass	✔	
Aristida raviosa var speciosa			✔
Arrhenechtites mixta	Purple Fireweed	✔	
Astrotricha longifolia	Longleaf Star-hair	✔	
Baeckea linifolia	Swamp Baeckea	✔	
Baeckea utilis	Mountain Baeckea	✔	
Banksia cunninghamii		✔	
Banksia ericifolia	Heath Banksia	✔	
Banksia marginata	Silver Banksia	✔	
Banksia oblongifolia			✔
Banksia spinulosa	Hairpin Banksia	✔	✔
Baumea nuda		✔	
Baumea rubiginosa	Soft Twig-rush	✔	
Billardiera scandens	Apple Berry	✔	
Blechnum cartilagineum	Fishbone Water-fern		✔
Blechnum nudum	Fishbone Water Fern	✔	
Boronia anemonifolia	Sticky Boronia	✔	
Boronia deanei		✔	
Boronia microphylla	Small-leaved Boronia	✔	✔
Bossiaea heterophylla			✔
Caladenia cucullata		✔	
Caladenia dimorpha			✔
Calytrix tetragona	Fringe-myrtle	✔	
Callicoma serratifolia	Blackwattle	✔	
Cassinia aculeata	Dolly Bush	✔	
Caustis flexuosa	Old-mans Whiskers	✔	✔
Celmisia longifolia	Snow Daisy	✔	
Centrolepis fascicularis		✔	
Chionochloa pallida	Redanther Wallaby Grass	✔	
Comesperma retusum	Myrtle-leaf Milkwort	✔	
Conyza sp.	Fleabane	✔	
Culcita dubia	Soft Bracken		✔
Dampiera stricta	Blue Dampiera	✔	✔
Danthonia monticola	Wallaby Grass	✔	
Danthonia tenuior	Wallaby Grass	✔	
Daviesia latifolia	Gorse Bitter-pea	✔	✔
Daviesia squarrosa			✔
Daviesia ulicifolia	Gorse- Bitter-pea		✔
Deyeuxia angustifolia		✔	
Deyeuxia decipiens		✔	
Deyeuxia parviseta		✔	
Deyeuxia quadriseta		✔	

Table 2.1 - Floristic Species List

Scientific Name	Common Name	Corkery & Co (1993)	Current Survey
Dianella revoluta	Spreading Flax Lilly	✔	
Dianella tasmanica	Mountain Flax-lilly	✔	
Dichelachne rara	Sparse Plume Grass	✔	
Dichondra repens	Kidney Weed	✔	
Dillwynia floribunda		✔	
Dillwynia phylicoides	Eggs and Bacon	✔	
Diuris sulphurea	Tiger Orchid		✔
Drosera binata	Forked Sundew	✔	
Drosera peltata	Pale Sundew	✔	
Drosera spatulata	Common Sundew	✔	
Empodisma minus	Tanglefoot	✔	
Entolasia stricta	Wiry Panic	✔	
Epacris microphylla	Coral Heath	✔	
Epacris obtusifolia		✔	
Epacris paludosa	Swamp Heath	✔	
Epacris pulchella		✔	✔
Epilobium billardierianum	Smooth Willow-herb	✔	
Eucalyptus blaxlandii	Blaxland's Stringybark	✔	✔
Eucalyptus dalrympleana	Mountain Gum	✔	
Eucalyptus dives	Broad-leaved Peppermint	✔	
Eucalyptus ligustrina	Privet-leaved Stringybark	✔	
Eucalyptus mannifera	Brittle Gum	✔	
Eucalyptus oreades	Blue Mountains Ash	✔	
Eucalyptus pauciflora	Snow Gum	✔	
Eucalyptus piperita	Sydney Peppermint	✔	✔
Eucalyptus radiata	Narrow-leaved Peppermint	✔	✔
Eucalyptus sclerophylla	Hard-leaved Scribbly Gum	✔	✔
Eucalyptus sieberi	Silvertop Ash	✔	✔
Eucalyptus sparsifolia		✔	
Eucalyptus stricta	Blue Mountains Mallee	✔	
Gahnia filifolia		✔	
Gahnia microstachya	Slender Saw-sedge	✔	✔
Gahnia sieberiana	Red-fruited Saw-sedge	✔	
Gahnia subaequiglumis		✔	
Galium binifolium		✔	
Gleichenia dicarpa	Pouched Coral Fern	✔	
Gnaphalium involucratum	Star Cudweed	✔	
Gompholobium uncinatum	Red Wedge Pea	✔	
Gonocarpus tetragynus	Raspwort	✔	
Gonocarpus teucrioides		✔	✔
Gonocarpus micranthus	Creeping Raspwort	✔	
Goodenia bellidifolia		✔	
Goodenia dimorpha var. dimorpha			✔
Grevillea acanthifolia		✔	
Grevillea laurifolia		✔	✔
Gymnoschoenus sphaerocephalus	Button Sedge	✔	
Haemodorum	Rush-leaf Bloodroot		✔

