INTEGRA COAL

Integra Coal Operations Pty Ltd

ABN: 96 118 030 998

Glennies Creek Open Cut Coal Mine

Flora Assessment

Prepared by

Geoff Cunningham Natural Resource Consultants Pty Ltd

October 2007

Specialist Consultant Studies Compendium: Part 4a

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Flora Assessment

of the

Glennies Creek Open Cut Coal Mine

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EXECUTIVE SUMMARY

The flora of the proposed Glennies Creek Open Cut Coal Mine Flora Study Area [the "Part 4a Flora Study Area"] has been described, mapped and documented as Part 4a of the *Specialist Consultant Studies Compendium*.

An extensive review of the literature pertaining to the vegetation in the vicinity of the Project Site has been prepared to place the present study in context.

Four flora communities have been identified within the Flora Study Area. These communities include:

- Tussock Grassland [Community 1];
- Regenerating Native Woodland / Shrubland [Community 2];
- a *Eucalyptus crebra* [Narrow-leaf Ironbark] – *Corymbia maculata* [Spotted Gum] – *Eucalyptus tereticornis* [Forest Red Gum] Community [Community 3]; and
- an *Allocasuarina luehmannii* [Bull Oak] Community [Community 5].

An additional two flora communities have been identified within areas of previous or existing mining-related disturbance, including:

- Rehabilitated Disturbed Land [Community 4]; and
- Disturbed Land [Community 6].

No threatened flora species, endangered flora populations or endangered ecological communities [*Threatened Species Conservation Act 1995* or *Environment Protection and Biodiversity Conservation Act 1999*] have been recorded within the Study Area in the past and none were recorded during the present field study.

No critical habitat is present on the Study Area.

A Seven Part Test concluded that there would be no significant impact of the proposed development on threatened flora species, endangered flora populations or endangered ecological communities or critical habitat.

Issues related to the impact of the proposed clearing on native vegetation have been discussed.

The requirements of the *Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley, NSW*, the Green Offsets for Sustainable Development and the *Guidelines for Biodiversity Certification of Environmental Planning Instruments* have also been addressed. The latter, together with the biodiversity offset issues related to the Project have been discussed more fully in the companion report to this report, namely Part 4b of the *Specialist Consultant Studies Compendium*.

Key Statistics Relating to the Flora Assessment

Existing Vegetation Communities within the Study Area

Community No.	Description	To be disturbed	Not to be disturbed	Total
1	Tussock Grassland	6.1ha	7.8ha	13.9ha
2	Regenerating Native Woodland / Shrubland	0.7ha	45.9ha	46.6ha
3	Narrow Leaf Ironbark – Spotted Gum-Forest Red Gum	68.3ha	62.4ha	130.7ha
4	Rehabilitated Disturbed Land	47.6ha	46.2ha	93.8ha
5	Bull Oak Forest	Nil	21.1ha	21.1ha
6	Disturbed Land	12.3ha	64.0ha	76.3ha

1 INTRODUCTION AND DESCRIPTION OF PROJECT

1.1 Introduction

The flora study and assessment was carried out on behalf of Integra Coal Operations Pty Ltd ["the Proponent"] for the proposed Glennies Creek Open Cut Mine ["the Project"]. The proposed mine would be located within a 376ha Project Site, incorporating a 321ha Open Cut Area together with additional areas of existing disturbance, namely Haul Route Corridors D and E and the Camberwell Coal Handling and Preparation Plant. The Project Site is located approximately 12km north of Singleton [**Figures 1** and **2**].

The Study Area for this flora study comprises the whole of the Open Cut Area [see Section 2] plus additional areas to the west and north of the Project Site. [**Figures 2** and **3**].

Field sampling of the area was carried out on 9th and 10th February, 2003, 24th September; 2003, 18th and 22nd April, 2004; 6th January 2006 and 17th July, 2007. The July, 2007 field inspection involved a reassessment of the areas previously mapped as Community 1 [Tussock Grasslands]. It had become apparent that, with the effluxion of time and cessation of grazing, some sections of this community had changed into regenerating woodlands / shrublands.

During the July, 2007 inspection, the Study Area was enlarged to cover areas outside the Project Site as shown in **Figure 3**.

Associated with this report is an additional report relating to a proposed biodiversity offset areas external to the Project Site [see Part 4b of the *Specialist Consultant Studies Compendium*].

1.2 Project Description

The proposed open cut coal mine development would involve the following activities. **Figure 2** displays the overall Project Site layout identifying where the various activities are planned.

- Construction of an access road off Middle Falbrook Road.
- Construction of facilities [contractor office, amenity buildings and workshop].
- Construction of two dirty water containment dams to the east of the proposed out-of-pit waste rock emplacement.
- Coal mining by open cut methods within a pit shell covering approximately 90ha [7.7Mt reserve], within which drilling has identified three principal coal seams amenable to mining by open cut methods, namely the:
  - Middle / Lower Liddell;
  - Barrett; and
  - Hebden Coal Seams.
- Direct transport of mined coal to the Camberwell Coal Handling and Processing Plant [CHPP] for washing and rail dispatch via internal haul roads.
- Temporary stockpiling of Run of Mine [ROM] coal, as and when required, at a temporary ROM coal stockpile area located at the top of the open cut ramp or at the existing RL100 Stockpile Area, with subsequent transportation to the CHPP.

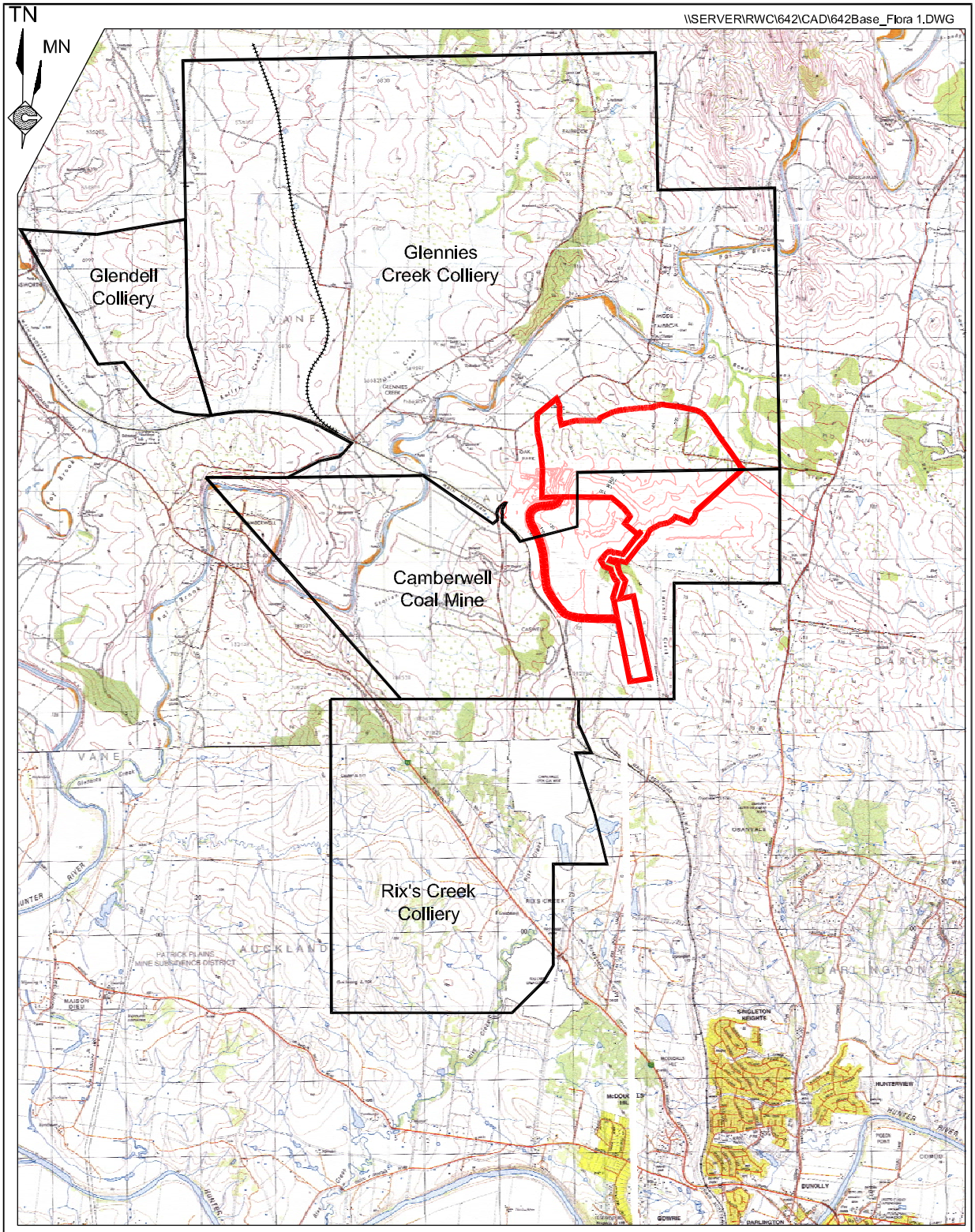


Figure 1
LOCALITY PLAN

Note: A colour version of this figure is available on the project CD

\\SERVER\RWC\642\CAD\642Base_Flora a2.DWG

TN
MN

Site Entrance Intersection
Middle Falbrook Road
Proposed Site / Open Cut Access Road Corridor
Possum Skin Dam
Stony Creek Road
Trevy Creek
Amenity Bund
Northern Dirty Water Containment Dam
Proposed Open Cut Facilities Area
Glennies Creek Colliery Pit Top Facilities
Portal Area
RL100 ROM Stockpile Area
Southern Dirty Water Containment Dam
Camberwell North Pit Sump
Proposed Coal Haul Route E Corridor (40m Wide) (Existing RL100 Haul Route)
Proposed Coal Haul Route D Corridor (100m Wide)
Tailings Dam 2
Tailings Dam TD2
Detail

See Detail
Project Site Boundary
Proposed Coal Haul Route E Corridor (40m Wide) (Existing RL100 Haul Route)
Proposed Coal Haul Route D Corridor (100m Wide)
Camberwell CHPP

REFERENCE

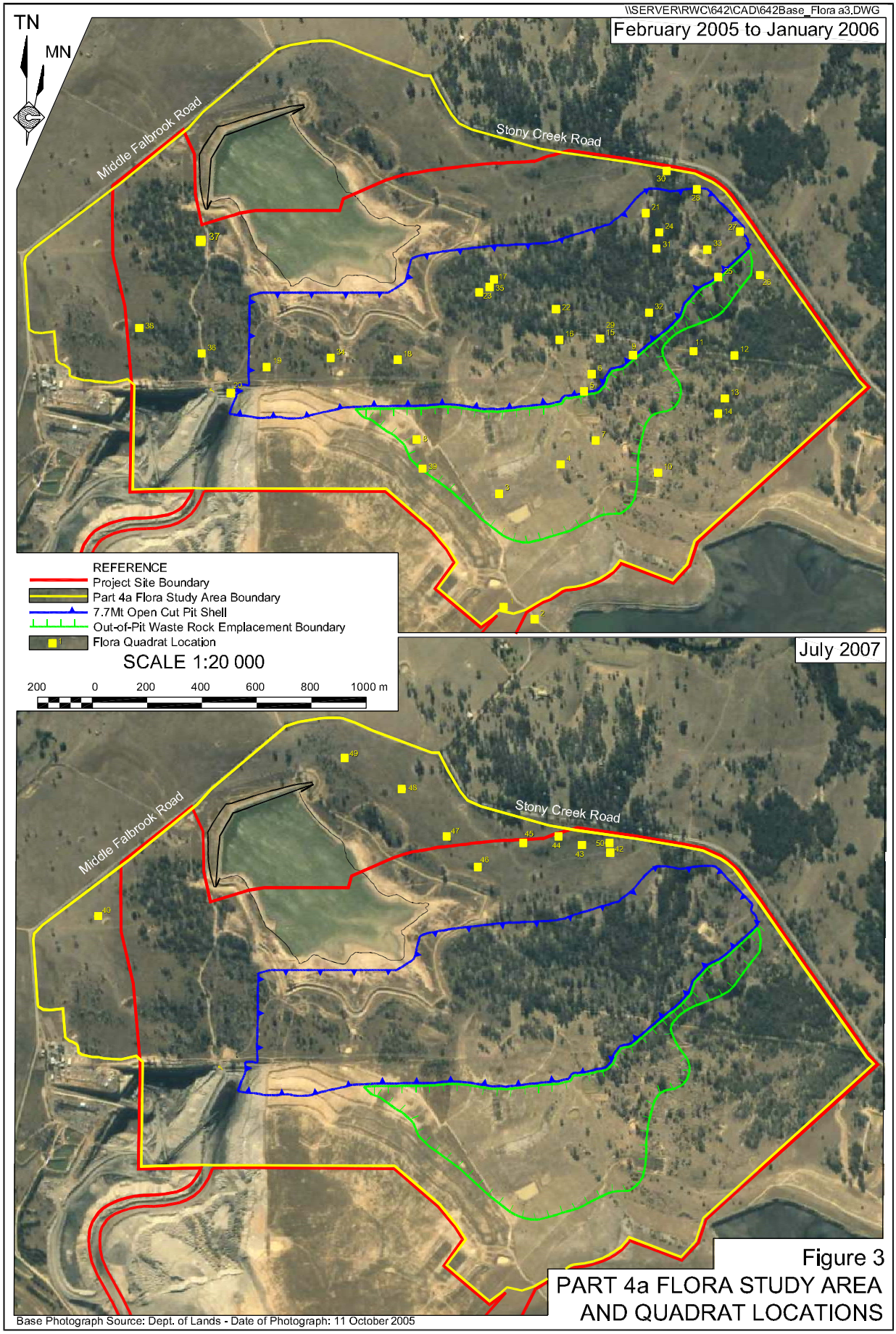
- Project Site Boundary
- Open Cut Area Boundary
- 7.7Mt Open Cut Pit Shell
- Out-of-Pit Waste Rock Emplacement Boundary
- Existing RL100 ROM Stockpile Area Boundary
- Lateral Extent of Highwall / Auger Mining
- Existing RL100 Haul Route (to Camberwell CHPP)
- A Proposed Coal Haul Route (See Inset)
- 135 Contour (m AHD)(Interval = 5m)
- Creek / Drainage Line
- Dam / Water Storage
- Sealed Road
- Unsealed Road / Track
- Fence
- Amenity Bund
- Proposed Site / Open Cut Access Road Corridor

