Appendix G

Biodiversity Management Plan

Abel Underground Coalmine EP Area 4 Proposed Panels 27 to 35 Biodiversity Management Plan

HUNTER ECO

May 2014

HUNTER ECO

Colin Driscoll
Environmental Biologist
NPWS Scientific Licence SL101245
Exp 31 October 2014

CONTENTS

FIGURES

TABLES

Abel Underground Coalmine EP Area 4 Proposed Panels 27 to 35
Biodiversity Management Plan

1.0 Introduction

Donaldson Coal Pty Limited (Donaldson Coal) operates the Abel Underground Mine (ML1618, the mine), which is located in the Newcastle Coalfield of New South Wales. The mine was approved under Part 3A of the *Environmental Planning and Assessment Act 1979* in June 2007 (Project Approval 05-0136). Donaldson Coal is currently extracting coal at the mine using bord and pillar total and partial extraction methods within the Upper Donaldson Seam in EP Area 3. Donaldson Coal is proposing to extract Panels 27 to 35 in EP Area 4 using bord and pillar total extraction methods within the Upper Donaldson Seam. **Figure 1** shows the location of the Abel mine within the region and **Figure 2** shows the local detail. This Biodiversity Management Plan (BMP) focuses on the potential surface impacts of mining Panels 27 to 35.

1.1 Purpose & Scope

This BMP is prepared as a component of the overall Extraction Plan for mining Panels 27 to 35. The purpose is to identify potential impacts from mining on flora, fauna and vegetation communities, monitoring, and outlining management protocols should impacts occur.

2.0 Baseline Data

Long-term monitoring programs are in place for both Donaldson open cut and Abel underground coalmines with portions relevant to this BMP. Reports from these monitoring programs provided relevant information on flora, fauna and ecological communities occurring in or near the EP area.

Abel Vegetation Community Mapping

As part of the original environmental application for the Abel mine (Eco Central 2006), a comprehensive vegetation map was prepared (**Figure 3**) that described the vegetation communities within the mine lease, and their conservation status.

Abel Flora and Fauna Monitoring Plan

This plan (Ecobiological 2007a) contains the *Abel Surface Ecological Monitoring Plan* (SEMP) within which is the *Dam Monitoring and Management Plan* (DMMP). The DMMP involves annual monitoring of 84 of the 156 dams located within the Abel boundary, of which 22 dams are located within the EP area. Monitoring consists of targeted searches for threatened flora and fauna species that could possibly use the type of habitat located in each dam. **Figure 4** shows these dams along with the target species being monitored.

Also within the SEMP there is the Abel *Subtropical Rainforest Monitoring and Management Plan* (SRMP) that defines the annual monitoring of subtropical rainforest in Black Hill Long Gully. The SRMP involves the use of transects to monitor the extent of the rainforest as well as flora and fauna. **Figure 5** shows the monitoring locations in relation to the EP boundary, mine panels and the predicted 20 mm subsidence area.