Table 2.1 - Floristic Species List

Scientific Name	Common Name	Corkery & Co (1993)	Current Survey
corymbosum			
Haemodorum planifolium	Strap-leaf Bloodroot		✔
Hakea dactyloides	Broad-leaved Hakea	✔	
Hakea propinqua		✔	
Helichrysum adenophorum var. waddelliae	Waddell Everlasting		✔
Helichrysum leucopsideum	Satin Everlasting	✔	✔
Helichrysum rutidolepis	Pale Everlasting		✔
Helichrysum scorpioides	Button Everlasting	✔	
Hemarthria uncinata	Mat Grass	✔	
Hibertia obtusifolia		✔	
Hibertia pedunculata		✔	
Hibertia serpyllifolia		✔	
Histiopteris incisa	Batswing Fern	✔	
Holcus lanatus	Yorkshire Fog	✔	
Hovea linearis	Narrow-leaf Hovea	✔	
Hybanthus monopetalus	Slender Violet		✔
Hydrocotyle algida	Pennywort	✔	
Hydrocotyle peduncularis	Pennywort	✔	
Hypericum gramineum	Small St Johns-wort	✔	
Hypericum japonicum	Matted St John's Wort	✔	
Hypochoeris radicata	Flatweed	✔	
Isolepis inundata	Swamp Club-rush	✔	
Isopogon anemonifolius	Broad-leaf Drumsticks		✔
Isopogon anethifolius	Narrow-leaf Drumsticks		✔
Isopogon prostratus	Prostrate Drumsticks		✔
Juncus planifolius	Broad Rush	✔	
Juncus procerus		✔	
Lambertia formosa	Mountain Devil	✔	
Lepidosperma laterale	Variable Sword-sedge		✔
Leptospermum arachnoides		✔	
Leptospermum continentale		✔	
Leptospermum grandifolium	Woolly Tea-tree	✔	
Leptospermum marcrocarpum		✔	✔
Leptospermum myrtifolium	Swamp Tea-tree	✔	✔
Leptospermum polygalifolium	Yellow Tea-tree	✔	
Leptospermum sphaerocarpum	Round-fruited Tea-tree		✔
Leptospermum trinervium	Paperbark Tea-tree	✔	
Lepidosperma limicola	Razor Sedge	✔	
Lepidosperma tortuosum		✔	
Leptomeria acida	Native Currant	✔	
Lepyrodia anarthria		✔	
Lepyrodia scariosa	Scale-rush	✔	✔
Leucochrysum graminifolium	Grass-leaf Sunray	✔	

Table 2.1 - Floristic Species List

Scientific Name	Common Name	Corkery & Co (1993)	Current Survey
Leucopogon lanceolatus	Lance-leaf Bear-heath	✔	
Leucopogon microphyllus		✔	
Leucopogon muticus	Blunt Beard-heath	✔	
Lindsaea linearis	Screw Fern	✔	
Lomandra filiformis	Wattle Mat-rush	✔	
Lomandra glauca	Pale Mat-rush	✔	
Lomandra longifolia	Spiny Mat-rush	✔	✔
Lomandra multiflora	Many-flowered Mat-rush	✔	
Lomatia myricoides	Long-leaved Lomatia	✔	
Lomatia silaifolia	Crinkle Bush	✔	✔
Luzula ovata		✔	
Lycopedium deuterodenium	Bushy Club Moss	✔	
Lycopedium laterale	Slender Clubmoss	✔	
Microlaena stipoides	Weeping Grass	✔	
Microtis unifolia	Onion Orchid	✔	
Mirbelia platyloboides			✔
Mitrasacme polymorpha	Mitre Weed	✔	
Monotoca scoparia	Prickly Broom-heath	✔	✔
Myriophyllum pedunculatum	Mat Water-milfoil	✔	
Nertera granadensis		✔	
Notochloe microdon		✔	
Olearia erubescens		✔	
Olearia quercifolia		✔	
Opercularia varia	Stinkweed	✔	
Pinus radiata	Monterey Pine	✔	
Patersonia fragilis	Short Purple-flag	✔	
Patersonia glabrata	Leafy Purple-flag	✔	✔
Persoonia laurina	Laurel Geebung	✔	
Persoonia levis	Broad-leaf Geebung		✔
Persoonia linearis	Narrow-leaf Geebung		✔
Persoonia mollis ssp mollis	Geebung	✔	
Petrophile canescens		✔	
Petrophile pedunculata			
Petrophile pulchella	Conesticks	✔	✔
Phebalium squamulosum	Alpine Phebalium	✔	
Phyllota squarrosa		✔	✔
Pimelea linifolia ssp. linifolia	Slender Rice-flower	✔	
Platysace lanceolata	Lance-leaf Platysace	✔	
Platysace linearifolia	Narrow-leaf Platysace	✔	✔
Poa labillardieri	Tussock Grass	✔	
Poa sieberana ssp. sieberana		✔	
Polyscias sambucifolia	Elderberry Panax	✔	
Poranthera microphylla	Small Poranthera	✔	
Prostanthera scutellarioides			✔
Pteridium esculentum	Bracken Fern	✔	
Pterostylis concinna	Trim Greenhood		✔
Pultenaea divaricata		✔	
Pultenaea scabra	Rough Bush-pea	✔	
Restio australia	Mountain Cord-rush	✔	✔