SCALE 1:12 500
200 0 200 400 600 m

SCALE 1:25 000
250 0 250 500 750 1000 1250 m

Base Map Source: Geo-Spectrum (Australia) Pty Ltd - Date: December 2004

Figure 2
PROJECT SITE LAYOUT


\\SERVER\RWC\642\CAD\642Base_Flora a3.DWG
TN
MN
February 2005 to January 2006
Middle Fallbrook Road
Stony Creek Road
REFERENCE
Project Site Boundary
Part 4a Flora Study Area Boundary
7.7Mt Open Cut Pit Shell
Out-of-Pit Waste Rock Emplacement Boundary
Flora Quadrat Location
SCALE 1:20 000
200 0 200 400 600 800 1000 m
July 2007
Middle Fallbrook Road
Stony Creek Road
Figure 3
PART 4a FLORA STUDY AREA AND QUADRAT LOCATIONS
Base Photograph Source: Dept. of Lands - Date of Photograph: 11 October 2005

- Highwall / auger mining. During the course of the proposed open cut mining, there may be opportunities to undertake mining from the northern highwall using either highwall or auger mining to extract additional coal. This method of mining would result in underground extraction for a length of no more than approximately 300m from the base of the highwall, although the final distance would depend on the form of mining undertaken.
- Programmed placement of waste rock materials from the open cut, initially to an out-of-pit emplacement, with subsequent placement out-of-pit as well as in-pit in areas where mining has been completed. The proposed out-of-pit emplacement has a disturbance footprint of approximately 43ha.
- Progressive reshaping and rehabilitation of all areas of mining-related disturbance. Overall, the total disturbed area to be rehabilitated is approximately 135ha [7.7Mt reserve].
- Compensation for the clearing of approximately 68.3ha of native vegetation, 6.1ha of pasture, approximately 0.7ha of regenerating woodland / shrubland and approximately 47.6ha of previous rehabilitation vegetation with the following biodiversity offsets and remediation commitments.
    - Exclusion of stock, protection and enhancement of approximately 254ha of land owned and controlled by the Proponent [the Northern, Southern and Western Biodiversity Offset Areas]. In addition, the Proponent would exclude stock, protect and enhance approximately 33ha of privately owned land subject to the receipt of project approval and a suitable arrangement with the owners of the land being negotiated.
    - The Proponent would undertake remediation of Glennies Creek on Project-related and other land, including weed control and revegetation programmes.
- Implementation and maintenance of comprehensive systems to manage noise, vibration, air quality, visibility, surface water, groundwater, flora and fauna.

2 DESCRIPTION OF THE STUDY AREA

The Study Area is located adjacent to the Middle Falbrook Road at Glennies Creek and is 12km north of Singleton [**Figure 1**]. An aerial photograph of the Study Area is reproduced as **Figure 3**.

The Study Area comprises low rises and shallow valleys to the north of the existing Camberwell Coal Mine. It is bordered on the north by the Middle Falbrook and Stony Creek Roads.

The Study Area comprises a mixture of native vegetation remnants and more open gently sloping country, some of which is a rehabilitated overburden emplacement. In more recent times, some of the originally open grassland area has developed into a regenerating woodland / shrubland as young trees and shrubs grow above the grass height. A further section has been used by the management of Camberwell Coal Mine to store low mounds of topsoil. The Study Area is grazed, in part, but not cultivated.

The Study Area does not include areas of the Project Site outside those indicated on **Figure 3**, namely the Proposed Coal Haul Road Route Corridors D or E, or the Camberwell Coal Handling and Preparation Plant [CHPP]. These areas are either areas of current mining activities [Proposed Coal Haul Road Route Corridor E and the Camberwell CHPP] or areas of previous intense mining-related disturbances [Proposed Coal Haul Road Route Corridor D]. As a consequence, the potential for flora related impacts in these areas related to the proposed open cuts deemed to be negligible and these areas have not been considered in this assessment.

3 SURVEY METHODOLOGY

The Study Area was subjected to stereoscopic interpretation of 1: 10,000 scale colour airphotos prior to, and during, the field survey to determine vegetation community features and boundaries.

The photographs originally used were those produced by Geo-Spectrum [Australia] Pty Limited. The prints used in the stereoscopic interpretation were Glennies Creek Colliery Run 4, prints 6760, 6761, 6762, 6763 flown on 31st December, 2002.

Subsequently, more recent photographs produced by the Department of Lands on 11th October, 2005 [Run13] and 12th November, 2005 [Run 12] were used to determine community boundaries. The photographs were Camberwell Run 12, prints 94, 95, 96, 97; Run 13, prints 217, 218, 219.

The different landforms and vegetation communities identified through stereoscopic airphoto interpretation were then sampled in the field to ascertain the variation in species density and composition within these communities.

A total of 50 sample sites were described within the Study Area and at each of these sites the vegetation species composition data was recorded [**Figure 3**]. Thirty nine quadrats were described during the original series of field surveys and a further eleven were added during the July, 2007 inspection.

At these selected sites, quadrats 40m x 40m in area were examined to record the occurrence of all tree, shrub and ground cover species present. The exception was that during the July, 2007 inspection, only the tree and shrub status of the new quadrat sites was recorded as the aim of the survey was the re-assessment of the open tussock grassland community that had been observed to have progressively, developed following cessation of grazing.

4 VEGETATION OF THE STUDY AREA

4.1 Previous Botanical Studies of the Study Area

4.1.1 Soil Conservation Service Technical Manuals

There is no Soil Conservation Service Technical Manual covering the Study Area.

4.1.2 General Report on the Lands of the Hunter Valley [Story *et al,* 1963]

Story *et al* [1963] in their report on the lands of the Hunter Valley area describe the area near the proposed Glennies Creek Open Cut Coal Mine Project Site as being typical of Killarney Land System. They note that the native remnant vegetation is a Savannah Woodland of box, gum and ironbark that has mostly been thinned or cleared. The main species include *Eucalyptus albens* [White Box], *Eucalyptus dawsonii* [Slaty Gum], *Eucalyptus* [now *Corymbia*] *maculata* [Spotted Gum], *Eucalyptus tereticornis* [Forest Red Gum] and Ironbarks.

These authors also note that shrubs are rare and that ground layer species include *Themeda australis* [Kangaroo Grass], *Aristida* spp.. [Wiregrasses], *Chloris* spp.. [Windmill Grasses], *Austrodanthonia* spp. [Wallaby Grasses], *Dichanthium* spp.. [Bluegrasses], *Stipa setacea* [Spear Grass], *Trifolium* spp.. [Clovers] and *Medicago* spp. [Medics].

Note: * denotes an introduced species throughout this report

4.1.3 Flora Survey of Part of the Lands to be Incorporated within the Proposed Modified Glennies Creek Coal Mine [GCNRC, 1998a]

This survey was carried out by Geoff Cunningham Natural Resource Consultants Pty Ltd [GCNRC] in June, 1998 and covered only a small area near the former Oak Park School [GCNRC, 1998a].

Three distinct areas were covered by the study, namely:

i) the stripped and ripped area near the present entry to the underground workings of Glennies Creek Coal Mine within the original Camberwell Lease;

ii) an area between Camberwell North Pit and the vicinity of the former Oak Park School; and

iii) the former Oak Park School yard.

The report noted that the vegetation of the Study Area was a drastically altered community that was probably originally dominated by *Eucalyptus crebra* [Narrow-leaf Ironbark], *Eucalyptus tereticornis* [Forest Red Gum], *Allocasuarina luehmannii* [Bull Oak], *Eucalyptus blakelyi* [Blakely's Red Gum], *Eucalyptus fibrosa* [Broad-leaf Ironbark] and *Eucalyptus moluccana* [Grey Box].

This study also noted that no protected or threatened flora species, endangered ecological communities or areas of critical habitat were present and so none would be affected by the work proposed at that time.

4.1.4 Endangered Flora Report for the Glennies Creek Coal Mine Site [GCNRC, 1998b]

This survey was carried out by Geoff Cunningham Natural Resource Consultants Pty Ltd in June, 1998 and covered an area extending from near the former Oak Park School to Stony Creek Road near the proposed Barrett Seam Entry and north to the Middle Falbrook Road [GCNRC, 1998b].

No protected or threatened plants, Endangered Ecological Communities or areas of Critical Habitat were recorded on this area during the field survey and none were previously recorded from the site.

4.1.5 Environmental Impact Statement [EIS] Proposed Glennies Creek Colliery for Maitland Main Collieries Pty Ltd [Dames and Moore, 1990]

This study covered a number of areas of planned disturbance and their surrounds, including the present Study Area. It identified four broad vegetation communities:

- Savannah Woodland;
- Casuarina Ironbark Woodland
- Cleared Pastureland; and
- Creek Lines and Pondages.

No permanent creeks run though the present Study Area although there are some ephemeral drainage lines and a number of scattered small dams are present. [In addition, the relatively recently constructed Possum Skin Dam currently exists on the Project Site].

The EIS summarised the composition of these vegetation communities as follows.

- **Savannah Woodland** - *Eucalyptus crebra* [Narrow-leaf Ironbark] and *Eucalyptus fibrosa* [Broad-leaf Ironbark] occur on the ridges; the upper slopes usually support a tree cover of Broad-leaf Ironbark; and the lower slopes support a mixture of gums including *Eucalyptus* [now *Corymbia*] *maculata* [Spotted Gum], *Eucalyptus tereticornis* [Forest Red Gum] and *Eucalyptus punctata* [Grey Gum] with scattered *Eucalyptus moluccana* [Grey Box], Shrub cover is sparse with the species noted including *Maireana microphylla* [Eastern Cottonbush], *Acacia decora* [Western Golden Wattle] and *Acacia parvipinnula* [Silver-stemmed Wattle]. Pastures were primarily composed of grasses such as *Poa* sp. and *Themeda* sp.
- **Casuarina Ironbark Woodland** - This community is dominated by *Allocasuarina luehmannii* [Bull Oak] and Narrow-leaf Ironbark with very little lower storey cover. Two main occurrences were noted and the EIS noted that this community appeared to be slowly invading the surrounding pastureland.
- **Cleared Pastureland** - These areas have been cleared and support a herbaceous cover dominated by *Poa* spp. and *Stipa* spp. along with a range of native herbs and low shrubs such as *Dillwynia* spp., *Hibbertia* spp. and *Helichrysum* spp. It was noted that several introduced weed species including thistles and *Opuntia stricta** [Prickly Pear] were also present in these pastures.
- **Creek Lines and Pondages** - The area subject to the present study does not include any permanent creek lines. However the EIS noted that *Casuarina cunninghamiana* [River Oak] was present in Station Creek near the main railway line. The remaining area contains a number of ephemeral drainage lines and small dams that variously support water-loving species including *Typha* sp. [Cumbungi], *Juncus* spp. [Rushes], *Eleocharis* sp. [Spike-rushes] and *Cyperus* spp. [Sedges].

The EIS concluded that the most significant impact of the Glennies Creek Colliery proposal, as it was presented in 1990, would be the destruction of areas of *Eucalyptus crebra* [Narrow-leaf Ironbark] Woodland.

It was also noted that no rare, threatened or endangered plant species were known to be present on the site.

4.2 Other Relevant Vegetation Surveys in the Vicinity of the Study Area

4.2.1 Environmental Impact Statement [EIS] Camberwell Coal Project, Glennies Creek, NSW. Camberwell Coal Joint Venture [EPPS and Associates, 1989]

The flora study relating to the EIS for the adjacent Camberwell Coal Mine site was prepared by T.J. Fatchen and Associates in 1986 following field survey in July, 1985. The area studied includes an area that comprises the southern half of the current proposal's Open Cut Area.

This EIS summarises Fatchen and Associates' report and notes that seven vegetation communities were identified.

It should be noted that this report indicated that none of the communities could be regarded as relict since, despite having many of their main species still present, all reflected past land use and vegetation alteration.

The main features of each community are summarised below.

- **Community 1** - on the crests and upper slopes, layered woodlands with *Eucalyptus crebra* [Narrow-leaf Ironbark] and *Eucalyptus* [now *Corymbia*] *maculata* [Spotted Gum] as the main species and some *Eucalyptus moluccana* [Grey Box] and *Eucalyptus tereticornis* [Forest Red Gum]. Some *Acacia decora* [Western Golden Wattle] was present. Grey Box was more important on the lower slopes along with Narrow-leaf Ironbark and Spotted Gum. A more shrubby variant of this woodland community occurs on the Middle Falbrook Road reserve where a more diverse shrub layer is present. Species noted included *Calytrix tetragona* [Common Fringe Myrtle], *Bursaria spinosa* [Native Blackthorn], *Exocarpos cupressiformis* [Native Cherry], *Allocasuarina verticillata* [Drooping Sheoak] and *Myoporum montanum* [Western Boobialla]. The main pasture species in the community are also described.
- **Community 2** - grassy woodlands of Narrow-leaf Ironbark and Spotted Gum on the upper slopes and Narrow-leaf Ironbark and Grey Box on the lower slopes; with a grassy ground layer and some shrubs of *Maireana microphylla* [Eastern Cottonbush].
- **Community 3** - fringing woodlands occurring as a narrow band along Station and Blackwall Creeks. The main tree species are *Casuarina glauca* [Swamp Oak] and *Angophora floribunda* [Rough-barked Apple]. A shrub layer is not present and a mixture of grasses and herbs provides the ground cover. Some patches of *Casuarina cunninghamiana* [River Oak] occur.