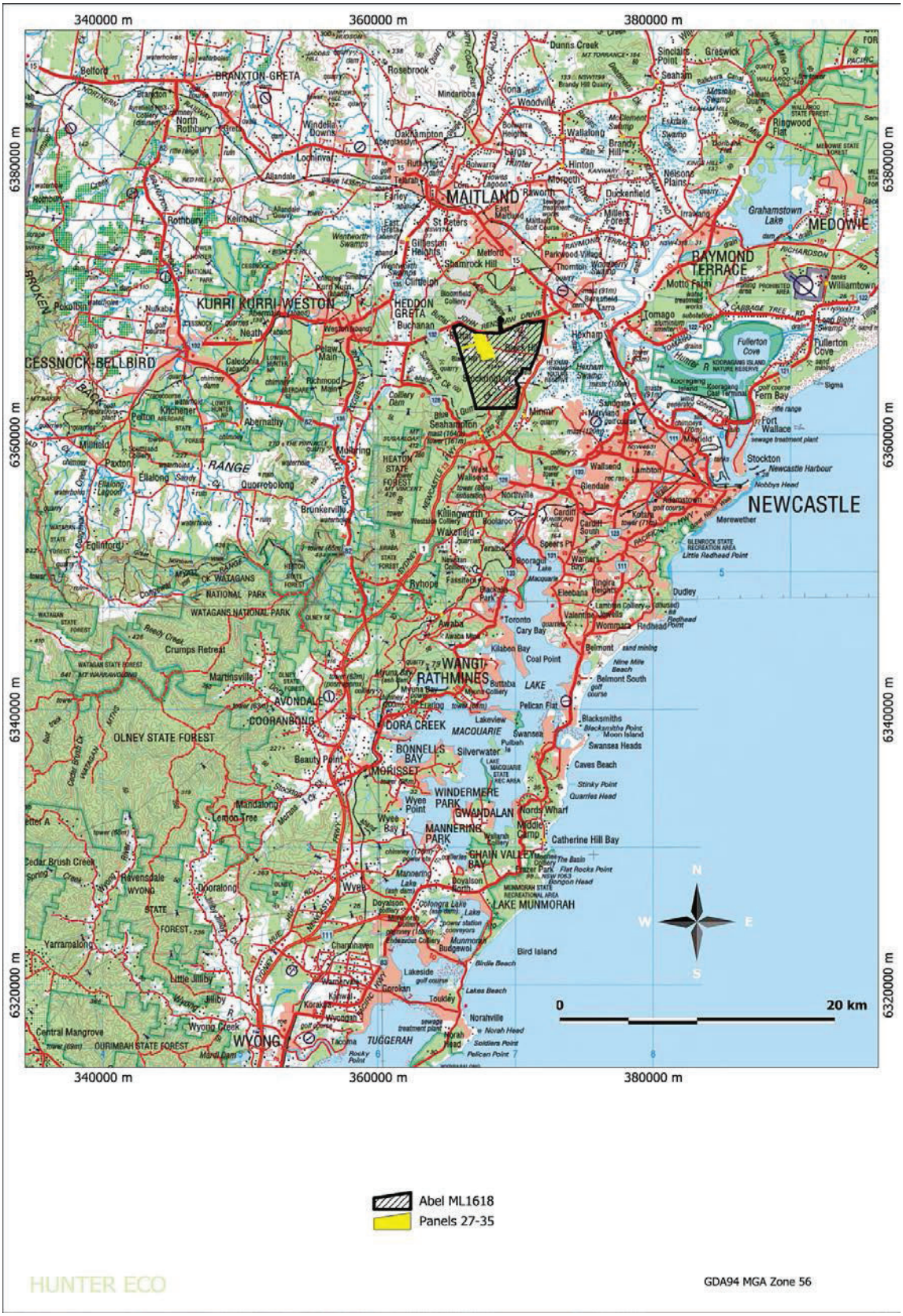

Figure 1 Location of the Abel mine in the region

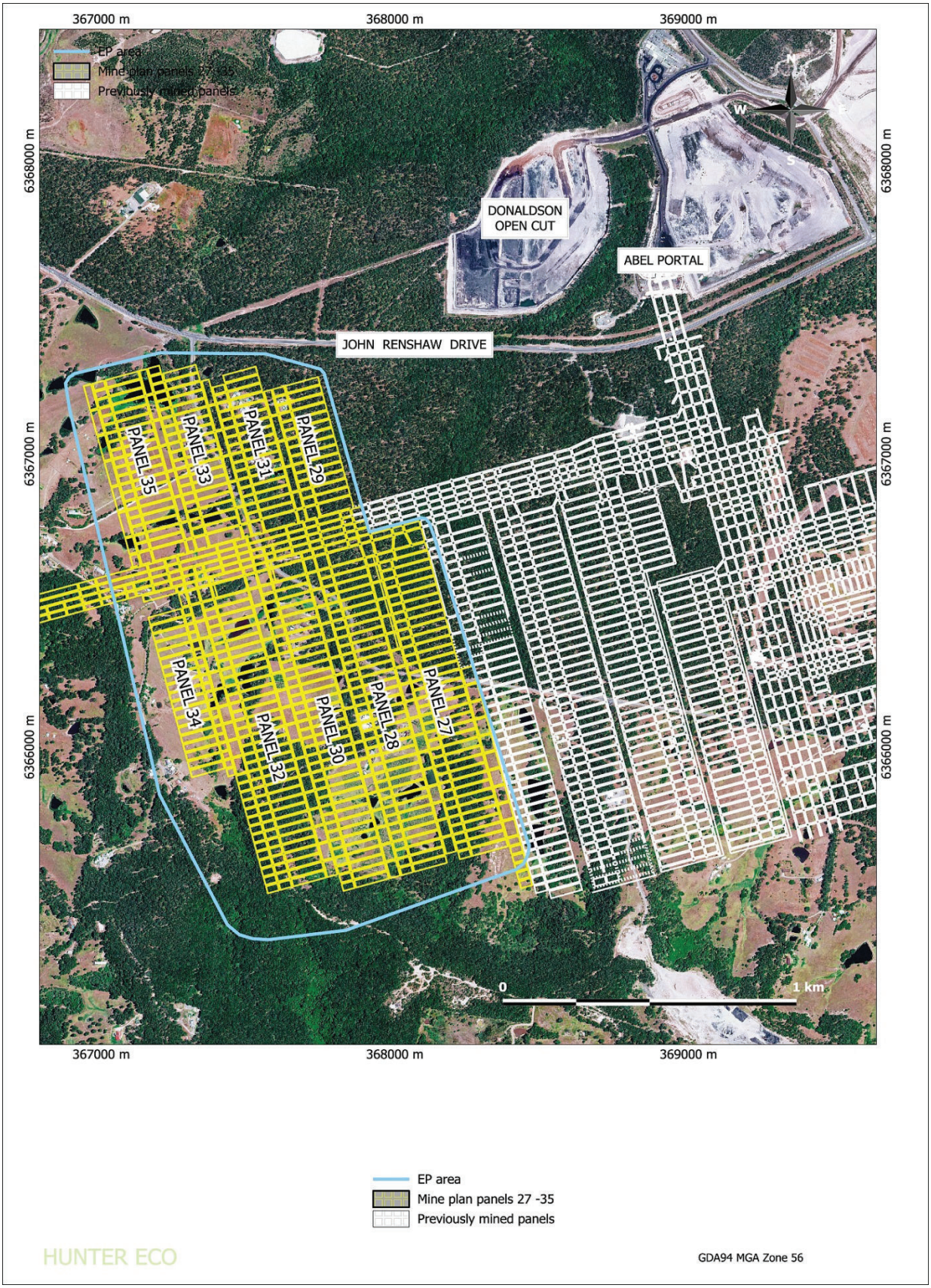

Figure 2 Detail of the mine panels and EP area

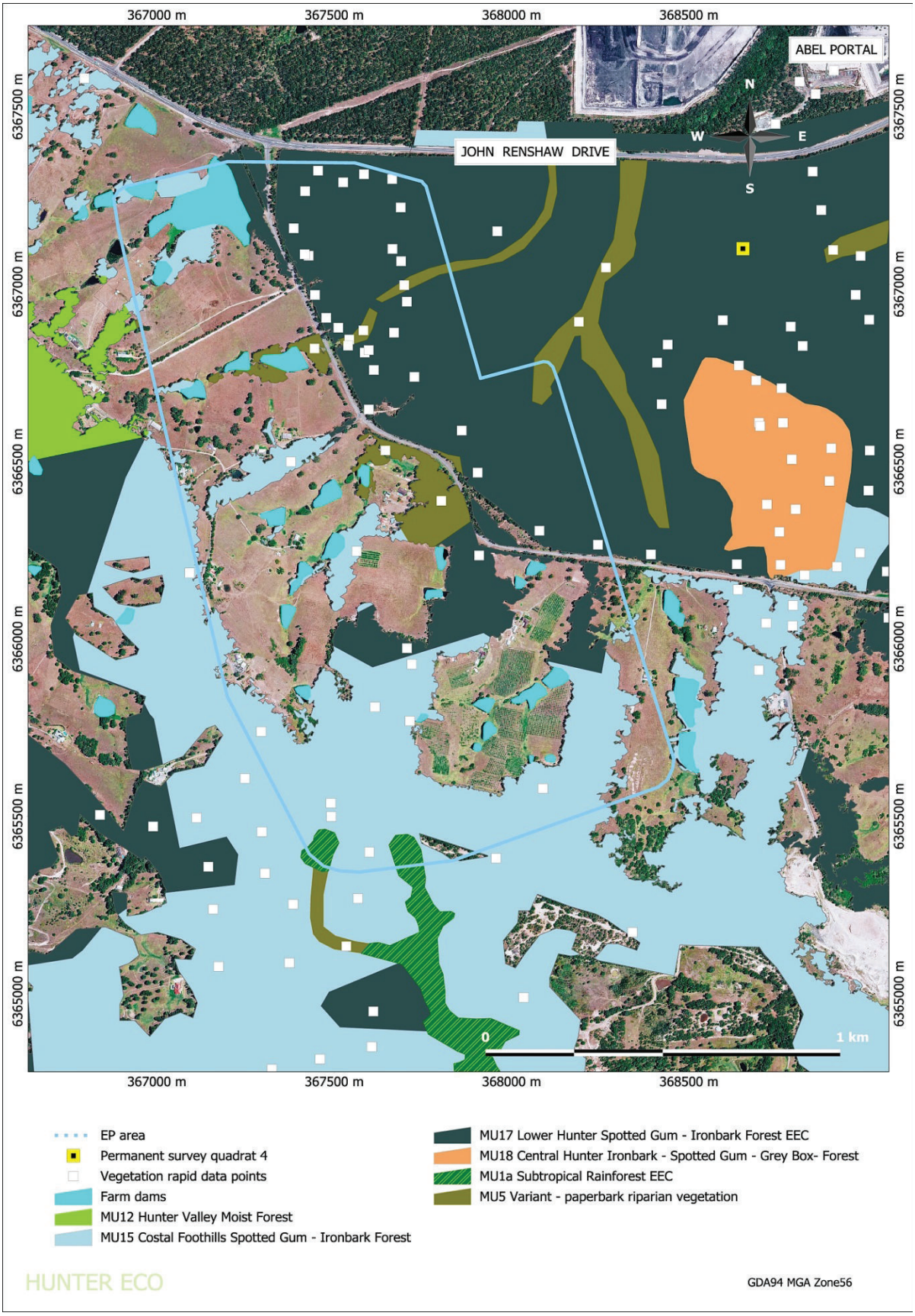

Figure 3 Part of the Abel vegetation map showing the EP area

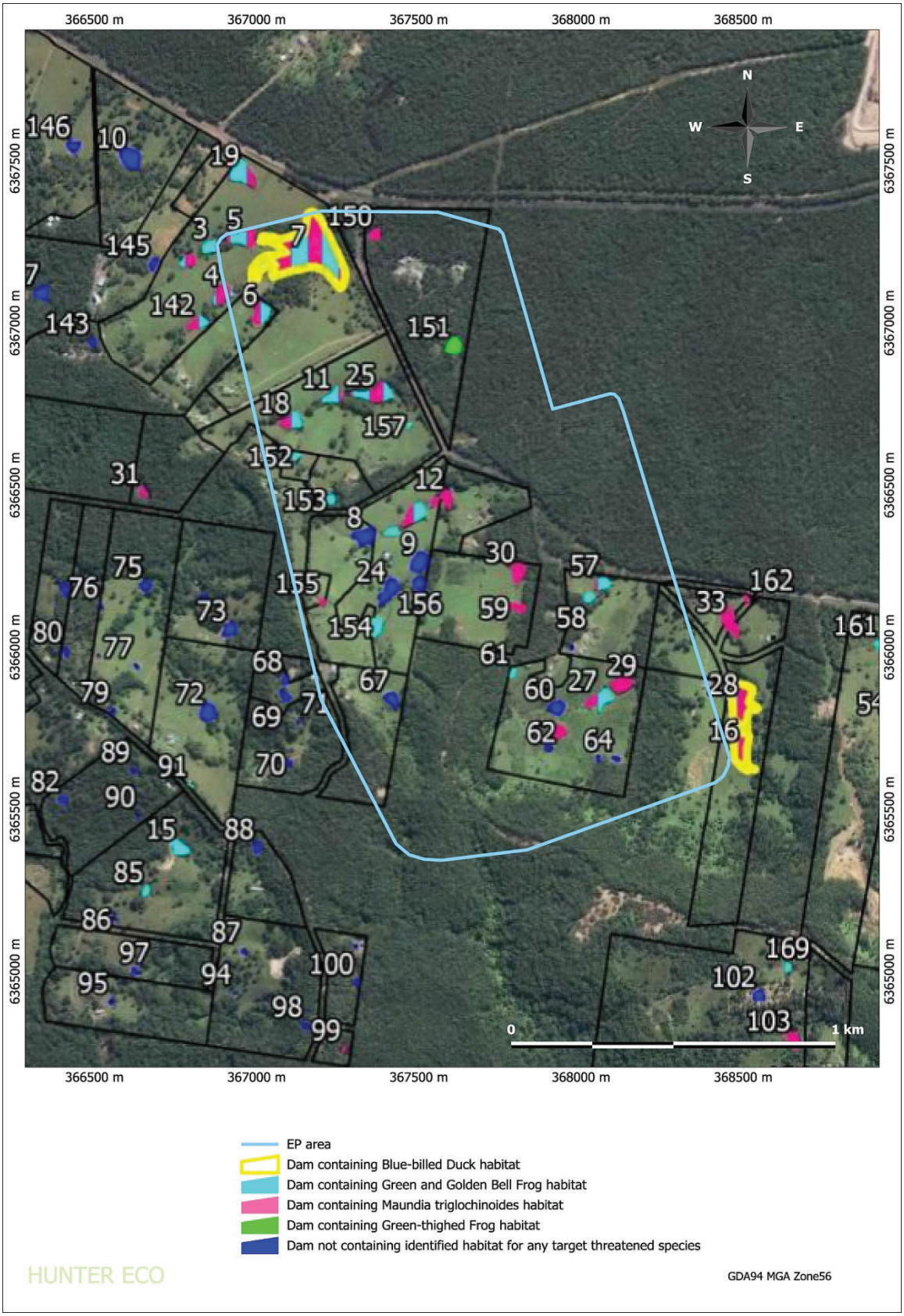

Figure 4 Dams within the EP area monitored under the Abel DMMP

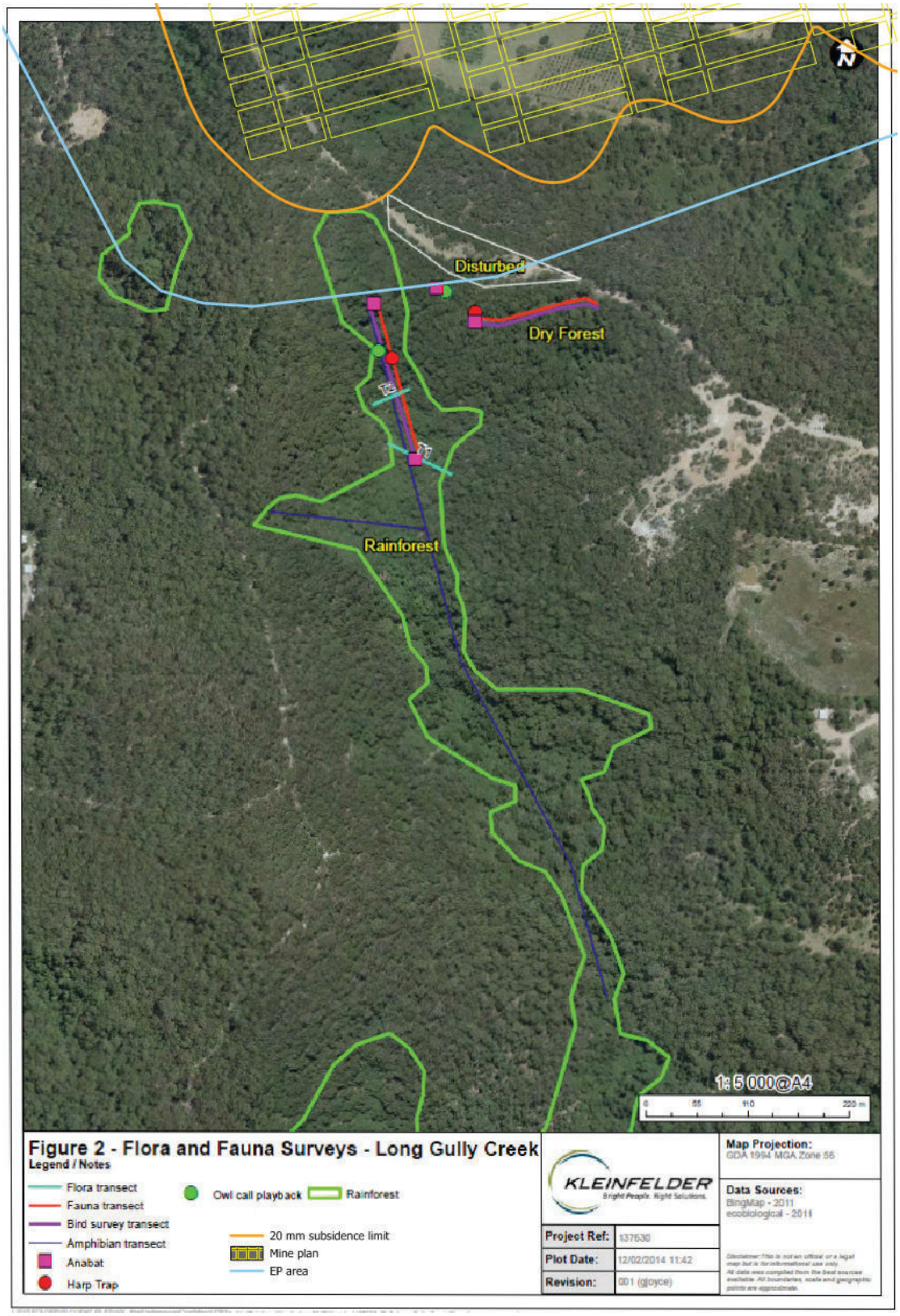

Figure 5 Long Gully Rainforest locations monitored under the Abel SRMP in relation to the mine panels and 20 mm predicted subsidence area
Source: Kleinfelder (2013)

Donaldson Flora and Fauna Monitoring Plan

As part of the Donaldson Flora and Fauna Monitoring Plan (Ecobiological 2007b), permanent 20x20 m quadrats have been monitored annually since 2001. Quadrat 4 is located approximately 800 metres north east of the EP area in habitat similar to that in the EP area (see **Figure 3**).

3.0 Vegetation Communities, Flora and Fauna

3.1 Vegetation Communities

Four vegetation communities have been mapped across the EP area (**Table1**), two of which are listed as endangered ecological communities (EEC) in the NSW *Threatened Species Conservation Act 1995.* The original community classification used was that of NPWS (2000) and these have been matched in **Table 1** to the recently developed NSW Plant Community Types (http://www.environment.nsw.gov.au/research/Visclassification.htm).