Table 2.1 - Floristic Species List

Scientific Name	Common Name	Corkery & Co (1993)	Current Survey
Rhytidosporum procumbens		✔	
Schoenus brevifolius	Zig-zag Bog-rush		✔
Schoenus melanostchys	Black Bog-rush		✔
Schoenus villosus	Hairy Bog-rush	✔	
Senecio minimus		✔	
Senecio sp. E aff. apargiifolius		✔	
Sowerbaea juncea	Rush Lilly	✔	
Sprengelia incarnata		✔	
Stipa pubescens	Tall Speargrass	✔	
Stipa rudis	Speargrass	✔	
Stylidium graminifolium	Grass-leaf Trigger Plant	✔	
Stylidium laricifolium			
Symphionema montanum		✔	
Thelionema caespitosum	Tufted Blue-lily	✔	
Thelymitra pauciflora	Slender Sun Orchid	✔	
Thysanotus tuberosus	Fringed Violet	✔	
Telopea speciosissima	Waratah	✔	✔
Utricularia dichotoma	Fairy Aprons	✔	
Viola betonicifolia	Showy Violet	✔	
Viola hederacea	Ivy-leaved Violet	✔	
Wahlenbergia communis	Tufted Bluebell	✔	
Xanthorrhoea media			✔
Xanthorrhoea resinosa		✔	
Xanthosia dissecta		✔	
Xanthosia pilosa		✔	
Xyris ustulata		✔	

Note: Corkery & Co (1993) survey covered a much larger portion of the Newnes Plateau, north of the current survey site.

Appendix D3 – Fauna Species List

Appendix D3 - Fauna Species List

Table 3.1 - Fauna Species List

	Scientific Name	Common Name	Previous Surveys 1993	Previous Surveys 1999	Current Survey
	Mammals				
	Antechinus stuartii	Brown Antechinus		✔	
*	*Canis familiaris dingo*	Wild Dog	✔	✔	
	Chalinolobus gouldii	Gould's Wattled Bat	✔		
*	*Feline catus*	Cat		✔	
	Isoodon macrourus	Northern Brown Bandicoot	✔		
	Macropus giganteus	Eastern Grey Kangaroo	✔	✔	✔
	Macropus robustus	Common Wallaroo		✔	
	Macropus rufogriseus	Red-necked Wallaby	✔		
*	*Mus musculus*	House Mouse		✔	
*	*Oryctolagus cuniculus*	Rabbit	✔	✔	
	Paeudocherius peregrinus	Common Ringtail Possum	✔	✔	✔
	Petauroides volans	Greater Glider	✔	✔	
	Petaurus australis	Yellow-bellied Glider		✔	
	Phascolarctos cinereus	Koala	✔		
	Pseudomys novaehollandiae	New Holland Mouse	✔		
	Rattus fuscipes	Southern Bush Rat	✔	✔	
	Rattus lutreolus	Swamp Rat	✔		
	Tadarida australis	White-striped Mastiff-Bat	✔		
	Trichosurus vulpecula	Common Brushtail Possum		✔	
	Vombatus ursinus	Common Wombat	✔	✔	
*	*Vulpes Vulpes*	Fox	✔	✔	
	Wallabia bicolor	Swamp Wallaby	✔		
	Birds				
	Acanthiza nana	Yellow Thornbill	✔		
	Acanthiza pusilla	Brown Thornbill			
	Acanthiza reguloides	Buff-rumped Thornbill			✔
	Acanthorhynchus tenuirostris	Eastern Spinebill	✔	✔	
	Alectura lathami	Brush Turkey		✔	
	Alisterus scapularis	King Parrot		✔	
	Anthochaera carunculata	Red Wattlebird	✔	✔	
	Anthochaera chrysoptera	Little Wattle Bird		✔	✔
	Cecropis nigricans	Tree Martin	✔		
	Cinclosoma punctatum	Spotted quail-thrush	✔		
	Climacteris leucophaea	White-throated Treecreeper	✔		
	Climacteris picumnus	Brown Treecreeper	✔		
	Colluricincia harmonica	Grey Shrike-thrush			
	Coracina novaehollandiae	Black-faced Cuckoo-shrike	✔	✔	
	Coracina tenuirostris	Cicada Bird	✔		
	Corcorax	White-winged Chough		✔	✔