- **Community 4** - open woodlands of Narrow-leaf Ironbark and Grey Box on the upper area and Grey Box on the deeper soils of the lower slopes and some remnants of *Eucalyptus blakelyi* [Blakely's Red Gum] on lower flats. The presence of eucalypt saplings was noted within this Unit as were occurrences of *Acacia amblygona* [Fan Wattle]. *Allocasuarina luehmannii* [Bull Oak] regeneration was also noted within this broad Unit.
- **Community 5 -** cleared land with dryland pasture that is often highly invaded by weeds.
- **Community 6 -** irrigated land used for cropping and pasture, often also with considerable weed invasion.
- **Community 7** - farm dams and Glennies Creek - the aquatic species associated with these habitats are briefly noted

The vegetation mapped for the section of the Camberwell Flora Study Area that is included in the present flora Study Area comprised a mixture of Grassy Woodlands [Community 2], Ironbark and Grey Box on Upper Slopes [Community 4] and Cleared Land – Dryland Pasture [Community 5].

4.2.2 Mount Owen Flora Assessment [Umwelt, 2003]

In 2003, Umwelt Environmental Consultants prepared a flora assessment for the Mount Owen mining area to the north of the present Project Site.

Umwelt reviewed a number of previous flora studies of areas in the vicinity of the Mount Owen site and identified five terrestrial communities present at Mount Owen.

These were:

- **Spotted Gum / Grey Box / Ironbark Woodland** - dominated by *Corymbia maculata* [Spotted Gum], *Eucalyptus crebra* [Narrow-leaved Ironbark] and *Eucalyptus fibrosa* [Broad-leaved Ironbark] with low densities of *Eucalyptus moluccana* [Grey Box]. A sparse shrub layer was present. Species recorded included *Daviesia genistifolia* [Broom Bitter-pea]*, Acacia amblygona* [Fan Wattle]*, Bursaria spinosa* [Native Blackthorn]*, Pultenaea retusa, Lissanthe strigosa* [Peach Heath]*, Acacia implexa* [Hickory Wattle]*,* and *Cassinia aculeata* [Dolly Bush]. Ground layer species included *Lomandra longifolia* [Spiny-headed Matrush]*, Cymbopogon refractus* [Barbed-wire Grass]*, Austrostipa* spp.[Speargrass], *Cheilanthes sieber*i [Rock Fern] and *Dichondra repens* [Kidney Weed]*.*
- **Regenerating Woodland** – an area replanted / regenerated to native vegetation in 1995 and 1996. Tree species present include Spotted Gum, Narrow-leaved Ironbark, Broad-leaved Ironbark and Grey Box. Shrub species recorded included *Acacia concurrens*, *Acacia parvipinnula* [Silver-stemmed Wattle]*, Acacia filiformis, Cassinia glauca, Pultenaea retusa* and *Dodonaea viscosa* [Broadleaf Hopbush].

- **Riparian Vegetation** – along drainage lines. Tree species recorded include *Casuarina glauca* [Swamp Oak], *Angophora floribunda* [Rough-barked Apple] and *Eucalyptus tereticornis* [Forest Red Gum]. This community is highly modified as a consequence of past land use. The riparian vegetation on the downstream parts of the Mount Owen Study Area is considered to be representative of the Central Hunter Riparian Forest [House, 2003]. Riparian vegetation along a drainage line within the Ravensworth State Forest is dominated by Forest Red Gum, *Eucalyptus punctata* [Grey Gum] and Grey Box and is considered to be representative of the Hunter Lowlands Redgum Forest Endangered Ecological Community. Shrubs within this community included *Notelaea microcarpa* [Native Olive], *Daviesia ulicifolia* [Gorse Bitter-pea], *Breynia oblongifolia* [Breynia] and Native Blackthorn. Ground layer species include *Cynodon dactylon** [Couch Grass], *Desmodium* sp. [Tick-trefoil], Barbed-wire Grass and *Centella asiatica* .
- **Bull Oak Woodland** – dominated by *Allocasuarina luehmannii* [Bull Oak] with some Narrow-leaved Ironbarks. Shrubs are generally absent although some *Pultenaea retusa* was noted. The ground layer species include *Aristida ramosa, Bothriochloa macra* [Red Grass], *Austrodanthonia* sp. [Wallaby Grass], *Dichelachne micrantha* [Short-haired Plume Grass],Rock Fern, *Glycine microphylla, Wahlenbergia stricta* [Tall Bluebell], *Opuntia aurantiaca** [Tiger Pear] and *Lomandra filiformis*.
- **Pastoral Grassland** – a mixed native and introduced species pasture. Mainly grassland with some regenerating Bull Oak, Narrow-leaved Ironbark and Spotted Gum. The main ground layer species recorded included *Sporobolus creber* [Western Rat's-tail Grass], *Austrostipa* spp. [Speargrass], Short-haired Plume Grass, *Paspalum dilatatum** [Paspalum], *Senecio madagascariensis** [Fireweed], Couch Grass*, Centella asiatica, Anagallis arvensis** [Scarlet Pimpernell], *Calotis lappulacea* [Yellow Burr-daisy], *Glycine tabacina* [Variable Glycine] and Tall Bluebell.

The Spotted Gum / Grey Box / Ironbark Woodland community identified by Umwelt [2003] at the Mount Owen Study Area is noted to be representative of the Central Hunter Ironbark / Spotted Gum / Grey Box Woodland described by House [2003].

This community is related to the Lower Hunter Spotted Gum - Ironbark Forest Endangered Ecological Community but is not itself listed on the Schedules of the NSW *Threatened Species Conservation Act, 1995*.

4.2.3 Ravensworth East Assessment [ERM Mitchell McCotter [ERMMM], 1999]

ERMMM surveyed the flora for the Ravensworth East Mine and identified five main habitat types. These were:

- Bull Oak Low Woodland;
- Swamp Oak Open Forest;
- Grassland;
- River Oak Open Forest; and
- Narrow-leaved Ironbark Woodland.

Descriptions of these communities are presented below.

- **Bull Oak Low Woodland -** this community is dominated by *Allocasuarina luehmannii* [Bull Oak] with components of *Eucalyptus crebra* [Narrow-leaved Ironbark], *Eucalyptus moluccana* [Grey Box] and *Eucalyptus fibrosa* [Broad-leaved Ironbark]. Regenerating trees were common and the community was largely devoid of shrubs. A sparse groundcover of *Aristida vagans* [Three-awned Speargrass] and *Austrostipa scabra* [Speargrass] was present along with some *Opuntia stricta** [Prickly Pear].
- **Swamp Oak Open Forest -** this community occurs along creek lines. *Casuarina glauca* [Swamp Oak] is dominant with *Angophora floribunda* [Rough-barked Apple], Narrow-leaved Ironbark and *Casuarina cunninghamiana* [River Oak] also present. Shrub cover was sparse with *Maireana microphylla* [Eastern Cottonbush] present. Groundcover species included Speargrass, Three-awned Speargrass, *Themeda australis* [Kangaroo Grass], *Cynodon dactylon** [Couch] and *Chloris gayana** [Rhodes Grass].
- **Grassland -** this community comprises largely cleared areas supporting scattered Narrow-leaved Ironbark and a moderate cover dominated by the native grasses *Bothriochloa decipiens* [Redleg Grass], *Cymbopogon refractus* [Barbed-wire Grass] and Speargrass. The native herb, *Chrysocephalum apiculatum* [Yellow Buttons] was also recorded. Exotic species included *Cirsium vulgare** [Spear Thistle], *Gomphocarpus fruticosus** [Narrow-leaved Cottonbush], *Trifolium repens** [White Clover] and Prickly Pear*. The alluvial flats were observed to have been pasture improved.
- **River Oak Open Forest -** this community was located along Bowmans Creek in a narrow riparian corridor. *Schinus ariera** [Pepper Tree] was co-dominant with River Oak. Shrubs were absent. Groundcover was dominated by exotic species.
- **Narrow-leaved Ironbark Woodland -** this woodland, though dominated by Narrow-leaved Ironbark, also contains mature Bull Oak and Grey Box trees and understorey dominated by Bull Oak regrowth. The groundcover was sparse and dominated by Redleg Grass, Three-awned Speargrass and Speargrass along with *Senecio madagascariensis** [Fireweed].

4.2.4 Rixs Creek Assessment [Croft and Associates, 1986]

Croft and Associates conducted a flora study of the proposed Rixs Creek Coal Mine site and identified four vegetation communities. These were:

- Creekside Swamp Oak Community;
- Forest Remnants;
- Spiny Rush Thicket; and
- Pasture and Scattered Trees.

Descriptions of these communities are presented below.

- **Creekside Swamp Oak Community -** this community occurs as a riparian corridor along Rixs Creek and is dominated by *Casuarina glauca* [Swamp Oak]. Understorey species were absent.
- **Forest Remnants -** this community comprised regenerating forest remnants with the main species including *Corymbia maculata* [Spotted Gum], *Eucalyptus crebra* [Narrow-leaved Ironbark], *Eucalyptus tereticornis* [Forest Red Gum] and *Eucalyptus moluccana* [Grey Box]. The shrub layer was relatively sparse over most of the community except on road reserves where the species richness was greater. The species generally present were *Acacia paradoxa* [Kangaroo Thorn], *Olearia elliptica* [Sticky Daisy Bush] and *Acacia decora* [Western Silver Wattle]. On the less disturbed areas *Myoporum montanum* [Western Boobialla], *Acacia ulicifolia* [Prickly Moses], *Pimelia* sp. [Riceflower], *Billardiera scandens* [Dumplings] and *Hardenbergia violacea* [False Sarsaparilla] were present in the shrub layer.
- **Spiny Rush Thicket -** this community dominated damper areas along the tributaries of Rixs Creek. The main species was *Juncus acutus* [Spiny Rush].
- **Pasture and Scattered Trees -** this community comprised grasslands invaded by *Rubus vulgaris** [Blackberry]. *Senecio lautus* [Fireweed] and *Wahlenbergia stricta* [Tall Bluebell] were recorded from the community along with *Gomphocarpus fruticosus** [Narrow-leaved Cotton Bush].

4.2.5 Ashton Mine Assessment [HLA Envirosciences, 2001]

HLA Envirosciences [2001] identified six flora communities within the Ashton Mine Study Area. These were:

- Grassland;
- Woodland;
- Bull Oak;
- Riparian;
- Aquatic; and
- Rail Corridor.

Descriptions of these communities are presented below.

- **Grassland -** these areas have been extensively cleared of trees and shrubs. The community comprises two basic pasture types – those that were based on improved pasture species and those consisting of native and naturalized pastures. The improved pastures were dominated by *Lolium* spp.* [Ryegrasses], *Chloris gayana** [Rhodes Grass], *Paspalum dilatatum** [Paspalum], *Medicago sativa** [Lucerne], *Trifolium repens** [White Clover] and *Pennisetum*

*clandestinum** [Kikuyu] along with other less valuable exotic species. The areas dominated by native and naturalized pasture species support scattered native trees and some areas of regeneration along with scattered occurrences of the shrubs, *Maireana microphylla* [Eastern Cottonbush] and *Acacia amblygona* [Fan Wattle]. The woody weed, *Lycium ferocissimum** [African Boxthorn] was also present.

- **Woodland -** a number of occurrences of closed woodland were recorded in the Study Area. The dominant species were *Eucalyptus crebra* [Narrow-leaved Ironbark], *Eucalyptus moluccana* [Grey Box] and *Allocasuarina luehmannii* [Bull Oak]. Also present were some plants of *Brachychiton populneus* [Kurrajong] regeneration and *Geijera parviflora* [Wilga]. The shrub layer was scattered and comprised Eastern Cottonbush, *Eremophila deserti* [Turkey Bush], Fan Wattle, *Daviesia genistifolia* [Broom Bitter-pea] and Eremophila *debile* [Winter Apple]. The weed species *Opuntia stricta** [Prickly Pear], *Opuntia aurantiaca** [Tiger Pear] and African Boxthorn* were present as scattered plants. Groundcover species include *Austrodanthonia* sp. [Wallaby Grass], *Aristida vagans* [Three-awned Speargrass], *Solanum nigrum** [Black Nightshade] and *Senecio madagascariensis** [Fireweed].

- **Bull Oak -** the dominant in this community was *Allocasuarina luehmannii* [Bull Oak] and because of its density there are very few shrubs present. *Opuntia stricta** [Prickly Pear] is scattered through the community. Groundcover was also sparse but was more prevalent in openings in the community. The main species recorded were *Cymbopogon refractus* [Barb Wire Grass], *Sporobolus creber* [Slender Rat's Tail], *Cynodon dactylon** [Couch], *Chloris truncata* [Windmill Grass], *Wahlenbergia* sp. [Bluebells], *Chrysocephalum apiculatum* [Yellow Buttons] and scattered *Senecio madagascariensis** [Fireweed].

- **Riparian -** *Casuarina cunninghamiana* [River Oak] and *Angophora floribunda* [Rough-barked Apple] dominated the riparian vegetation along the northern section of Bowmans Creek with *Salix babylonica** [Weeping Willow] more common closer to the Hunter River. The vegetation along Glennies Creek was noted to be similar. Shrub species were limited in occurrence but *Lycium ferocissimum** [African Boxthorn] was present. Grass species dominated the ground layer, particularly where grazing was excluded. Species such as *Urtica incisa** [Stinging nettle], *Bidens pilosa** [Pitchforks] and *Verbena bonariensis** [Purple Top] were also recorded. In the seasonally inundated sections of the creek beds species such as *Juncus* sp. [Rush] and *Persicaria* sp. [Knotweeds] were noted.

- **Aquatic -** the vegetation associated with areas of permanent water in stock dams was also sampled. The vegetation near most dams was very much disturbed by grazing. Typical aquatic species were *Marsilea mutica* [Common Nardoo] and *Potamogeton tricarinatus* [Floating Pondweed]. *Typha orientalis* [Cumbungi] was present at one site and many others were associated with occurrences of *Juncus acutus* [Spike Rush] – an indicator of soil salinity.