The dominant community present is the EEC Lower Hunter Spotted Gum - Ironbark Forest.

3.2 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDE) are vegetation communities primarily dependent on water held in the soil in the form of aquifers. Within the EP area, the only habitat that might comprise a GDE is that in the shallow drainage lines. However the dominant species of the associated community identified in **Table 1** as MU5 *Variant – paperbark riparian vegetation* do not exhibit groundwater dependence.

Table 1 Vegetation communities within the EP area

Local Community	NSW PCT Unit and Name	Status	Area (ha)
Farm dams	-	-	7
MU15 Costal Foothills Spotted Gum - Ironbark Forest	874 Grey Ironbark - Spotted Gum - Grey Box open forest on hills of the Hunter Valley, Sydney Basin Bioregion	-	48
MU17 Lower Hunter Spotted Gum - Ironbark Forest	1207 Spotted Gum - Broad-leaved Ironbark grassy open forest of dry hills of the lower Hunter Valley, Sydney Basin Bioregion	EEC *Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion*	56
MU1a Subtropical Rainforest	- Giant Stinging Tree - Fig dry subtropical rainforest of the NSW North Coast Bioregion and Brigalow Belt South Bioregion[1]	EEC *Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions*	2
MU5 Variant - paperbark riparian vegetation	1282 Turpentine - Grey Myrtle forest of sheltered sandstone gullies of the Central Coast hinterland, Sydney Basin Bioregion	-	7
Cleared farmland, roads, cultivation, dwellings and other infrastructure	-	-	90

[1]Nearest equivalent but has no PCT code

Summaries of the floristic content of the main vegetation communities are as follows:

- **MU1a Coastal Warm Temperate – Subtropical Rainforest**

Canopy *Dendrocnide excelsa, Toona ciliata, Emmenosperma alphitonioides, Elaeocarpus obovatus, Alphitonia excelsa, Acacia maidenii, Diploglottis australis, Euroschinus falcata, Ficus watkinsoniana, Ficus macrophylla, Pararchidendron pruinosum, Podocarpus elatus, Rhysotoechia bifoliata*

Mid *Baloghia inophylla, Ripogonum album, Pittosporum multiflorum, Tetrastigma nitens, Mallotus philippensis, Ficus coronata, Ficus fraseri, Capparis arborea, Aphanopetalum resinosum, Dendrocnide photinophylla, Acmena smithii, Streblus brunonianus*

Lower *Adiantum formosum, Oplismenus imbecillus, Pellaea falcata, Arthropteris tenella, Doodia aspera, Asplenium australasicum*

- **MU5 Variant – paperbark riparian vegetation**

Canopy *Corymbia maculata, Eucalyptus umbra, Eucalyptus siderophloia, Eucalyptus acmenoides.*

Mid *Melaleuca styphelioides*

Lower *Lantana camara, Poa labillardierei, Imperata cylindrica, Carex appressa, Oplismenus imbecillus*

- **MU15 Coastal Foothills Spotted Gum- Ironbark Forest**

Canopy *Corymbia maculata, Eucalyptus fergusonii subsp. dorsiventralis, Eucalyptus umbra, Allocasuarina torulosa, Eucalyptus propinqua*

Mid *Daviesia ulicifolia subsp. ulicifolia, Persoonia linearis, Rapanea variabilis, Syncarpia glomulifera subsp. glomulifera, Acacia fimbriata, Leptospermum polygalifolium subsp. cismontanum*

Lower *Microlaena stipoides var. stipoides, Entolasia stricta, Lepidosperma laterale, Lomandra longifolia, Imperata cylindrica var. major, Dichondra repens, Lomandra multiflora subsp. multiflora, Opercularia diphylla, Aristida vagans, Goodenia heterophylla var. heterophylla*

- **MU17 Lower Hunter Spotted Gum Ironbark Forest**

Canopy *Corymbia maculata, Eucalyptus fibrosa, Eucalyptus umbra, Eucalyptus punctata*

Mid *Bursaria spinosa, Acacia falcata, Acacia fimbriata, Daviesia ulicifolia subsp. ulicifolia, Pultenaea villosa, Macrozamia reducta, Melaleuca nodosa*

Lower *Themeda australis, Dichondra repens, Microlaena stipoides var. stipoides, Entolasia stricta, Lepidosperma laterale, Aristida vagans, Lomandra confertifolia subsp. pallida, Lomandra filiformis subsp. coriacea, Pratia purpurascens, Lomandra multiflora subsp. multiflora, Phyllanthus hirtellus, Joycea pallida, Cymbopogon refractus, Imperata cylindrica var. major*

3.1 Threatened Flora

No threatened flora species have been recorded either within or near the EP area. However, several threatened flora species have been recorded locally and **Appendix 1** provides a list of all threatened flora species recorded within a 5 km radius of the EP area.

3.2 Threatened Fauna

Indication of fauna likely to be present in the EP area can be drawn from past reports for the Donaldson permanent Quadrat 4 and farm dam monitoring (described in Section 2.0 above). Quadrat 4 records are from 2001 to 2013 while farm dams have been monitored since 2009.

Table 2 lists 17 fauna species recorded at Quadrat 4 and lists five threatened bat species but no threatened mammal species. Two introduced species have been recorded.