Table 3.1 - Fauna Species List

Scientific Name	Common Name	Previous Surveys 1993	Previous Surveys 1999	Current Survey
melanorhamphos				
Cormobates leucophaeus	White-throated Treecreeper		✔	✔
Corvus coronoides	Australian Raven		✔	
Dacelo gigas	Laughing Kookaburra	✔	✔	✔
Eopsaltria australis	Eastern Yellow Robin			✔
Gymnorhina tibicen	Australian Magpie		✔	
Halcyon sancta	Sacred Kingfisher	✔		
Lichenostomus chrysops	Yellow-faced Honeyeater		✔	
Lichenostomus leucotis	White-eared Honeyeater		✔	✔
Malurus cyaneus	Superb Blue Wren	✔	✔	
Malurus lamberti	Variegated Fairy-wren		✔	✔
Manorina melanocephala	Noisy Miner	✔	✔	✔
Manoria melanophrys	Bellbird			✔
Melithreptus lunatus	White-naped Honeyeater	✔		
Myiagra cyanoleuca	Satin Flycatcher	✔		
Ninox novaeseelandiae	Boobook Owl	✔		
Ninox strenua	Powerful Owl		✔	
Pachycephala rufiventris	Golden Whistler	✔	✔	
Pardalotus punctatus	Spotted Pardalote		✔	
Pardalotus striatus	Striated Pardalote	✔		
Petroica multicolor	Scarlet Robin	✔		
Phylidonyris nigra	White-cheeked Honeyeater	✔	✔	
Phylidonyris novaehollandiae	New Holland Honeyeater		✔	
Phylidonyris pyrrhoptera	Cresent Honeyeater		✔	
Platycercus elegans	Crimson Rosella	✔	✔	✔
Platycercus eximius	Eastern Rosella		✔	✔
Podargus strigoides	Tawny Frogmouth		✔	
Rhipidura fuliginosa	Grey Fantail		✔	✔
Sericornis frontalis	White-browed Scrubwren			✔
Stipiturus malachurus	Southern Emu Wren	✔		
Strepera graculina	Pied Currawong		✔	✔
Zosterops lateralis	Silvereye		✔	✔
Amphibians				
Litoria citropa	Blue Mountains Tree Frog	✔		
Ranidella (Crinai) signifera	Common Eastern Froglet	✔		✔
Reptiles				
Ctenotus taeniolatus	Copper-tailed Skink	✔		
Lampropholis delicata	Grass Skink	✔	✔	✔
Tiliqua scincoides	Common Bluetongue		✔	
Tympanocryptis diemensis	Mountain Heath-dragon		✔	

* = Introduced Species
1993 Survey reported in Corkery, 1993
1999 Survey conducted by IEC, 1999

Appendix D4 – 8-Part Assessment

Appendix D4 – 8-Part Assessment

4.1 Threatened Flora Species

The following test of significance has been prepared in accordance with Part 5A of the *Environmental Planning and Assessment Act 1979* as amended by the *Threatened Species Conservation Amendment Act 2002* (as in force at 2 October 2002), to determine whether there is likely to be a significant effect on the threatened species, populations or ecological communities or their habitats for the 8 flora species (*Acacia bynoeana, Acacia flocktoniae, Apatophyllum constablei, Caladenia tessellata, Diuris aequalis, Persoonia acerose, Persoonia marginata,* and *Thesium australe*) for which potential habitat exists in the survey area.

a) in the case of threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

No threatened species were identified as being present in the study area. With no local populations present in the area where impact will occur, the life cycle of rare or threatened species is not likely to be disrupted or placed at risk of extinction.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

No endangered populations were found within the proposed development area.

c) in the case of an endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological communities are present on the site.

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological communities are present on the site.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

While the site of the proposed development is not currently known to house any rare or threatened species, approximately 25.5 ha of potential habitat for *Acacia bynoeana, Acacia flocktoniae, Caladenia tessellata, Diuris aequalis, Persoonia acerose, Persoonia marginata* and *Thesium australe* will be removed or modified by the proposed development.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

The proposed action will not leave any areas of vegetation isolated or fragmented.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No species of conservation significance were identified in the area of the proposed development. Potential habitat areas exist for a number of species, however since they are not currently present, the areas of potential habitat are not considered to be key or essential to the long-term survival of these species.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

There are no areas of critical habitat present in the proposed development area.

f) Whether the action proposed is consistent with the objectives or actions or a recovery plan or threat abatement plan,

A recovery plan has not been developed for any of the species for which potential habitat is present.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The development will require clearing of approximately 25.5 ha of native vegetation. Clearing of native vegetation has been identified as a threatening process under Schedule 3 of the TSC Act 1995. The area of vegetation that will be cleared does not contain any areas of critical habitat and the impact of the removal of vegetation is considered to be negligible on a regional scale.