- **Rail Corridor -** this community was associated with the Main Northern Railway line and is highly modified. The main native flora species occurring along the rail corridor were *Allocasuarina luehmannii* [Bull Oak], *Grevillea arenaria*, *Maireana microphylla* [Eastern Cotton Bush] and some *Lomandra longifolia* and *Dianella revoluta*. The ground layer species comprised a mixture of native grasses and exotic weed species such as *Foeniculum vulgare** [Fennel], *Fumaria muralis** [Wall Fumitory], *Rapistrum rugosum** [Turnip Weed], *Anagallis arvensis** [Pimpernell], *Bidens pilosa** [Pitch Forks], *Galenia pubescens**, *Sonchus oleraceus** [Common Sowthistle] and *Plantago lanceolata** [Ribwort].

4.2.6 Glendell Coal Mine [Croft and Associates, 1982]

Croft and Associates [1982] identified four vegetation communities within the Glendell Coal Mine site. The communities were:

- pastureland;
- creek side vegetation;
- regenerating Narrow-leaved Ironbarks and Oaks; and
- roadside Bull Oak Stands.

The descriptions presented in the Glendell Environmental Impact Statement are quite brief but are set out below.

- **Pastureland** – this community occupied most of the site and included areas of cultivation. Scattered trees of *Allocasuarina luehmannii* [Bull Oak], *Eucalyptus crebra* [Narrow-leaved Ironbark] and *Angophora floribunda* [Rough-barked Apple] are present along with scattered clumps of *Acacia decora* [Western Golden Wattle]. The pasture comprised mainly of a number of grass species including *Bothriochloa macra* and *Bothriochla decipiens* [Red Grasses], *Cynodon dactylon** [Couch Grass], *Austrodanthonia* spp. [Wallaby Grasses], *Panicum effusum* [Hairy Panic], *Austrostipa scabra* [Rough Spear Grass] and *Stipa variabilis* [Variable Spear Grass]. *Opuntia stricta** [Prickly Pear] was also present.
- **Creek Side Vegetation –** this community comprised the clumps of *Casuarina stricta* [Swamp Oak] along the banks of Swamp Creek and Bettys Creek. The introduced *Schinus ariera** [Pepper Tree] was naturalized amongst the Swamp Oaks on the southern section of Bettys Creek.
- **Regenerating Narrow-leaved Ironbarks and Oaks** – this community comprised two basic forms – pure Bull Oak stands and mixed Narrow-leaved Ironbark / Bull Oak stands. The Bull Oak stands contained no other tree or shrub species and a light cover of grass was present. The mixed community comprised scattered mature Narrow-leaved Ironbarks with regenerating Narrow-leaved Ironbarks and Bull Oaks beneath them. The only shrub recorded was *Maireana microphylla* [Eastern Cottonbush]. The ground cover comprised grasses.

- **Roadside Bull Oak Stands** – this community comprises narrow belts of Bull Oak and *Eucalyptus moluccana* [Grey Box]. The shrub and ground cover layers were poorly developed.

4.3 Summary of Previous Vegetation Studies

All of the previous vegetation studies show the vegetation of the area associated with, and surrounding, the present Study Area to be a mixture of eucalypt woodlands and cleared areas with some stream-fringing woodlands and wet areas where the vegetation is dominated by water loving species.

The woodlands are noted to be dominated by a mixture of Narrow-leaf Ironbark, Broad-leaf Ironbark, Spotted Gum, Grey Box, Blakely's Red Gum, and Forest Red Gum. Some occurrences of Grey Gum were also noted in one study although none were recorded within the present Study Area.

The cleared lands are either grass dominated and basically treeless pastures or pastures with a scattering of regenerating eucalypt and, at times, *Allocasuarina luehmannii* saplings.

The occurrence of a large number of weeds in the cleared and cropped areas is noted as well as in some of the areas that are just grazed.

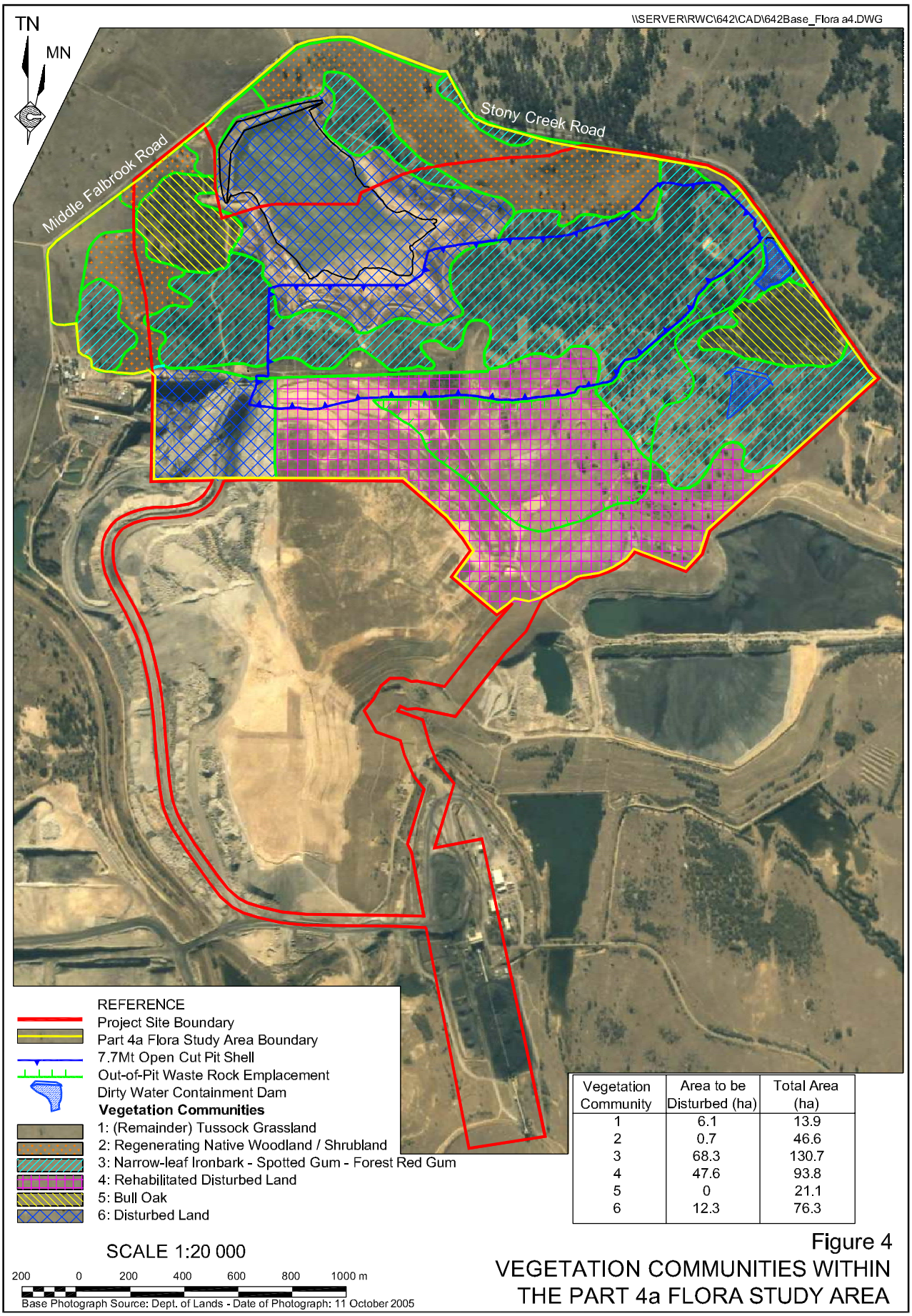
The point has been made in these studies that the vegetation in this area has been highly modified by past land use and that the vegetation communities encountered are relatively widespread in the Hunter region [albeit with some cautionary comment that mining was having an impact on the areas of these communities].

5 THE PRESENT STUDY

The present field study identified six separate vegetation communities within the Study Area identified in **Figure 3** [the "Part 4a Flora Study Area"]. A separate flora study area, namely the Part 4b Flora Study Area, is described in the companion report to this report presented as Part 4b of the *Specialist Consultant Studies Compendium*. A total of 50 quadrat sites were examined within Communities 1 to 5. Community 6 [Disturbed Land] was not surveyed for vegetation [**Figure 4**]. The locations of the quadrat sites and a description of the trees and shrubs present are listed in **Table 1**.

Thirty nine quadrats were described during the original series of field surveys and a further eleven were added during the July, 2007 inspection.

At these selected sites, quadrats 40m x 40m in area were examined to record the occurrence of all tree, shrub and ground cover species present. The exception was that at the July, 2007 inspection, only the tree and shrub status of the new quadrat sites was recorded as the aim of the survey was the re-assessment of the open tussock grassland community that had been observed to have progressively developed following cessation of grazing.



Vegetation Community	Area to be Disturbed (ha)	Total Area (ha)
1	6.1	13.9
2	0.7	46.6
3	68.3	130.7
4	47.6	93.8
5	0	21.1
6	12.3	76.3

Figure 4
VEGETATION COMMUNITIES WITHIN THE PART 4a FLORA STUDY AREA

These are:

- **Community 1** – Tussock Grassland;
- **Community 2** - Regenerating Native Woodland / Shrubland;
- **Community 3** – Rehabilitated Disturbed Land;
- **Community 4** – *Eucalyptus crebra* [Narrow-leaf Ironbark] - *Corymbia maculata* [Spotted Gum] – *Eucalyptus tereticornis* [Forest Red Gum] Community;
- **Community 5** – *Allocasuarina luehmannii* [Bull Oak] Community; and
- **Community 6** – Disturbed Land.

NOTE: * *denotes an introduced species*

5.1 Community 1 – Tussock Grassland

[*Quadrats 18, 19, 20, 21, 27, 34, 38,*]

These areas are generally open grassland communities with very scattered trees of *Eucalyptus crebra* [Narrow-leaf Ironbark] or *Eucalyptus moluccana* [Grey Box] trees are throughout the community. Other sections of this community support varying degrees of eucalypt and other regeneration with the main species regenerating being *Allocasuarina luehmannii* [Bull Oak], Grey Box, Narrow-leaf Ironbark and *Eucalyptus fibrosa* [Broad-leaf Ironbark]. The main distinction between this community and Community 2 lies in the general lack of trees and shrubs in this community.

Shrubs are sometimes present as scattered individuals or small clumps and comprise mainly *Maireana microphylla* [Eastern Cottonbush].

Common ground layer species include *Aristida* sp. [Wiregrass], *Anagallis arvensis** [Scarlet Pimpernell], *Bothriochloa macra* [Red Grass], *Cheilanthes sieberi* [Rock Fern], *Cymbopogon refractus* [Barbed Wire Grass], *Dianella revoluta* [Spreading Flax-lily], *Digitaria brownii* [Cotton Panic], *Linum marginale* [Native Flax], *Romulea rosea** [Onion Grass] and *Senecio madagascariensis** [Fireweed].

A complete listing of the ground layer species recorded within this community is contained in **Table 2**.

5.2 Community 2 - Regenerating Native Woodland / Shrubland

[*Quadrats 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50*]

In the late 1990's and early 2000's these areas were generally open grassland communities supporting scattered native trees. At that time, cattle were grazed on the land. Prior to the removal of domestic livestock from the landscape, there were some areas of regeneration of tree saplings around the very scattered trees of *Eucalyptus crebra* [Narrow-leaf Ironbark], *Eucalyptus moluccana* [Grey Box], *Corymbia maculata* [Spotted Gum], *Allocasuarina luehmannii* [Bull Oak] and *Eucalyptus fibrosa* [Broad-leaf Ironbark].

However, since removal of cattle, there has been an explosion in the establishment of native shrubs and native tree regeneration.

Regeneration of the native eucalypt species has usually been in the areas surrounding the existing scattered individual trees or clumps but regeneration of Bull Oak has been widespread over the whole of the mapped area. Bull Oak regeneration varies in density from very dense around older trees to scattered over the intervening landscape.

The main native shrubs to establish have been *Daviesia genistifolia* [Broom Bitter-pea], *Daviesia ulicifolia* [Gorse Bitter-pea], *Acacia amblygona* [Fan Wattle], *Acacia falcata*, *Hakea decurrens, Acacia falcata, Myoporum montanum* [Western Boobialla], *Pultenaea* sp. and *Maireana microphylla* [Eastern Cottonbush]. The two *Daviesia* species are by far the most common regenerating native shrubs.

These shrubs have established in the period since cattle grazing ceased and form a stand of varying density throughout the community – usually at spacings of <1m to 2m between individual plants, thinning to 5-10m apart in places.

The shrub layer in this regenerating community varies from about 80cm to 3-4m high and forms impenetrable stands in some areas.

Common ground layer species include *Aristida* sp. [Wiregrass], *Anagallis arvensis** [Scarlet Pimpernell], *Bothriochloa macra* [Red Grass], *Cheilanthes sieberi* [Rock Fern], *Cymbopogon refractus* [Barbed Wire Grass], Panicum sp. [Panic Grass], *Dianella revoluta* [Spreading Flax-lily], *Digitaria brownii* [Cotton Panic], *Lomandra* sp. [Matrush], *Linum marginale* [Native Flax], *Romulea rosea** [Onion Grass] and *Senecio madagascariensis** [Fireweed].

The listing of the ground layer species recorded within this community is similar to that recorded for Community 1 in **Table 2**.

5.3 Community 3 – *Eucalyptus crebra* [Narrow-leaf Ironbark] - *Corymbia maculata* [Spotted Gum] – *Eucalyptus tereticornis* [Forest Red Gum] Community

[*Quadrats 4, 5, 6, 9, 10, 13, 14, 15, 16, 17, 22, 23, 24, 25, 26, 28, 29, 30, 31, 32, 33, 35, 36,*]

The main tree species within this community are *Eucalyptus crebra* [Narrow-leaf Ironbark], *Corymbia maculata* [Spotted Gum], *Eucalyptus moluccana* [Grey Box] and *Eucalyptus tereticornis* [Forest Red Gum]. Other trees include *Eucalyptus fibrosa* [Broad-leaf Ironbark], *Eucalyptus blakelyi* [Blakely's Red Gum], *Allocasuarina luehmannii* [Bull Oak] and *Angophora floribunda* [Rough-barked Apple].