Table 2 Fauna species recorded around permanent monitoring Quadrat 4

Family	Scientific Name	Common Name	Status
Terrestrial Mammals			
Dasyuridae	*Antechinus stuartii*	Brown Antechinus	
Macropodidae	*Macropus giganteus*	Eastern Grey Kangaroo	
Leporidae	*Lepus europaeus*	European Brown Hare	I
Muridae	*Rattus rattus*	Black Rat	I
Arboreal Mammals			
Petauridae	*Petaurus breviceps*	Sugar Glider	
Petauridae	*Pseudocheiris peregrinus*	Common Ringtail Possum	
Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum	
Bats			
Miniopteridae	*Miniopterus australis*	Little Bent-wing Bat	V
Molossidae	*Mormopterus norfolkensis*	East Coast Free-tail Bat	V
Molossidae	*Mormopterus sp. 2*	Eastern Free-tail Bat	
Vespertilionidae	*Myotis macropus*	Large-footed Myotis	V
Vespertilionidae	*Nyctophilis geoffroyi*	Lesser Long-eared Bat	
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail Bat	V
Molossidae	*Tadarida australis*	White-striped Mastiff Bat	
Vespertilionidae	*Vespadelus pumilis*	Eastern Forest Bat	
Vespertilionidae	*Vespadelus vulturnus*	Little Forest Bat	
Vespertilionidae	*Vespadelus troughtoni*	Eastern Cave Bat	V

Table 3 lists 22 bird species recorded at Quadrat 4 with no threatened species being recorded. **Table 4** lists 15 bird species that have been recorded in Dam 7 within the EP area and again no threatened species have been recorded. **Table 5** lists six amphibian species that have been recorded across 14 dams within the EP area with no threatened species recorded.

Table 3 Birds recorded around permanent monitoring Quadrat 4

Scientific Name	Common Name
Acanthiza lineata	Striated Thornbill
Acanthorhynchus tenuirostris	Eastern Spinebill
Colluricincla harmonica	Grey Shrike-thrush
Coracina novaehollandiae	Black-faced Cuckoo-shrike
Cormobates leucophaeus	White-throated Treecreeper
Corvus coronoides	Australian Raven
Cracticus torquatus	Grey Butcherbird
Dacelo novaeguineae	Laughing Kookaburra
Dicaeum hirundinaceum	Mistletoebird
Eopsaltria australis	Eastern Yellow Robin
Eurystomus orientalis	Dollarbird
Lichenostomus chrysops	Yellow-faced Honeyeater
Malurus cyaneus	Superb Fairy-wren
Malurus lamberti	Variegated Fairy-wren
Melithreptus lunatus	White-naped Honeyeater
Neochmia temporalis	Red-browed Finch
Pachycephala pectoralis	Golden Whistler
Pachycephala rufiventris	Rufous Whistler
Pardalotus punctatus	Spotted Pardalote
Philemon corniculatus	Noisy Friarbird
Rhipidura fuliginosa	Grey Fantail
Todiramphus sanctus	Sacred Kingfisher

Table 4 Water birds recorded at Dam 7 within the EP area

Scientific Name	Common Name
Acrocephalus australis	Australian Reed Warbler
Anas superciliosa	Pacific Black Duck
Anhinga novaehollandiae	Australasian Darter
Chenonetta jubata	Australian Wood Duck
Cygnus atratus	Black Swan
Egretta novaehollandiae	White-faced Heron
Fulica atra	Eurasian Coot
Gallinula tenebrosa	Dusky Moorhen
Nycticorax caledonicus	Nankeen Night Heron
Phalacrocorax carbo	Great Cormorant
Phalacrocorax melanoleucos	Little Pied Cormorant
Phalacrocorax sulcirostris	Little Black Cormorant
Porphyrio porphyrio	Purple Swamphen
Tachybaptus novaehollandiae	Australasian Grebe
Todiramphus sanctus	Sacred Kingfisher

Table 5 Amphibians recorded in farm dams within the EP area

Dam	*Litoria fallax*	*Litoria peronii*	*Litoria tyleri*	*Litoria latopalmata*	*Litoria nasuta*	*Litoria verreauxii*
6	✓	✓		✓		✓
7	✓	✓	✓	✓		✓
11	✓	✓	✓			✓
18	✓	✓	✓	✓		✓
25	✓	✓		✓		✓
27	✓	✓	✓	✓		✓
57	✓	✓	✓	✓		
58	✓	✓	✓	✓		
61	✓	✓	✓	✓		
62	✓	✓	✓	✓		
151	✓	✓	✓	✓	✓	✓
152	✓	✓	✓	✓		✓
153	✓	✓	✓	✓		✓
157	✓	✓		✓		

In addition to the species listed above, **Appendix 2** provides a list of all threatened fauna species recorded from within a five kilometre radius of the EP area. Several of these species have been recorded locally and could possibly occur within the EP area.

4.0 Overall Predicted Subsidence

MSEC (2014) provides details of the subsidence predicted to occur following mining of panels 27 – 35. Maximum subsidence of 1.4 m is predicted for the centre of panels 27 and 30 with the maximum for all panels ranging from 0.75 m to 1.4 m. The pattern of subsidence can be seen in **Figure 6**.

5.0 Potential Environmental Consequences on Biodiversity

To have an impact on biodiversity subsidence would primarily need to result in significant long-term loss of available water as a consequence of surface and subsurface cracking which is inevitable following mining. MSEC (2014) note that cracking following extraction from Abel panels already mined has generally ranged from <50 mm to > 100 mm, with the majority <50 mm.

Cracking having the greatest potential to impact on surface vegetation is *continuous cracking* that forms hydraulic connectivity down to the mine workings, thus having the potential to permanently divert water. According to MSEC (2014) this is most likely to occur in areas with shallow depth of cover at the central and northern parts of the area to be mined.

6.0 Monitoring

6.1 Habitat and EEC Monitoring

Habitat is a surrogate for the presence of fauna. Provided habitat remains relatively unchanged the suite of fauna using that habitat should also remain unchanged. It is proposed that the EEC *Lower Hunter Spotted Gum – Ironbark Forest* be monitored for subsidence impact. This would be achieved by placing one permanent 20x20 m quadrat in the maximum subsidence area in Panel 27 with a similar quadrat placed in a nearby location where no subsidence would occur (**Figure 6**).