Conclusion

The site of the proposed development provides potential habitat for a number of species of conservation significance. However, to date none of these species have been recorded from the site, and the resulting impact is therefore restricted to impacts on *potential* habitat. Since areas of potential habitat for these species are

extensive in the surrounding region, the impact is considered to be minor and a Species Impact Statement is therefore unnecessary.

4.2 Threatened Fauna Species

The following test of significance has been prepared in accordance with Part 5A of the *Environmental Planning and Assessment Act 1979* as amended by the *Threatened Species Conservation Amendment Act 2002* (as in force at 2 October 2002), to determine whether there is likely to be a significant effect on the threatened species, populations or ecological communities or their habitats for the Spotted Tailed Tiger Quoll.

a) in the case of threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

The proposal will involve clearing of some native vegetation, including woodland areas that may provide a potential habitat area. However, the site is not a known breeding ground for the species, and it is therefore considered highly unlikely that the life cycle of the Spotted-tailed Tiger Quoll will be disrupted with the removal of the area of forest. It is therefore considered that a local population, if present, is highly unlikely to be placed at risk of extinction as a result of the proposed project.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

The Spotted-tailed Tiger Quoll species as a whole is considered endangered. The likely impact on the life cycle of the species is discussed above.

c) in the case of an endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not applicable.

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

Potential habitat for the Spotted-tailed Tiger Quoll is extensive throughout the region. The proposed development will result in the loss of approximately 25.5 ha of woodland. While no Spotted-tailed Tiger Quolls were observed during the entire survey, this area might provide potential habitat. The removal of this patch of vegetation however, is considered negligible, given the large continuous tracts of potential habitat areas that will remain in dedicated conservation areas in the immediately surrounding area.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

The proposed development will not leave any areas of native vegetation isolated from other areas of potential habitat for the Spotted-tailed Tiger Quoll.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The Spotted-tailed Tiger Quoll was not observed at the time of the survey, however the areas of forest could provide a potential habitat. Approximately 25.5 ha will be removed as part of the mine proposal, however larger areas of forest containing potential habitat are available in the area.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Critical habitat has not been declared for this species.

f) Whether the action proposed is consistent with the objectives or actions or a recovery plan or threat abatement plan,

A recovery plan has not been developed for the Spotted-tailed Tiger Quoll.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed open cut development will require clearing of approximately 25.5 ha of native vegetation. Clearing of native vegetation has been identified as a threatening process under Schedule 3 of the TSC Act 1995. The area of vegetation that will be cleared does not contain any areas of critical habitat, however does involve removal of forest which may provide potential habitat for the species. The impact of the removal of vegetation is considered to be negligible on a regional scale.

Conclusion

Forest areas provide important potential habitat areas for a range of species, including the Spotted-tailed Tiger Quoll. However, only a small area will be removed as part of the open cut proposal, and other larger areas will remain in the immediate area. Furthermore, no population of Spotted-tailed Tiger Quolls were observed during the field surveys.

It is therefore considered that the overall impact on the Spotted-tailed Tiger Quoll as a species, as a result of the proposed development will be negligible, and a Species Impact Statement is not required.

Appendix D5 – Frog Report

Surveys for the Giant Burrowing Frog
Heleioporus australiacus
Newnes Kaolin Site

Introduction

The Giant Burrowing Frog *Heleioporus australiacus* is a large frog that inhabits several habitats. In the northern end of its range, in the Sydney Basin, it utilises sandstone escarpments and decomposing sandstone layers as shelter and foraging areas. This frog is listed as "vulnerable" and is included in Schedule 2 Part 1 of the *New South Wales' Threatened Species Conservation Act 1995*.

A Development Application (DA) has been prepared by the Newnes Kaolin Pty Ltd for the extraction of sand and kaolin from a site near Newnes Junction. The site borders the Blue Mountains National Park, a World Heritage Area. In May 2002, Biosphere Environmental Consultants Pty Ltd were engaged to:

1. determine whether habitat for Giant Burrowing Frogs occurs on the project site,
2. if habitat is present, to map the extent of the habitat areas, and
3. to conduct initial surveys for the frogs.

Project Site

The Project Site is approximately 32 Ha and lies immediately north-east of the township of Newnes Junction (Figure 1). The northern boundary of the site is 500 metres long while the eastern boundary is 850 metres long. The site occupies part of the upper western slope of Wollangambe River valley (the river lies just over 1 kilometer to the east). A thin sand layer lies over a heavily decomposing sandstone layer. In a few places the underlying sandstone is visible but there are no escarpment or obvious outcrops on the site.