Shrub species recorded include *Pittosporum angustifolium* [Butterbush], *Acacia falcata*, *Pultenaea* sp., *Daviesia genistifolia* [Broom Bitter-pea], *Hardenbergia violacea* [False Sarsaparilla], *Lissanthe strigosa* [Peach Heath], *Daviesia ulicifolia* [Gorse Bitter-pea], *Acacia parvipinnula* [Silver-stemmed Wattle], *Eremophila debile* [Amulla], *Acacia pravifolia* [Coil-pod Wattle], *Lycium ferocissimum** [African Boxthorn], *Notelaea microcarpa* [Native Olive], *Myoporum montanum* [Western Boobialla], *Cassinia arcuata* [Chinese Shrub], *Acacia decora* [Western Golden Wattle] and *Phyllanthus hirtellus* [Thyme Spurge].

Common ground layer species include *Aristida* sp. [Wiregrass], *Cheilanthes sieberi* [Rock Fern], *Chloris ventricosa* [Tall Chloris], *Chrysocephalum apiculatum* [Yellow Buttons], *Cymbopogon refractus* [Barbed Wire Grass], *Cirsium vulgare** [Spear Thistle], *Conyza bonariensis** [Flax-leaf Fleabane], *Demodium varians* [Slender Tick-trefoil], *Dianella revoluta* [Spreading Flax-lily], *Dichondra repens* [Kidney Weed], *Fimbristylis* sp. [Fringe Rush], *Linum marginale* [Native Flax], *Modiola caroliniana** [Red-flowered Mallow], *Lomandra* sp. [Matrush], *Senecio madagascariensis** [Fireweed], *Pomax umbellata* [Pomax], *Sida rhombifolia** [Paddy's Lucerne], *Opuntia stricta** [Prickly Pear], *Themeda australis* [Kangaroo Grass] and *Xerochrysum bracteatum* [Golden Everlastings].

A complete listing of the ground layer species recorded within this community is contained in **Table 2**.

5.4 Community 4 – Rehabilitated Disturbed Land and Soil Stockpile Sites

[*Quadrats 1, 2, 3 , 7, 8, 39*]

This community is basically treeless although there are small areas of what appear to be planted seedlings / saplings present.

The landform appears to have been reshaped after disturbance associated with mining on the original Camberwell lease.

There is also an area in the south eastern section of the Study Area where the landscape is covered with low mounds of stockpiled topsoil that have covered any native groundcover plants and low shrubs. Scattered through this area are *Eucalyptus crebra* [Narrow-leaf Ironbark] and *Eucalyptus tereticornis* [Forest Red Gum] trees and some regeneration of these species.

Some occurrences of the shrubs *Acacia falcata*, *Eremophila debile* [Amulla], *Daviesia ulicifolia* [Broom Bitter-pea], *Pultenaea* sp. and *Maireana microphylla* [Eastern Cottonbush] are also present.

Common ground layer species include *Cirsium vulgare** [Spear Thistle], *Conyza bonariensis** [Flax-leaf Fleabane], *Galenia pubescens** [Galenia], *Hypochaeris glabra** [Smooth Catsear], *Hypochaeris radicata** [Flatweed], *Medicago sativa** [Lucerne], *Senecio madagascariensis** [Fireweed], *Setaria sphacelata* var. *sericea** [Setaria cultivar Narok], *Trifolium repens** [White Clover] and *Trifolium subterraneum** [Subterranean Clover].

A complete listing of the ground layer species recorded within this community is contained in **Table 2**.

5.5 Community 5 - *Allocasuarina luehmannii* [Bull Oak] Community

[*Quadrats 11, 12, 37*]

Allocasuarina luehmannii [Bull Oak] is the dominant species within this community with mature trees and regeneration present - the latter particularly around the perimeter of the main occurrences. *Eucalyptus crebra* [Narrow-leaf Ironbark], *Angophora floribunda* [Rough-barked Apple] and *Eucalyptus moluccana* [Grey Box] trees are present in some sections to varying

degrees. Shrub species recorded include *Acacia parvipinnula* [Silver-stemmed Wattle], *Acacia paradoxa* [Kangaroo Thorn], *Cassinia laevis* [Cough Bush], *Cassinia arcuata* [Chinese Shrub], *Acacia pravifolia* [Coil-pod Wattle] and *Myoporum montanum* [Western Boobialla].

Ground layer species include *Aristida* sp. [Wiregrass], *Cheilanthes sieberi* [Rock Fern], *Chrysocephalum apiculatum* [Yellow Buttons], *Cymbopogon refractus* [Barbed Wire Grass], *Dianella revoluta* [Spreading Flax-lily] and *Eragrostis brownii* [Brown's Lovegrass].

A complete listing of the ground layer species recorded within this community is contained in **Table 2**.

5.6 Community 6 – Disturbed Land

Quadrats not sampled

Land disturbed by and currently in use for mining operations.

Table 1
Location of Quadrat Sites

SITE*	EASTING / NORTHING	COMMUNITY DESCRIPTION
1	325878E / 6405561N	**Treeless:**
2	325991E / 6405517N	**Treeless**:
3	325862E / 6405887N	**Treeless:** **Shrubs:** occasional *Maireana microphylla* [Eastern Cottonbush]
4	326086E / 6405994N	**Trees:** *Eucalyptus crebra* [Narrow-leaf Ironbark] **Shrubs:** *Acacia falcata*
5	326172E / 6406260N	**Trees**: T<1 *Eucalyptus fibrosa* [Broad-leaf Ironbark] and regeneration, *Eucalyptus blakelyi* [Blakely's Red Gum] **Shrubs:** *Pittosporum angustifolium* [Butterbush]
6	326199E / 6406324N	**Trees:** T<1-5 Broad-leaf Ironbark, *Eucalyptus moluccana* [Grey Box], *Allocasuarina luehmannii* [Bull Oak] **Shrubs**: *Pultenaea* sp.
7	326214E / 6406082N	**Treeless:** **Shrubs:** clump of *Acacia falcata* nearby
8	325561E / 6406172N	**Treeless:** **Shrubs:** Eastern Cottonbush
9	326350E / 6406394N	**Trees:** *Eucalyptus maculata* [Spotted Gum], Broad-leaf Ironbark, Bull Oak, eucalypt regrowth **Shrubs**: *Pultenaea* sp., *Daviesia genistifolia* [Broom Bitter-pea], *Acacia falcata*
10	326441E / 6405964N	**Trees**: Scattered Narrow-leaf Ironbark **Shrubs**: Eastern Cottonbush, *Acacia falcata*
11	326572E / 6406407N	**Trees:** T<1 Bull Oak, Narrow-leaf Ironbark **Shrubs:** *Acacia paradoxa* [Kangaroo Thorn],*Acacia parvipinnula* [Silver-stemmed Wattle], *Cassinia laevis* [Cough Bush], *Cassinia arcuata* [Chinese Shrub], *Acacia pravifolia* [Coil-pod Wattle],

Table 1 [Cont'd]
Location of Quadrat Sites

SITE*	EASTING / NORTHING	COMMUNITY DESCRIPTION
12	326720E / 6406392N	**Trees:** Bull Oak, Narrow-leaf Ironbark **Shrubs:** *Myoporum montanum* [Western Boobialla], Broom Bitter-pea
13	326685E / 6406234N	**Trees:** T1-5 Narrow-leaf Ironbark and regeneration [T<1], *Angophora floribunda* [Rough-barked Apple],Bull Oak **Shrubs:** Broom Bitter-pea, *Acacia falcata*
14	326661E / 6406181N	**Trees:** Rough-barked Apple, Grey Box and Blakely's Red Gum, regeneration of Narrow-leaf Ironbark **Shrubs:** Eastern Cottonbush
15	326231E / 6406454N	**Trees:** Spotted Gum, Grey Box, Narrow-leaf Ironbark, Bull Oak, Broad-leaf Ironbark **Shrubs:** Fan Wattle, *Acacia falcata*
16	326082E / 6406449N	**Trees:** Grey Box and regeneration, Narrow-leaf Ironbark
17	325842E / 6406670N	**Trees:** Spotted Gum , Rough-barked Apple, Bull Oak **Shrubs:** Fan Wattle, *Acacia falcata,* Chinese Shrub, Broom Bitter-pea, Western Boobialla, *Pultenaea* sp., *Hardenbergia violacea* [False Sarsaparilla],
18	325491E / 6406464N	**Trees:** Occasional Narrow-leaf Ironbark plus T<1-2 regeneration, Bull Oak, Broad-leaf Ironbark and regeneration
19	325014E / 6406438N	**Trees:** Occasional Narrow-leaf Ironbark and T5 -10 – 30 regeneration, Occasional Broad-leaf Ironbark
20	324882E / 6406342N	**Trees:** Narrow-leaf Ironbark and regeneration, Grey Box and regeneration
21	326397E / 6406911N	**Treeless:** **Shrubs:** scattered, Fan Wattle, Broom Bitter-pea, [Grey Box clump nearby]
22	326069E / 6406560N	**Trees:** Spotted Gum [some older trees but mainly saplings to 15cm DBH], Narrow-leaf Ironbark, Broad-leaf Ironbark, Grey Box, Bull Oak **Shrubs:** Fan Wattle, *Lycium ferocissimum** [African Boxthorn], *Acacia falcata, Daviesia ulicifolia* [Gorse Bitter-pea], *Lissanthe strigosa* [Peach Heath],
23	325789E / 6406622N	**Trees:** Grey Box, Bull Oak, Narrow-leaf Ironbark, Clump of Spotted Gum on small knoll on north side of small upstream dam **Shrubs:** *Acacia falcata,* Silver-stemmed Wattle, Eastern Cottonbush, Western Boobialla, *Pultenaea* sp., *Eremophila debile* [Amulla], Chinese Shrub
24	326445E / 6406842N	**Trees:** Grey Box, Occasional Bull Oak and Spotted Gum **Shrubs:** Western Boobialla, *Notelaea microcarpa* [Native Olive], *Pultenaea* sp.
25	326661E / 6406679N	**Trees:** Narrow-leaf Ironbark, Bull Oak, Grey Box **Shrubs:** Silver-stemmed Wattle, Coil-pod Wattle, Western Boobialla
26	326814E / 6406686N	**Trees:** Bull Oak and regeneration, Rough-barked Apple and regeneration **Shrubs:** Eastern Cottonbush, Silver-stemmed Wattle, Broom Bitter-pea.
27	326741E / 6406844N	**Trees**: Scattered Bull Oak regeneration, scattered eucalypt regeneration [probably Broad-leaf Ironbark] **Shrubs:** Broom Bitter-pea

Table 1 [Cont'd]
Location of Quadrat Sites

SITE*	EASTING / NORTHING	COMMUNITY DESCRIPTION
28	326583E / 6406998N	**Trees:** Grey Box and T<1 regeneration in parts, occasional Spotted Gum **Shrubs:** Eastern Cottonbush
29	326237E/ 6406461N	**Trees:** T 5-20; Spotted Gum, Narrow-leaf Ironbark, Grey Box, Forest Red Gum, Bull Oak, Rough-bark Apple **Shrubs:** S 1-2; *Acacia falcata Myoporum montanum* [Western Boobialla], *Acacia decora* [Western Golden Wattle], Amulla, *Phyllanthus hirtellus* [Thyme Spurge], *Lissanthe strigosa* [Peach Heath], Gorse Bitter-pea, Broom Bitter-pea
30	326475E / 6407066N	**Trees:** T 1-5-10; Spotted Gum, Narrow-leaf Ironbark, Grey Box, Broad-leaf Ironbark, Rough-barked Apple **Shrubs**: S 1-2; *Acacia falcata,* Western Boobialla, Gorse Bitter-pea, Western Golden Wattle, Amulla, Thyme Spurge, Chinese Shrub, Peach Heath, Cough Bush, Coil-pod Wattle
31	3264327E / 6406783N	**Trees:** T 5-10; Spotted Gum, Grey Box, Forest Red Gum, Blakely's Red Gum, Bull Oak, Rough-barked Apple, **Shrubs:** S 1-10; Silver-stemmed Wattle , *Acacia falcata* , Coil-pod Wattle, Western Boobialla, Western Golden Wattle, Amulla, Thyme Spurge, Gorse Bitter-pea, Native Olive
32	326411E / 6406549N	**Trees:** T 1-15; Spotted Gum, Broad-leaf Ironbark, Grey Box, Bull Oak **Shrubs:** S 5-10; Coil-pod Wattle, *Exocarpos aphyllus* [Leafless Cherry], Eastern Cottonbush, Amulla, *Hardenbergia violacea* [False Sarsaparilla]
33	326622E / 6406779N	**Trees**: T <1-3; Bull Oak, scattered Broad-leaf Ironbark **Shrubs:** S 2-15->50; Coil-pod Wattle, Western Boobialla, Amulla, Thyme Spurge, Eastern Cottonbush, Peach Heath
34	325248E / 6406471N	**Mainly treeless**: scattered Bull Oak, Broad-leaf Ironbark and regenerating eucalypt seedlings; **Scattered shrubs:** Amulla
35	325826E / 6406643N	**Trees:** T5-10; Spotted Gum, Narrow-leaf Ironbark **Shrubs:** S1-2; *Acacia falcata*, Western Boobialla, Gorse Bitter-pea, Amulla, Thyme Spurge, Peach Heath, Broom Bitter-pea
36	324776E / 6406486N	**Trees:** T<1-5 Grey Box, Forest Red Gum, Rough-barked Apple [regrowth], Narrow-leaf Ironbark, Bull Oak **Shrubs:** Eastern Cottonbush, *Olea europaea* var. *africana* [African Olive]
37	324775E / 6406898N	**Trees:** T<1-2; Bull Oak [much regrowth], Narrow-leaf Ironbark, Rough-barked Apple **Shrubs:** Amulla, Cough Bush, Western Golden Wattle, Native Olive, *Gomphocarpus fruticosus** [Swan Plant]
38	324549E / 6406580N	**Trees:** Scattered Grey Box, Narrow-leaf Ironbark [and regeneration], occasional Bull Oak saplings **Shrubs:** Scattered Eastern Cottonbush, Swan Plant*
39	325582E / 6406067N	**Treeless**: rehabilitation area