Within these quadrats all flora species should be identified and each species should be scored according to its abundance using the modified Braun-Blanquet 1-6 scale (Braun-Blanquet 1932/1951). Monitoring should be conducted annually in late Spring/Early Summer and a photographic record should also be kept with photos taken from the same location on each occasion. On each monitoring occasion the general condition of the habitat in the immediate area should also be observed, taking particular note of any deterioration in quality.

Quantitative comparison over time should be made by computing the following diversity indices:

- Shannon Diversity Index (H')
  A measure of the diversity present in a set of samples. The highest diversity would be where all species were equally abundant and lower diversity values arise where one or some species are present in much greater amounts than the other species. This index was calculated using log(e).

- Pielou's Evenness Index (J')
  A measure of how evenly spread the numbers of all species is, and is the proportion H'/H'_{max} where H'_{max} is the highest possible Shannon index where all species are equally abundant.

- Margaleff Richness Index (d)
  A measure of the number of species present for a given number of individuals.

These indices are only interpretable within and not between monitoring sites so it will be the comparative movement of the indices between the control and impact site that will provide an indication of any changes subsequent to subsidence occurring.

6.2 Continuation of Current Monitoring

Monitoring of farm dams will continue as part of the overall Abel F&FMP requirement, as will monitoring of the Long Gully rainforest. This monitoring has been ongoing since 2009 and a good baseline has been established from which any changes subsequent to mining of panels 27 – 35 can be detected.

7.0 Reporting

An annual standalone biodiversity report should be prepared for Abel Mine Panels 27 - 35 that is a compilation of the quadrat, farm dam and rainforest data and analysis.

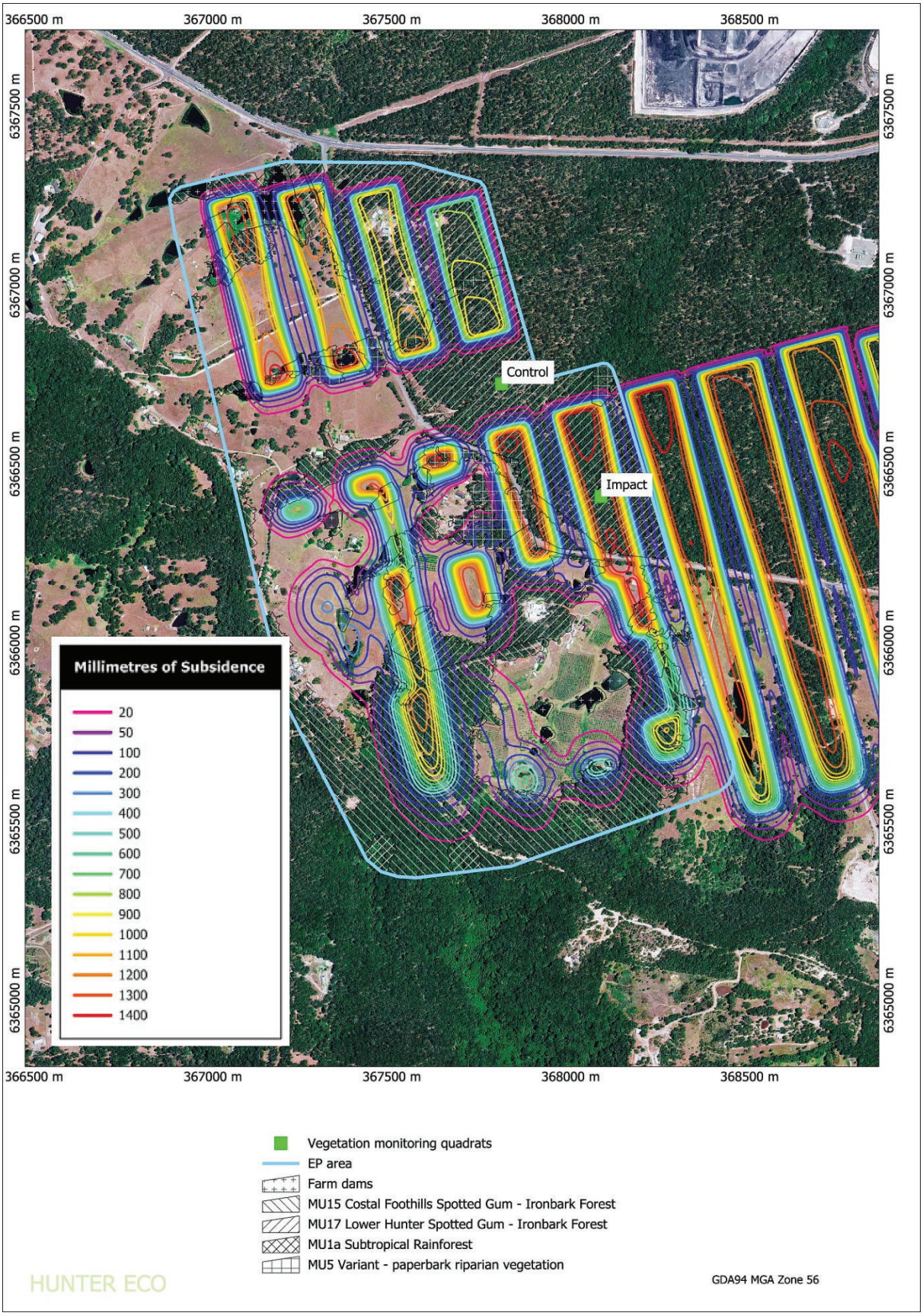

Figure 6 Location of habitat monitoring quadrats
Quadrat locations: Control E367807, N6366724; Impact E368085, N6366409

8.0 Management of Impact

No surface infrastructure is planned for the EP area, therefore the only potential for impact is from the effects of subsidence, primarily surface and sub-surface cracking. Management of impacts will be guided by the following Triggers Action and Response Plan (**Table 6**). The mine plan has been designed to have negligible impact on the Long Gully rainforest (**Figure 6**).