The site is almost completely wooded. Silver-top Ash *Eucalyptus sieberi* is the dominant tree type present. Ash forest covers over 90% of the site, only the northern portion of the site is dominated by Scribbly Gum *E. sclerophylla*. There is a well-developed shrub layer containing a mixture of species, most notably Waratah, Drumsticks, Geebungs and Wattles. Smaller shrubs contain a high proportion of epacrids.

Two ephemeral water courses drain the site. The northern water course has two primary feeder channels that unite on site and flow out through the north-eastern corner of the site. The southern water course originates off site (near Newnes Junction) and passes eastwards towards the Wollangambe River. Both watercourses remain ephemeral until they reach the Wollangambe River. At the time of the survey, neither water courses was flowing but both contained wet seepage areas; for the northern water course a wet area existed at the 990 m contour while a diffuse wet area soil area existed at the 1020 m contour.

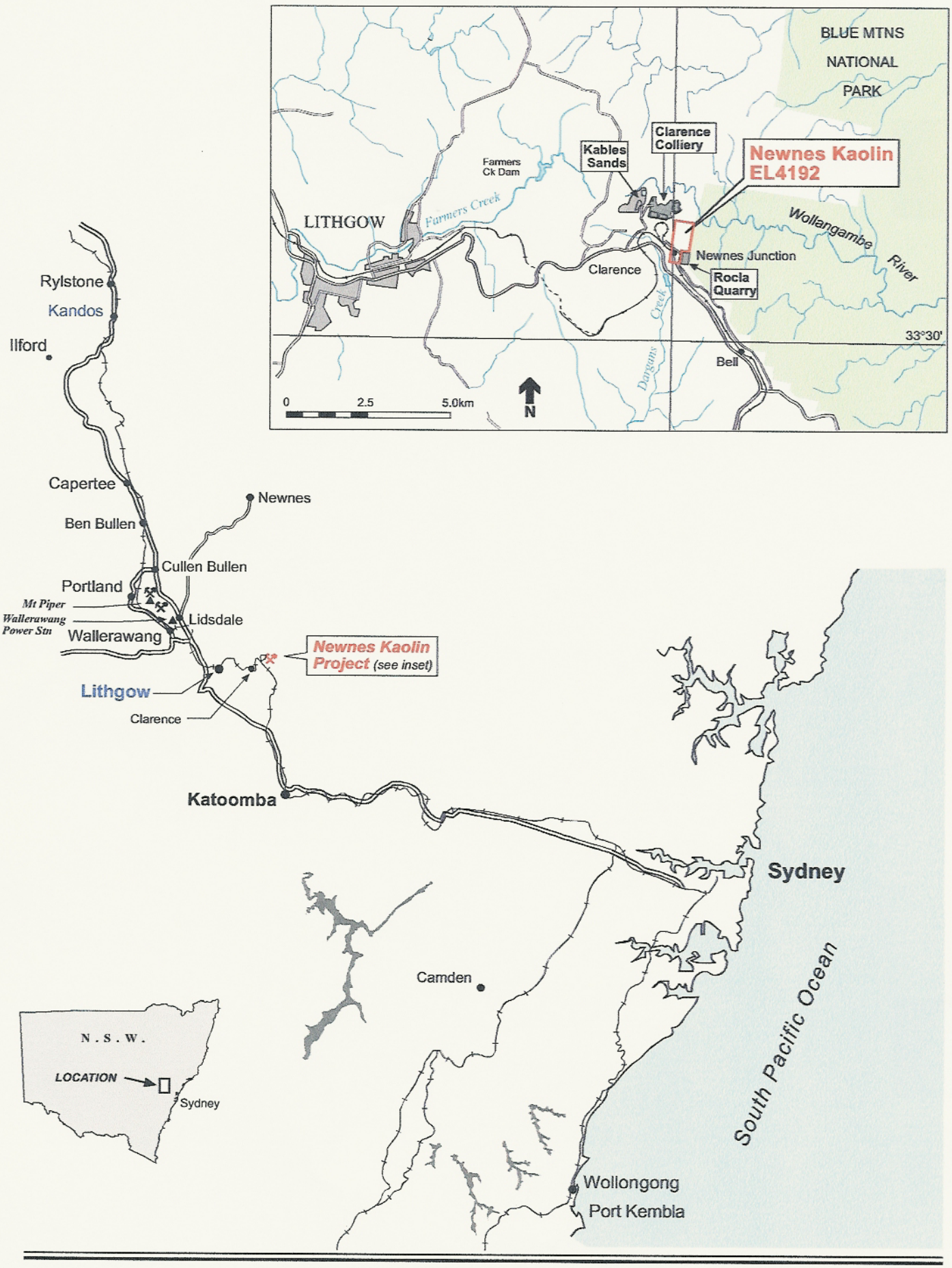

FIGURE 1
Regional Locality Plan

The wet area on the northern water courses consist of a narrow seepage area (located at 244950; 6293320). The shrub and tree layer give way to Saw Sedge*s Ghania radula*, Ferns *Blechnum sp*. , and Black Wattle *Callicoma serratifolium*. Fringing the area is an encircling zone of Parramatta Green Wattle *Acacia parramattensis*. Small pools of water had formed in vehicle tyre ruts across this area.