Table 1 [Cont'd]
Location of Quadrat Sites

SITE*	EASTING / NORTHING	COMMUNITY DESCRIPTION
40	324366E / 6406815N	Scattered Narrow-leaf Ironbark with some regeneration, scattered Bull Oak with regeneration
41	324740E / 6406500N	T20-40-80 Narrow-leaf Ironbark, Forest Red Gum, Grey Box, Bull Oak
42	326235E / 6407048N	T10-20-30 Bull Oak; S<1-2 *Acacia amblygona*, Eastern Cottonbush, Broom Bitter-pea
43	326132E / 6407075N	T5-20-50 Bull Oak; S<1 *Acacia amblygona,* Broom Bitter-pea, Gorse Bitter-pea
44	326046E / 6407107N	S1-5-10 Broom Bitter-pea, Gorse Bitter-pea
45	325918E / 6407082N	Scattered Bull Oak, Grey Box, Narrow-leaf Ironbark, patches of Spotted Gum and Broad-leaf Ironbark; S<1-5-10 Broom Bitter-pea, Gorse Bitter-pea
46	325753E / 6406994N	S<1-5 *Hakea decurrens*
47	325639E / 6407107N	T5-30-50 Bull Oak; S1 [clumped over 80%] Hakea decurrens, Eastern Cottonbush, Acacia amblygona, Broom Bitter-pea, Gorse Bitter-pea, Western Boobialla, Cough Bush
48	325476E / 6407279N	T5-120 Bull Oak, Forest Red Gum; S15-20 Eastern Cottonbush
49	325266E / 6407392N	T2-20 Bull Oak, Grey Box, Forest Red Gum; Scattered Eastern Cottonbush
50	326232E / 6407083N	Scattered Bull Oak; S<1 Broom Bitter-pea, Gorse Bitter-pea

Note 1: The symbols **T** and **S** followed by a number denotes the average spacing between trees and shrubs [respectively] in metres
Note 2: Eastings and Northings are in AMG coordinates
* See **Figure 3**

Table 2[a]
Groundcover Species Recorded at Quadrats 1 to 14 within the Study Area

'P' = present '-' = absent

SPECIES	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***	***13***	***14***
Agave sp.* [Aloe]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agrostis avenacea [Blown Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ajuga australis [Australian Bugle]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Ammi majus** [Queen Anne's Lace]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Anagallis arvensis** [Blue Pimpernell]	-	-	P	-	-	-	P	P	-	-	-	-	-	-
Aristida sp. [Wiregrass]	-	-	-	-	-	-	-	-	P	-	P	P	P	-
Asperula sp. [Woodruff]	-	-	-	P	-	-	-	-	-	-	-	-	-	-
Austrodanthonia sp. [Wallaby Grass]	-	-	-	-	-	-	-	-	P	-	-	-	-	-
Austrodanthonia linkii var. *linkii* [Wallaby Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Austrostipa sp. [Speargrass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Austrostipa verticillata [Slender Bamboo Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Bidens pilosa** [Cobbler's Pegs]	-	P	-	-	P	-	-	-	-	P	-	-	-	-
Bothriochloa macra [Red Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brachiaria sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Brassica napus** [Canola]														
Brunoniella australis [Blue Trumpets]	-	-	-	-	-	P	-	-	-	-	-	-	-	-
*Bryophyllum delagoense** [Mother-of-Millions]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calocephalus citreus [Lemon Beauty Heads]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calotis lappulacea [Yellow Burr-daisy]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Carthamus lanatus** [Saffron Thistle]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Centaurium erythrea** [Centaury]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Cestrum parqui** [Green Cestrum]	-	P	-	-	-	-	-	-	-	-	-	-	-	-
Cheilanthes sieberi ssp. *sieberi* [Rock Fern]	-	-	-	-	-	P	-	-	-	P	P	P	-	-
Chenopodium sp. [Goosefoot]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Chloris gayana** [Rhodes Grass]	P	P	P	P	P	-	P	P	-	-	P	-	-	-
Chloris ventricosa [Tall Chloris]	-	-	-	-	P	P	-	-	-	-	-	-	P	-
Chrysocephalum apiculatum {Yellow Buttons]	-	-	-	-	-	-	-	-	-	-	P	-	-	-
*Cirsium vulgare** [Spear Thistle]	-	P	P	P	-	-	-	-	-	P	-	-	-	-
*Conyza bonariensis** Flax-leaf Fleabane]	-	P	-	P	-	-	P	P	-	P	-	-	-	-
Cotula sp.	-	-	P	-	-	-	P-	-	-	-	-	-	-	-
Cymbopogon refractus [Barbed-wire Grass]	-	-	-	-	P	P	-	-	-	P	P	P	P	-
*Cynodon dactylon** [Couch Grass]	-	P	P	P	-	-	P	-	P	P	-	-	P	-
Daucus glochidiatus [Australian Carrot]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Desmodium varians [Slender Tick-trefoil]	-	-	-	-	-	P	-	-	-	-	-	P	-	-

Table 2[a] [Cont'd]
Groundcover Species Recorded at Quadrats 1 to 14 within the Study Area

SPECIES	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***	***13***	***14***
Dianella laevis [Smooth Flax-lily]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dianella revoluta [Spreading Flax-lily]	-	-	-	-	-	P	-	-	-	-	-	P	-	-
Dichanthium sericeum [Queensland Bluegrass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichelachne micrantha [Shorthair Plumegrass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichondra repens [Kidney Weed]	-	-	-	-	-	P	-	-	-	-	-	-	P	-
Digitaria brownii [Cotton Panic]	-	-	-	-	-	-	-	-	-	-	P	-	-	-
*Dittrichia graveolens** [Stinkwort]	-	-	-	-	-	-	-	-	-	-	P	-	-	-
*Echinochloa utilis** [Japanese Millet]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Echinopogon caespitosus [Tufted Hedgehog Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Einadia nutans [Climbing Saltbush]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eleocharis sp. [Spike Rush]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Enteropogon acicularis [Curly Windmill Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eragrostis brownii [Brown's Lovegrass]	-	-	-	-	-	-	-	-	-	-	P			
Eragrostis sp.[Lovegrass]	-	-	-	-	P	-	-	-	-	-	-	P	-	-
Fimbristylis sp.[Fringe-rush]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Galenia pubescens** [Galenia]	P	P	P	P	-	-	P	-	-	-	-	-	-	-
Glycine sp. [Glycine]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Gnaphalium americanum** [Cudweed]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Gomphrena celosioides** [Gomphrena Weed]	-	-	-	-	-	-	-		-	-	-	-	-	-
Goodenia heterophylla [Variable Leaved Goodenia]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Goodenia sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Hypochaeris glabra** [Smooth Catsear]	-	-	-	P	-	-	P	-	-	-	P	-	-	-
*Hypochaeris radicata** [Flatweed]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Juncus sp. [Rush]	-	-	-	-	P	-	-		-	-	-	-	-	-
*Lactuca serriola** [Prickly Lettuce]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Linum marginale [Native Flax]	-	-	-	-	-	-	-	-	-	P	-	-	-	-
*Lolium perenne** [Perennial Ryegrass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Lolium rigidum** [Annual or Wimmera Ryegrass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lomandra sp. [Matrush]	-	-	-	-	P	P	-	-	P	-	-	-	-	-
Lomandra filiformis ssp. *coriacea* [Matrush[														
Ludwigia peploides ssp. *montevidensis* [Water Primrose]	-	-	-	-	-	-	-	-	-	-	-	-	-	P
*Medicago polymorpha** [Burr Medic]	-	P	-	-	-	-	-	-	-	-	-	-	-	-
*Medicago sativa** [Lucerne]	P	P	-	P	-	-	P	-	-	-	-	-	-	-

Table 2[a] [Cont'd]
Groundcover Species Recorded at Quadrats 1 to 14 within the Study Area

SPECIES	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***	***13***	***14***
Melinis repens* [Red Natal Grass]	-	-	-	-	-	-	-	-	-	-	P	-	-	-
*Modiola caroliniana** [Red-flowered Mallow]	-	-	-	P	-	-	-	-	-	-	-	-	P	-
*Opuntia stricta** [Prickly Pear]	-	-	-	-	-	P	-	-	-	-	-	-	-	-
Ottelia ovalifolia [Swamp Lily]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oxalis sp.[Oxalis]	-	-	P	-	-	-	-	-	-	-	-	-	-	-
Panicum sp. [Panic]	-	-	-	-	-	P	-	-	-	-	P	-	-	-
Panicum laevinode [Pepper Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Panicum maximum var. *trichoglume** [Green Panic]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Paspalum dilatatum** [Paspalum]	-	-	-	-	-	-	-		-	-	-	-	-	-
*Pennisetum clandestinum** [Kikuyu Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Phytolacca octandra** [Inkweed]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Plantago lanceolata** [Ribwort]	-	-	-	-	-	P	P	-	P	-	-	-	P	-
Poa sp.?*bulbosa**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pomax umbellata [Pomax]	-	-	-	-	-	-	-	-	-	-	-	-	P	-
Rapistrum sp.*	-	-	-	-	-	-	P	-	-	-	-	-	-	-
*Romulea rosea** [Onion Grass]	-	-	-	-	-	-	-	-	-	-	-	-	P	-
*Senecio madagascariensis** [Fireweed]	P	P	P	P	P	P	P	P	-	P	-	P	P	-
Senecio quadridentatus [Cotton Fireweed]	-	-	-	-	-	-	-	-	P	-	-	-	-	-
Setaria sphacelata var. *sericea** [Setaria cultivar Narok]	-	-	P	-	P	-	P		-	-	-	-	-	-
*Sida rhombifolia** [Paddy's Lucerne]	-	-	P	P	-	-	-		-	-	-	-	P	-
Sisymbrium sp.* [Mustard Weed]	-	-	P	-	-	-	-	-	-	-	-	-	-	-
*Solanum nigrum** [Black Nightshade]	-	-	-	-	-	P	-	-	-	-	-	-	-	-
Solanum cinereum [Narrawa Burr]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Sonchus oleraceus** [Sowthistle]	-	-	P	-	-	-	P	-	-	-	-	-	-	-
Sorghum sp.* [Sorghum]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sporobolus sp.[Rat's-tail Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stackhousia sp. [Stackhousia]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Themeda australis [Kangaroo Grass]	-	-	-	-	-	P	-	-	P	-	-	-	-	-
*Trifolium campestre** [Hop Clover]	-	-	P	-	-	-	-	-	-	-	-	-	-	-
*Trifolium repens** [White Clover]	P	-	P	P	-	-	P	-	-	-	-	-	-	-
*Trifolium subterraneum** [Subterranean Clover]	P	P	-	-	-	-	-	-	-	-	-	-	-	-
Typha sp. [Cumbungi]	-	-	-	-	-	-	-	-	-	-	-	-	-	P
*Verbena bonariensis** [Wild Stattice]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Vicia villosa** [Woolly Pod Vetch]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wahlenbergia sp.[Bluebell]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xerochrysum bracteatum [Golden Everlastings]	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 2[b]
Groundcover Species Recorded at Quadrats 15 to 28 within the Study Area

SPECIES	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Agave sp.* [Aloe]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agrostis avenacea [Blown Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ajuga australis [Australian Bugle]	-	-	-	-	-	-	-	-	P	-	-	-	-	-
*Ammi majus** [Queen Anne's Lace]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anagallis arvensis [Blue Pimpernell]	-	-	-	P	-	-	P	-	-	-	-	-	-	-
Aristida sp. [Wiregrass]	-	-	P	-	-	P	-	P	P	-	P	P	P	P
Asperula sp. [Woodruff]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Austrodanthonia sp. [Wallaby Grass]	-	-	-	-	-	-	-	P	P	-	-	-	-	-
Austrodanthonia linkii var. *linkii* [Wallaby Grass]														
Austrostipa sp. [Speargrass]	-	-	-	-	-	-	-	-	P	-	-	-	-	-
Austrostipa verticillata [Slender Bamboo Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Bidens pilosa** [Cobbler's Pegs]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bothriochloa macra [Red Grass]	-	-	-	P	P	-	-	-	-	-	-	-	-	-
Brachiaria sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Brassica napus** [Canola]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brunoniella australis [Blue Trumpets]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Bryophyllum delagoense** [Mother-of-Millions]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calocephalus citreus [Lemon Beauty Heads]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calotis lappulacea [Yellow Burr-daisy]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Carthamus lanatus** [Saffron Thistle]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Centaurium erythrea** [Centaury]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Cestrum parqui** [Green Cestrum]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cheilanthes sieberi ssp. *sieberi* [Rock Fern]	-	-	-	P	-	P	-	-	P	-	-	-	-	-
Chenopodium sp. [Goosefoot].	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Chloris gayana** [Rhodes Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloris ventricosa [Tall Chloris]	-	-	-	-	-	-	-	-	-	-	P	-	-	-
Chrysocephalum apiculatum {Yellow Buttons]	-	-	-	-	-	-	-	-	P	-	-	-	-	-
*Cirsium vulgare** [Spear Thistle]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Conyza bonariensis** Flax-leaf Fleabane]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cotula sp.	-	-	-	-	-	-	-	-	-	-	P	-	-	-
Cymbopogon refractus [Barbed-wire Grass]	P	P	-	P	P	P	-	P	-	P	-	P	P	-
*Cynodon dactylon** [Couch Grass]	-	-	-	P	-	-	-	-	-	-	-	-	-	-
Daucus glochidiatus [Australian Carrot]	-	-	-	-	-	-	-	-	-	-	-	P	P	-
Desmodium varians [Slender Tick-trefoil]	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 2[b] [Cont'd]
Groundcover Species Recorded at Quadrats 15 to 28 within the Study Area