Table 6 Trigger Action Response Plan

Trigger	Action	Response
A steady decline in diversity indices in the impact quadrat compared with the control quadrat.	Determine whether the decline is limited to a particular component of the vegetation habitat e.g. canopy, shrub, ground species. Or a particular species. Also assess whether the decline is a consequence of natural variation such as short-lived species dying.	If the decline appears to be a consequence of subsidence, survey the wider area to determine the extent of the decline and consult with Donaldson personnel as to whether any remediation action would be appropriate. Any remediation plan should be evaluated for the amount of collateral harm to the habitat to ensure that greater damage would not occur.
A consistent increase in dry forest species over rainforest species documented in the Long Gully rainforest monitoring transects.	Determine whether the change is likely to have been a consequence of underground mining, such as a loss of available water due to sub-surface cracking.	If the change appears to have been a consequence of mining, consult with Donaldson personnel about possible remedial action. Any remediation plan should be evaluated for the amount of collateral harm to the habitat to ensure that greater damage would not occur.
Loss of water from any farm dams.	A Dam Monitoring and Management Strategy will be prepared prior to mining. This plan will include regular inspections before and during mining.	Prior to any remediation a due diligence flora and fauna impact assessment should be conducted.

9.0 References

Braun-Blanquet, J. (1932/1951) *Plant Sociology: The Study of Plant Communities*. (English translation), McGraw-Hill, New York.

Eco Central (2006) *Abel Underground Mine Part 3A Environmental Assessment*. Prepared for Donaldson Coal Pty Ltd September 2006

Ecobiological (2007a) Abel Underground Coalmine Flora and Fauna Management Plan, prepared for Donaldson Coal Pty Ltd, October 2007.

EcoBiological (2007b) *Donaldson Open-Cut Coal Mine Beresfield Flora and Fauna Management Plan Revision*.

Kleinfelder (2014) *Donaldson Opencut Coalmine Beresfield Flora and Fauna Monitoring 2013 Annual Report*.

MSEC (2014) Abel Underground Mine: EP Area 4 – Proposed Panels 27 to 35 Subsidence Predictions and Impact Assessments for the Natural and Built Features in Support of the EP Application.

NPWS (2000) *Vegetation Survey, Classification and Mapping Lower Hunter and Central Coast Region.* Version1.2. A project undertaken for The Lower Hunter and Central Coast Regional Environment Management Strategy CRA Unit Sydney Zone National Parks and Wildlife Service.

Appendix 1 Threatened flora species recorded within 5 km of the EP area

Family Name	Scientific Name	Common Name	NSW Status	Commonwealth Status
Asteraceae	*Rutidosis heterogama*[1]	Heath Wrinklewort	V	V
Elaeocarpaceae	*Tetratheca juncea*[2]	Black-eyed Susan	V	V
Juncaginaceae	*Maundia triglochinoides*		V	
Myrtaceae	*Callistemon linearifolius*	Netted Bottle Brush	V	
Proteaceae	*Grevillea parviflora* subsp. *parviflora*[1]	Small-flower Grevillea	V	V

[1]Species recorded locally with suitable habitat in the EP area, although not recorded there to date
[2]Species recorded locally but no suitable habitat in the EP area
Source NSW Wildlife Atlas data extracted 28 May 2014

Appendix 2 Threatened fauna species recorded within 5 km of the EP area

Family Name	Scientific Name	Common Name	NSW Status	Commonwealth Status
BIRDS				
Acanthizidae	*Chthonicola sagittata*	Speckled Warbler	V	
Accipitridae	*Hieraaetus morphnoides*	Little Eagle	V	
Anatidae	*Oxyura australis*[1]	Blue-billed Duck	V	
Cacatuidae	*Callocephalon fimbriatum*[1]	Gang-gang Cockatoo	V	
Climacteridae	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V	
Columbidae	*Ptilinopus magnificus*	Wompoo Fruit-Dove	V	
Meliphagidae	*Melithreptus gularis gularis*[1]	Black-chinned Honeyeater (eastern subspecies)	V	
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V	
Petroicidae	*Petroica boodang*	Scarlet Robin	V	
Pomatostomidae	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	V	
Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V	
Psittacidae	*Neophema pulchella*	Turquoise Parrot	V	
Rostratulidae	*Rostratula australis*	Australian Painted Snipe	E1	E
Strigidae	*Ninox connivens*	Barking Owl	V	
Strigidae	*Ninox strenua*[1]	Powerful Owl	V	
Tytonidae	*Tyto novaehollandiae*[1]	Masked Owl	V	
Tytonidae	*Tyto tenebricosa*[1]	Sooty Owl	V	
MARSUPIALS				
Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V	E
Petauridae	*Petaurus australis*	Yellow-bellied Glider	V	
Petauridae	*Petaurus norfolcensis*[1]	Squirrel Glider	V	
Phascolarctidae	*Phascolarctos cinereus*[1]	Koala	V	V

MEGACHIROPTERAN BATS				
Pteropodidae	*Pteropus poliocephalus*[1]	Grey-headed Flying-fox	V	V
MICROCHIROPTERAN BATS				
Emballonuridae	*Saccolaimus flaviventris*[1]	Yellow-bellied Sheathtail-bat	V	
Molossidae	*Mormopterus norfolkensis*	Eastern Freetail-bat	V	
Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V	
Vespertilionidae	*Miniopterus australis*[1]	Little Bentwing-bat	V	
Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V	
Vespertilionidae	*Myotis macropus*[1]	Southern Myotis	V	
Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V	
Vespertilionidae	*Vespadelus troughtoni*[1]	Eastern Cave Bat	V	
AMPHIBIANS				
Hylidae	*Litoria aurea*	Green and Golden Bell Frog	E1	V

[1]Species recorded locally
Source NSW Wildlife Atlas data extracted 28 May 2014