The wet area on the southern water course consists of abroad area dominated by the Paperbark Tea-tree *Leptospermum trinervium*. Saw sedges and other sedges such as Scale Sedge *Lepyroidia gracilis* and Cord Rush *Restio complanatus* form the ground cover between the Tea-trees. No pools of water were present in this area but the ground was soft and sodden underfoot in places.

There are no buildings or artificial structures on the site. A well-formed dirt track crosses the site from west to east ("Ridge Track"). The site contains a series of informal tracks running from north to south along the longest axis of the site. These tracks are 100 metres apart and were created for the survey and drilling teams.

Proposed Development

It is proposed that a staged development of the site take place whereby a large open pit is created for the extraction of sand and clay. No processing of the excavated material will take place on the site. Instead, the crushed sandstone will be transported off site, via the nearby rail loop, for processing. As processing is not taking place on site, large tailing dams are not required on site.

In Stage 1 of the project, pit excavation will commence in the north-eastern portion of the mining area. A temporary crusher and works office will be constructed on the northern boundary and a conveyor will be constructed that will run along the northern boundary of the site to a loading bin on the rail loop. Surface water from the site will be diverted northwards, towards Clarence Colliery.

In the later stages of the development, the pit will be sequentially expanded and deepened. A permanent crusher will be constructed near the north-eastern corner of the pit and the conveyor extended along the northern boundary line. A Water Treatment Plant will be constructed inside the pit. Surface water will still be diverted northwards, away from the northern watercourse.

By the final stage of the project, the pit will reach its maximum depth of 993 metres RL (about 40 m below the ground level on the southern side of the pit). Several sediment control dams will collect water from within the pit and dirty water will be treated by the expanded water Treatment Plant inside the pit. The expansion of the pit southwards, will result in some surface water being directed southwards, into the southern watercourse. Most storm water will continue to be directed northwards. The northern watercourse will be truncated but will still receive some surface run-off.

Methods

Document Research

A review of the available documentation was carried out. This included an examination of the proposed development plan for the site, including the developmental stages of the project.

A data search was carried out of the New South Wales' National Parks and Wildlife Services' Wildlife Atlas for locations of Giant Burrowing Frogs. A similar search was carried out of the herpetological records of the Australian Museum.

Field Survey

Weather conditions

Weather conditions during the survey were fine and mild. The days were sunny, reaching a maximum air temperature of 22 ° C. Nights were quite cool, dropping to 8°C in the early morning of the 4th of May.

Although the weather was fine and dry during the survey the ground moisture on site was quite high. This was due to the regular rain that fell during the early autumn. There were boggy areas associated with the two main watercourses on the site as well as a wet slope area where ground water trickled over an exposed sandstone area.

Survey Methods

A field survey of the site was carried out in early May 2002. The site was visited during daylight hours on the 3rd of May 2002. Dr Ron Goldbery (from Newnes Kaolin Pty Ltd) escorted the field team around the site, highlighting the location of the pit, drilling roads, mining lease boundaries and infrastructure locations.

Later that day, the site was traversed on foot and potential habitat for Giant Burrowing Frogs was searched for. In particular, the search followed the northern and southern watercourses along their lengths on site and for another 300-500 metres off site.

Sites where free water was available was netted and tadpoles that were collected were identified and released.

On the evening of the 3rd of May, the site was again re-traversed on foot. Spot lights and head-lamps were used to search the ground and along the water courses for active frogs. At several sites along the northern and southern water courses, play-back calls of the mating calls of Giant Burrowing Frogs were broadcast from a small, portable amplifier. Calls were played for 2 minutes, this was followed by a 2 minute listening period. The tape was again played for 2 minutes and another two minute listening period followed. If there was no frog response, the team moved on to the next location. Seven locations were chosen as sites to play the calls (see Table 1 below).

Table 1

Sites where Play-back Calls were Broadcast for the Giant Burrowing Frog

Location No.	Description of Location
1	Head of northern arm of Northern Water Course
2	Head of southern arm of Northern Water Course
3	Junction of arms of Northern water Course
4	Off Site. 200 m downstream of arm junction on Northern Water Course
5	Head of Southern Water Course (near Rocla Site)
6	Tea-tree Flat. Southern Water Course crossing of Mining Lease Area
7	Off site. 250 m downstream of southern crossing site.