SPECIES	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Dianella laevis [Smooth Flax-lily]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dianella revoluta [Spreading Flax-lily]	P	P	-	-	-	-	P	P	P	-	-	-	-	-
Dichanthium sericeum [Queensland Bluegrass]	P	-	-	-	-	P	-	-	-	-	-	-	-	-
Dichelachne micrantha [Shorthair Plumegrass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichondra repens [Kidney Weed]	-	-	-	-	-	-	-	P	P	-	-	-	-	-
Digitaria brownii [Cotton Panic]	-	-	-	-	-	P	P	-	P	-	-	-	-	-
*Dittrichia graveolens** [Stinkwort]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Echinochloa utilis** [Japanese Millet]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Echinopogon caespitosum [Tufted Hedgehog Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Einadia nutans [Climbing Saltbush]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eleocharis sp. [Spike Rush]	-	-	-	-	-	-	-	-	-	-	-	P	-	-
Enteropogon acicularis [Curly Windmill Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eragrostis brownii [Brown's Lovegrass]	-	-	-	-	-	-	-	-	-	P	-	-	-	-
Eragrostis sp.[Lovegrass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fimbristylis sp.[Fringe-rush]	-	-	-	-	-	-	-	P	-	-	-	-	-	-
*Galenia pubescens** [Galenia]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Glycine sp. [Glycine]	-	-	-	-	-	-	-	-	P	-	-	-	-	-
*Gnaphalium americanum** [Cudweed]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Gomphrena celosioides** [Gomphrena Weed]	-	-	-	-	-	-	-		-	-	-	-	-	-
Goodenia variabilis [Variable-leaved Goodenia]	-	-	-	-	-	-	-	P	-	-	-	-	-	-
Goodenia sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Hypochaeris glabra** [Smooth Catsear]	-	-	P	P	-	-	-	-	-	-	-	-	-	-
*Hypochaeris radicata** [Flatweed]														
Juncus sp. [Rush]	-	-	-	-	-	-	-		-	-	-	P	P	-
*Lactuca serriola** [Prickly Lettuce]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Linum marginale [Native Flax]	-	-	P	P	-	-	-	P	-	-	-	-	-	-
*Lolium perenne** [Perennial Ryegrass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Lolium rigidum** [Annual or Wimmera Ryegrass]	-	-	-	-	-	-		-	-		-	-	-	-
Lomandra sp. [Matrush]	-	-	P	-	P	-	-	P	P	-	P	-	-	-
Lomandra filiformis ssp. coriacea [Matrush]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ludwigia peploides ssp. montevidensis [Water Primrose]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Medicago polymorpha** [Burr Medic]	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 2[b] [Cont'd]
Groundcover Species Recorded at Quadrats 15 to 28 within the Study Area

SPECIES	15	16	17	18	19	20	21	22	23	24	25	26	27	28
*Medicago sativa** [Lucerne]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Melinis repens** [Red Natal Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Modiola caroliniana** [Red-flowered Mallow]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Opuntia stricta** [Prickly Pear]	-	-	-	-	-	P	-	P	P	-	-	-	-	-
Ottelia ovalifolia [Swamp Lily]	-	-	-	-	-	-	-	-	-	-	-	P	-	-
Oxalis sp.[Oxalis]	-	P	-	-	P	-	-	-	-	-	P	-	-	-
Panicum sp. [Panic]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Panicum laevinode [Pepper Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Panicum maximum var. *trichoglume** [Green Panic]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Paspalum dilatatum** [Paspalum]	-	-	-	P	-	-	-		-	-	-	-	-	-
*Pennisetum clandestinum** [Kikuyu Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Phytolacca octandra** [Inkweed]	-	-	-	P	-	-	-	-	-	-	-	-	-	-
*Plantago lanceolata** [Ribwort]	-	-	-	P	-	-	-	-	-	-	-	-	-	-
Poa sp.? *bulbosa**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pomax umbellata [Pomax]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rapistrum sp.*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Romulea rosea** [Onion Grass]	-	-	-	P	-	-	P	-	-	-	-	P	P	-
*Senecio madagascariensis** [Fireweed]	-	-	-	P	-	P	P	P	-	-	P	P	P	P
Senecio quadridentatus [Cotton Fireweed]	-	-	-	-	-	-	P	-	-	-	-	-	-	-
Setaria sphacelata var. *sericea** [Setaria cultivar Narok]	-	-	-	-	-	-	-		-	-	-	-	-	-
*Sida rhombifolia** [Paddy's Lucerne]	-	-	-	-	-	-	-		-	-	-	-	-	-
Sisymbrium sp.* [Mustard Weed]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solanum cinereum [Narrawa Burr]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Solanum nigrum** [Black Nightshade]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Sonchus oleraceus** [Sowthistle]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sorghum sp.* [Sorghum]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sporobolus sp.[Rat's-tail Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stackhousia sp. [Stackhousia]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Themeda australis [Kangaroo Grass]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Trifolium campestre** [Hop Clover]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Trifolium repens** [White Clover]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Trifolium subterraneum** [Subterranean Clover]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Typha sp. [Cumbungi]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Verbena bonariensis** [Wild Stattice]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Vicia villosa** [Woolly Pod Vetch]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wahlenbergia sp. [Bluebell]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xerochrysum bractetum [Golden Everlastings]	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 2[c]
Groundcover Species Recorded at Quadrats 29 to 39 within the Study Area

SPECIES	***29***	***30***	***31***	***32***	***33***	***34***	***35***	***36***	***37***	***38***	***39***
Agave sp.* [Aloe]	-	-	-	-	-	-	-	-	P	-	-
Agrostis avenacea [Blown Grass]	-	P	-	-	-	-	-	-	-	-	-
Ajuga australis [Australian Bugle]	-	-	-	-	-	-	-	-	-	-	-
*Ammi majus** [Queen Anne's Lace]	P	-	-	-	-	-	-	-	-	-	-
*Anagallis arvensis** [Blue Pimpernell]	-	-	-	-	-	-	-	-	-	-	
Aristida sp. [Wiregrass]	P	P	-	-	-	P	P	P	P	P	
Asperula sp. [Woodruff]	-	-	-	-	-	-	-	-	-	-	
Austrodanthonia sp. [Wallaby Grass]	-	-	-	-	-	-	-	P	-	P	
Austrodanthonia linkii var. *linkii* [Wallaby Grass]	P	P	P	P	P	P	P	-	-	-	-
Austrostipa sp. [Speargrass]	-	-	-	P	-	-	P	-	P	-	
Austrostipa verticillata [Slender Bamboo Grass]	-	-	-	-	-	-	-	-	-	-	
*Bidens pilosa** [Cobbler's Pegs]	-	-	-	-	-	-	-	-	-	-	
Bothriochloa macra [Red Grass]	P	-	-	-	-	P	-	P	-	P	-
Brachiaria sp.	-	-	P	-	-	-	-	-	-	-	-
*Brassica napus** [Canola]	-	-	-	-	-	-	-	-	-	-	P
Brunoniella australis [Blue Trumpets]	-	-	-	-	-	-	-	-	-	-	-
*Bryophyllum delagoense** [Mother-of-Millions]	-	-	-	-	-	-	-	-	P	-	-
Calocephalus citreus [Lemon Beauty Heads]	-	P	-	P	-	P	P	P	-	P	-
Calotis lappulacea [Yellow Burr-daisy]	-	P	-	P	-	-	P	-	P	-	-
*Carthamus lanatus** [Saffron Thistle]	-	-	-	-	-	-	-	-	-	P	-
*Centaurium erythrea** [Centaury]	-	P	-	P	-	P	-	P	-	-	-
*Cestrum parqui** [Green Cestrum]	-	-	P	-	-	-	-	-	-	-	-
Cheilanthes sieberi ssp. *sieberi* [Rock Fern]	-	P	P	-	-	-	-	P	-	-	-
Chenopodium sp.	-	-	P	-	-	-	-	P	P	-	-
*Chloris gayana** [Rhodes Grass]	-	-	-	-	-	-	-	-	-	-	-
Chloris ventricosa [Tall Chloris]		-	-	-	-	-	-	P	-	-	
Chrysocephalum apiculatum {Yellow Buttons]	P	-	-	-	P	-	-	P	-	-	
*Cirsium vulgare** [Spear Thistle]	P	P	P	-	-	P	-	-	-	P	
*Conyza bonariensis** Flax-leaf Fleabane]	P	-	-	-	P	-	P	-	-	P	-
Cotula sp.	-	-	-	-	-	-	-	-	-	-	-
Cymbopogon refractus [Barbed-wire Grass]	P	P	P	P	P	P	-	P	-	P	-
*Cynodon dactylon** [Couch Grass]	-	-	-	-	-	-	-	P	-	-	-
Daucus glochidiatus [Australian Carrot]	-	-	-	-	-	-	-	-	-	-	-
Desmodium varians []Slender Tick Trefoil]	-	-	-	-	P	-	-	P	-	-	-
Dianella laevis [Smooth Flax-lily]	P	-	-	-	-	-	-	-	-	-	-
Dianella revoluta [Spreading Flax-lily]	-	P	-	P	P	-	P	-	P	-	-
Dichanthium sericeum [Queensland Bluegrass]	-	-	-	-	-	-	-	-	-	-	-

Table 2[c] [Cont'd]
Groundcover Species Recorded at Quadrats 29 to 39 within the Study Area

SPECIES	***29***	***30***	***31***	***32***	***33***	***34***	***35***	***36***	***37***	***38***	***39***
Dichelachne micrantha [Shorthair Plumegrass]	-	-	-	-	-	-	-	-	-	P	-
Dichondra repens [Kidney Weed]	-	-	-	-	-	-	-	P	-	-	
Digitaria brownii [Cotton Panic]	-	-	-	-	-	-	-	-	-	-	
*Dittrichia graveolens** [Stinkwort]	-	-	-	-	-	-	-	-	-	-	
*Echinochloa utilis** [Japanese Millet]	-	-	-	-	-	-	-	-	-	-	
Echinopogon caespitosum [Tufted Hedgehog Grass]	P	-	-	-	-	P	-	-	-	-	-
Einadia nutans [Climbing Saltbush]	-	-	-	-	-	-	P	-	-	-	-
Eleocharis sp. [Spike Rush]	-	-	-	-	-	-	-	-	-	-	-
Enteropogon acicularis [Curly Windmill Grass]	-	-	-	-	-	-	-	P	-	-	-
Eragrostis brownii [Brown's Lovegrass]	-	-	-	-	-	-	-	-	-	-	-
Eragrostis sp.[Lovegrass]	P	-	-	-	-	P	-	P	-	-	P
Fimbristylis sp.[Fringe-rush]	P	-	P	-	-	-	-	-	-	-	-
*Galenia pubescens** [Galenia]	-	-	-	-	-	-	-	P	-	P	P
Glycine sp. [Glycine]	P	P	P	-	-	-	-	-	-	-	-
*Gnaphalium americanum** [Cudweed]	-	-	P	-	-	-	-	-	-	P	-
*Gomphrena celosioides** [Gomphrena Weed]	-	-	P	-	-	-	-	-	-	-	-
Goodenia heterophylla [Variable-leaved Goodenia]	-	P	P	-	-	-	P	-	-	-	-
Goodenia sp.	-	P	-	-	-	-	-	-	-	-	-
*Hypochaeris glabra** [Smooth Cat'sear]						-	-	-	-	-	-
*Hypochaeris radicata** [Flatweed]	P	P	-	P	-	-	P	-	-	-	
Juncus sp. [Rush]	-	-	P	-	-	-	-	-	P	-	-
*Lactuca serriola** [Prickly Lettuce]	-	-	-	-	-	-	-	-	-	-	-
Linum marginale [Native Flax]	-	-	-	-	-	-	-	-	-	-	-
*Lolium perenne** [Perennial Ryegrass]	-	-	-	-	-	-	-	-	-	-	P
*Lolium rigidum** [Annual or Wimmera Ryegrass]	-	-	-	-	-	-	-	-	-	-	P
Lomandra sp. [Matrush]	-	-	-	-	-	-	-	P	-	-	-
Lomandra filiformis ssp. *coriacea* [Matrush]	-	-	P	-	-	P	P	-	-	-	-
Ludwigia peploides ssp. *montevidensis* [Water Primrose]	-	-	-	-	-	-	-	-	-	-	-
*Medicago polymorpha** [Burr Medic]	-	-	-	-	-	-	-	-	-	-	-
*Medicago sativa** [Lucerne]	-	-	-	-	-	-	-	-	-	-	-
*Melinis repens** [Red Natal Grass]	-	-	-	-	-	-	-	-	-	-	-
*Modiola caroliniana** [Red-flowered Mallow]	-	-	-	-	-	-	-	-	-	-	-
*Opuntia stricta** [Prickly Pear]	P	P	-	-	-	P	P	P	P	P	-
Ottelia ovalifolia [Swamp Lily]	-	-	-	-	-	-	-	-	-	-	-
Oxalis sp.[Oxalis]	-	-	-	-	-	-	-	-	-	-	-
Panicum sp. [Panic]	-	-	-	-	-	-	-	-	-	P	-
Panicum laevinode [Pepper Grass]	-	P	-	-	-	P	-	-	-	-	-

Table 2[c] [Cont'd]
Groundcover Species Recorded at Quadrats 29 to 39 within the Study Area