Assessment of Habitat for Giant Burrowing Frogs

Habitat was assessed using the criteria cited in Recsei (1997). Habitat consists of three components, breeding sites, foraging areas and shelter areas. Only potential breeding sites and shelter habitats were searched for.

Breeding Sites: Typically consists of wet heath areas associated with primary watercourses. Watercourses may be ephemeral or permanent. If they are permanent, flow must not be constant and small pools should be present for at least two months during the year.

Shelter Sites: Hanging sandstone shelves associated with the headwaters of primary creeks that do not flood. Often seepage areas form along the edges of sandstone layers creating a zone of decomposing sandstone and talus. The sand and decomposing sandstone layer should retain a relatively high ground moisture content (as indicated by the presence of indicator plant species such as Saw-sedges *Ghania sp*., Tea tree thickets *Leptospermum sp*. and sedges such as *Carex apressa*.

In the Upper Blue Mountains area, Giant Burrowing Frogs have also been found to use button grass swamps (LeBreton 1994).

Foraging Habitat: Giant Burrowing Frogs will range widely when foraging and hence have been found in a range of foraging habitats that include both dry and wet sclerophyll forest, montane riparian forest, wet and dry heath and button grass plains. For this reason, foraging habitat is not considered to be an indicator of the presence of Giant Burrowing Frogs. Shelter habitats and breeding sites are more specific and more likely to give an accurate indication of the presence of the frogs in an area.

Results:

Frog Surveys

Two frog species were located during the surveys. Table 2 gives the location and species details.

Table 2

Frogs found During Survey

Frog Species	Location	How Detected	AMG
Crinia signifera	Northern Water Course, near eastern site boundary	Males calling Tadpoles Present	244950 6293320
Crinia signifera	Southern Water Course, 50 m downstream of Eastern Site Boundary	Males Calling	244905 6292786
Limnodynastes dumerilii	Northern Water Course, near eastern site boundary	Tadpoles present	244950 6293320

Giant Burrowing Frog Habitat Assessment

Shelter habitat for Giant Burrowing Frogs occurs in one small area in the south-eastern corner of the site. The area consists of a small Tea-tree flat, dominated by Leptospermum trinervum. A small seepage zone occurs on the southern slope of the valley which brings ground water to the surface in this area. The water does not remain on the surface but soaks quickly into the deep sands that lie immediately downstream.

Breeding Sites are not present on the site or immediately downstream from either water courses. Particular survey attention was given to locating breeding habitat on the southern water course (as shelter habitat appears to be present). The downstream areas were not suitable for Giant Burrowing Frogs as the water course becomes drier and much less well defined. Eventually, the water course approaches the Wollangambe River and crosses rocky terrain before plunging into the Wollangambe valley.

Discussion

Distribution of Giant Burrowing Frogs

Giant Burrowing Frogs occur along the eastern sea board of Australia, from the Watagan Mountains south to north-eastern Victoria (Cogger 2000). In the northern end of their range, the species occurs near the coast (in the Watagan Mountains), west through parts of Marramarra National Parks to the Blue Mountains and Wollemi National Park.

The closest areas to Newnes where the frogs have been found is Blackheath in the Blue Mountains, a distance of only 15 kilometres away. Records in the Wollemi National Park are scarce as the park has not been intensively surveyed but the frogs have been found as far north as the Culoul Range (about 25 kilometres north of Newnes).

In the northern end of its range, Giant Burrowing Frogs have been found mainly on Hawkesbury Sandstone but some areas containing Narrabeen Group sandstones have also contained these frogs.

Newnes Junction appears to be geologically continuous with sites where the frog has been recorded, but to date, no Giant Burrowing Frogs have been found there (or in any site this far west).

Giant Burrowing Frog Habitat

Habitat for the Giant Burrowing Frogs is mostly absent from the site. The presence of shelter habitat alone on site cannot be taken as evidence for the likely presence of the frogs. Stronger evidence includes the absence of breeding habitat on site and in the immediate local area. Without breeding sites, the species cannot sustain itself in an area.

From the assessment of habitat, it is very unlikely that Giant Burrowing Frogs would be able to survive on the project site or in the immediate local area.

Conclusion

Frog surveys revealed the presence of two frog species on site, the Common Eastern Froglet *Crinia signifera* and the Eastern Pobblebonk *Limnodynastes dumerilii*. No evidence was found of the presence of Giant Burrowing Frogs.

Shelter habitat that could be used by Giant Burrowing Frogs was present in one small area in the south-eastern corner of the site. Other important components of habitat were not present, most notably breeding habitat. Given the absence of critical habitat components, it is unlikely that Giant Burrowing Frogs occur on the project site or in the immediate local area.

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8 May 2002.