SPECIES	***29***	***30***	***31***	***32***	***33***	***34***	***35***	***36***	***37***	***38***	***39***
*Panicum maximum var. trichoglume** [Green Panic]	-	-	-	-	-	-	-	-	-	-	P
*Paspalum dilatatum** [Paspalum]	-	-	P	-	-	-	-	-	-	-	-
*Pennisetum clandestinum** [Kikuyu Grass]	-	-	-	-	-	-	-	-	-	-	P
*Phytolacca octandra** [Inkweed]	-	-	-	-	-	-	-	P	-	-	-
*Plantago lanceolata** [Ribwort]	P	-	P	P	-	P	-	P	-	P	-
Poa sp.? *bulbosa**	P	-	-	-	-	-	-	-	-	-	-
Pomax umbellata [Pomax]	P	P	P	P	-	-	-	-	-	-	-
Rapistrum sp.*	-	-	-	-	-	-	-	-	-	-	-
*Romulea rosea** [Onion Grass]	-	-	-	-	-	-	-	-	-	-	-
*Senecio madagascariensis** [Fireweed]	-	-	-	-	-	P	P	-	-	-	-
Senecio quadridentatus [Cotton Fireweed]	-	-	-	P	-	P	-	-	-	-	-
*Setaria sphacelata var. sericea** [Setaria cultivar Narok]	-	-	-	-	-	-	-	P	-	-	P
*Sida rhombifolia** [Paddy's Lucerne]	-	P	P	P	-	-	P	P	P	-	-
Sisymbrium sp.* [Mustard Weed]	-	-	-	-	-	-	-	-	-	-	P
Solanum cinereum [Narrawa Burr]	-	-	P	P	-	-	-	-	-	-	-
*Solanum nigrum** [Black Nightshade]	-	-	-	-	-	-	-	-	-	-	-
*Sonchus oleraceus** [Sowthistle]	-	-	P	-	-	-	-	-	-	-	-
Sorghum sp.* [Sorghum]	-	-	-	-	-	-	-	-	-	-	P
Sporobolus sp.[Rat's-tail Grass]	-	P	-	-	-	P	-	-	-	-	-
Stackhousia sp. [Stackhousia]	P	-	-	-	-	-	-	-	-	-	-
Themeda australis [Kangaroo Grass]	-	P	-	-	P	-	P	-	-	-	-
*Trifolium campestre** [Hop Clover	-	-	-	-	-	-	-	-	-		-
*Trifolium repens** [White Clover]	-	-	-	-	-	-	-	-	-	-	-
*Trifolium subterraneum** [Subterranean Clover]	-	-	-	-	-	-	-	-	-	-	-
Typha sp. [Cumbungi]	-	-	-	-	-	-	-	-	-	-	-
*Verbena bonariensis** [Wild Stattice]	-	-	-	-	-	-	-	-	-	-	-
*Vicia villosa** [Woolly Pod Vetch]	-	-	-	-	-	-	-	-	-	-	P
Wahlenbergia sp. [Bluebell]	-	-	-	-	P	-	-	-	-	-	-
Xerochrysum bracteatum [Golden Everlastings]	P	P	-	P	P	-	P	-	-	-	-

6 NOXIOUS WEED CONSIDERATIONS

Five species recorded within the Study Area are listed as Noxious Weeds for Singleton Shire [Upper Hunter County Council area] on the NSW Department of Primary Industries [Agriculture] website. [*date of search 10th March, 2006*]. These species are:

- African Boxthorn* [*Lycium ferocissimum*] **Class 4**;
- Green Cestrum* [*Cestrum parqui*] **Class 3**;
- Mother-of-Millions* [*Bryophyllum delagoense*] **Class 3**;

- Onion Grass* [*Romulea rosea*] **Class 5**; and
- Prickly Pear* [*Opuntia stricta*] **Class 4**.

The Class codes shown after each species show the weed category in terms of the *Noxious Weeds Act 1993* classifications as indicated below.

- **Class 3:** The weed poses a serious threat to primary production or the environment of an area, is not widely distributed in the area and is likely to spread within the area or to another area.
- **Class 4:** The weed poses a threat to primary production, the environment or human health, are widely distributed in an area and are likely to spread in the area or into other areas.
- **Class 5:** The weed must not be sold as plants or seeds or moved within NSW – *hence movement of topsoil from the Study Area would be prohibited because of this classification.*

The **Class 3** and **4** weeds will require continuous monitoring of infestations and control, with appropriate herbicides, of any plants that appear. With regard to the Class 5 weed [Onion Grass] the main requirement is to not allow plants or seeds [or bulbs] to be removed from the site in topsoil as it is difficult to observe and identify in most seasons.

7 KOALA HABITAT CONSIDERATIONS

Circular B35 issued to Councils by the former Department of Urban Affairs and Planning provides information on State Environmental Planning Policy No 44 - Koala Habitat Protection [SEPP 44].

The Study Area is situated within Singleton Shire. Schedule 1 of the SEPP lists the Singleton Shire as a local government area to which the Policy applies.

SEPP 44 requires the identification of any “potential Koala habitat” within the Study Area.

However in Section 1.5 of the ‘Explanation of the Policy’ it is noted that... “In relation to affected DAs it is the intention of the policy that investigations for ‘potential’ and ‘core’ Koala habitats be limited to those areas in which it is proposed to disturb habitat”.

Potential Koala habitat is an area ”…..of native vegetation where trees of the types listed in Schedule 2 [of SEPP 44] constitute at least 15% of the total number of trees in the upper and lower components of the tree component.”

One of the species listed in Schedule 2 of SEPP 44 is found within the Study Area. This is *Eucalyptus tereticornis* [Forest Red Gum].

Trees of Forest Red Gum occur as scattered individuals and in some clumps. The proportion of these species in relation to the total number of trees present within the Study Area is unknown but may approach the 15% that defines 'potential Koala habitat' as described in SEPP 44.

As a consequence, the area should be thoroughly examined during the fauna study for signs of Koala occupation.

8 THREATENED SPECIES ISSUES

Prior to the field surveys, and prior to preparation of the final flora assessment report, requests were made to the NSW Department of Environment and Conservation's 'Atlas of NSW Wildlife' database for details of occurrences of any Threatened Species of plants listed in Schedules 1 and 2 of the *Threatened Species Conservation Act, 1995* [TSC Act].

8.1 The 'Atlas of NSW Wildlife' Database

The database was searched for records from the Camberwell 1: 100 000 scale map sheet area [*dates of search 26th May, 2005, 10th March, 2006,*]. The latter search was to ascertain if there had been any additional species recorded in the database since the original search. A subsequent search on 7th November 2006 [to confirm if there were any additional records of threatened flora species, populations, endangered ecological communities or critical habitat for the Study Area] revealed that there were no additional records for the Study Area or its immediate environs.

The database contains no records of Threatened Flora Species from the Study Area but 39 records of seven species from the map sheet area as a whole. These species were:

- *Diuris venosa;*
- *Eucalyptus glaucina;*
- *Euphrasia ciliolata;*
- *Marsdenia longiloba;*
- *Pterostylis elegans;*
- *Tasmannia glaucifolia;* and
- *Tasmannia purpurascens.*

A further search of the Department of Environment and Conservation [National Parks and Wildlife Service] website indicated that there are records of collections of fourteen threatened flora species from within Singleton Shire. These species are:

- *Apatophyllum constablei;*
- *Boronia ruppii;*
- *Cynanchum elegans;*

- *Darwinia biflora;*
- *Darwinia peduncularis;*
- *Dillwynia tenuifolia;*
- *Eucalyptus fracta;*
- *Eucalyptus glaucina;*
- *Grevillea evansiana;*
- *Melaleuca groveana;*
- *Olearia cordata;*
- *Persoonia hirsuta;*
- *Pterostylis gibbosa;* and
- *Zieria adenodonta.*

These species are discussed in **Table 3** and **Section 8.6**.

Table 3
Assessment of the Likelihood of Occurrence of Threatened Flora Species

Page 1 of 4

SPECIES	ASSESSMENT
Apatophyllum constablei	A diffuse, many branched shrub, to 40cm high, glabrous [Harden 1992]; recorded from sites in Wollemi National Park and near Glen Davis; grows on sandy skeletal soils in dry sclerophyll forest on slopes with a northwesterly aspect near cliffs [TS Website]; preferred habitat not present in the Study Area; an unlikely occurrence at the Study Area; no records from the Study Area; not recorded during field investigations at the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Boronia ruppii	Harden [2002] notes that this is a shrub 40cm to 2m high; grows in eucalypt woodland and is confined to the Woodsreef area growing on serpentine; also recorded from Yengo National Park near Howes Valley southwest of Singleton [TS Website]; an unlikely, occurrence at the Study Area; no records from the Study Area; not recorded during field investigations at the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Cryptostylis hunteriana	A saprophytic orchid, leafless, lives on decaying organic matter; collected in the past from the Ku-ring-gai area and from near Campbelltown, on sandstone [Robinson, 1991]; grows in swamp heath on sandy soils, chiefly in coastal districts, south from the Gibraltar Range [Harden, 1993]; a possible, though unlikely, occurrence at the Study Area; no records from the Study Area; not recorded during field investigations at the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Cynanchum elegans	Climber or twiner with stems to about 1m long; recorded from rainforest gullies, scrub and scree slopes; from the Gloucester district to the Wollongong area and inland to Mount Dangar [Harden, 1992; recorded from the Upper Hunter Valley as far west as Merriwa [TS Website]; a possible, though unlikely, occurrence at the Study Area; no records from the Study Area; not recorded during field investigations at the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.

Table 3 [Cont'd]
Assessment of the Likelihood of Occurrence of Threatened Flora Species

SPECIES	ASSESSMENT
Darwinia biflora	Erect or spreading shrub to 80cm high; grows in heath on sandstone or in the understorey of woodland, open forest or scrub-heath, on shale capped ridges, Recorded from Cheltenham to the Hawkesbury River [Harden, 2002]; Robinson [1997] also notes that it is found in sedgeland and low scrubland with a preference for moist, shallow depressions; recorded from south of Bulga [TS Website]; an unlikely, occurrence at the Study Area; no records from the Study Area; recorded ; not recorded during field investigations at the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Darwinia peduncularis	Shrub to 1.5m high; grows in dry sclerophyll forest on sandstone hillsides and ridges; occurs from Hornsby to the Hawkesbury River and west to Glen Davis [Harden, 2002]; recorded from Wollemi National Park [TS Website] a possible, though unlikely, occurrence at the Study Area; no records from the Study Area; not recorded during field investigations at the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Dillwynia tenuifolia	Erect shrub, 60cm to 1m high; grows in dry sclerophyll woodland and scrubby dry heath on sandstone, shale or laterite; from Cumberland Plain, Blue Mountains to Howes Valley / Bulga area [Harden, 2002, TS Website]; a possible, though unlikely, occurrence at the Study Area; no records from the Study Area; not recorded during field investigations at the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Diuris tricolor [sheaffiana]	This species was listed on the Schedules of the Threatened Species Conservation Act as *Diuris sheaffiana* but further taxonomic research indicates that the original species is really *Diuris tricolor* – a widespread orchid that occurs throughout the western slopes from Narrandera north; recorded from Muswellbrook [TS Website]. Its preferred habitat is sandy soils in *Callitris* communities. [Bishop, 1996]; suitable habitat not present at the Study Area; not recorded during field inspection; no records from the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Diuris venosa	Ground orchid that is widespread in sub-alpine areas of the Barrington Tops; grows in moist tussock grassland or in open shrubland on the margins of sub-alpine swamps [TS Website]; habitat not present in Study Area; not recorded during field inspection; no records from the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Eucalyptus fracta	A tree or mallee to 8m high; locally frequent but restricted to shallow soils along the upper escarpment of a steep sandstone gorge; known only from the northern Broken Back Range, near Cessnock [Harden, 2002]; an unlikely, occurrence at the Study Area; no records from the Study Area; not recorded during field investigations at the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Eucalyptus glaucina	Tree to 30m, bark smooth, white or grey, shedding in large plates, or flakes; locally frequent but very sporadic; in grassy woodland on deep, moderately fertile and well-watered soil; near Casino and from Taree to Broke [Harden, 2002]; a possible occurrence at the Study Area; no records from the Study Area; one record from Ravensworth State Forest [7km northwest] and a second from 10km southeast of the Study Area; not recorded during field investigations at the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.

Table 3 [Cont'd]
Assessment of the Likelihood of Occurrence of Threatened Flora Species

SPECIES	ASSESSMENT
Euphrasia ciliolata	Upright much-branched herb to 45cm; recorded from the margins of alpine and sub-alpine swamps and on a range of meadows and grasslands that are moist or seasonally inundated; major occurrences on the Barrington Tops [TS Website]; habitat not present in Study Area; not recorded during field inspection; no records from the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Grevillea evansiana	Spreading shrub to about 50cm high; grows in dry sclerophyll forest or woodland, occasionally in swampy heath, in sandy soils, usually on Hawkesbury sandstone; known only from an area east of Rylstone in Wollemi National Park; also in the Colo River catchment [Harden, 2002, TS Website]; an unlikely, occurrence at the Study Area; no records from the Study Area; not recorded during field investigations at the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Marsdenia longiloba	Slender climber; recorded from subtropical and warm temperate rainforest, lowland mist eucalypt forest adjoining rainforest and sometimes rocky areas; occurs on the Barrington Tops [TS Website]; habitat not present in Study Area; not recorded during field inspection; no records from the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Melaleuca groveana	Shrub or small tree 2-5m high, rarely to 10m; grows in heath and shrubland often in exposed site on rocky outcrops and cliffs; rare; restricted to higher areas; coastal districts north from Yengo National Park and west to Werrikimbe National Park [Harden, 2002, TS Website]; an unlikely, occurrence at the Study Area; no records from the Study Area; not recorded during field investigations at the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Olearia cordata	Shrub to 2m high; grows in dry sclerophyll forest and open shrubland, on sandstone; chiefly from Wisemans Ferry to Wollombi [Harden, 1992]; recorded in Wollemi and Yengo National Parks [TS Website]; a possible, occurrence at the Study Area; no records from the Study Area; not recorded during field investigations at the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Persoonia hirsuta	Spreading to decumbent shrub; occurs in woodlands and dry sclerophyll forest on sandstone or very rarely on shale; known from a number of locations from the Royal National Park to Gosford on the coast and Hill Top to Glen Davis and Putty inland, with records from Blue Mountains, Wollemi, Dharug, Ku-ring-gai Chase, Marrramarra, Royal and Sydney Harbour National Parks; most locations consist of 1 to 3 plants with the exception of two currently known locations with between 10 and 20 plants [Scientific Committee, 1998]; there are two subspecies [□*irsute* and *evoluta*]; both subspecies occur as isolated individuals or very small populations; the subspecies intergrade extensively from the lower Blue Mountains to within 15 km of the coast; ssp. □irsute – occurs from Gosford to Royal National Park; ssp. evoluta found from Putty district to Glen Davis and Hill Top [Harden, 2002]; recorded from the southern extremity of Yengo National Park [TS Website]; a possible, occurrence at the Study Area; no records from the Study Area; not recorded during field investigations at the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.

Table 3 [Cont'd]
Assessment of the Likelihood of Occurrence of Threatened Flora Species

SPECIES	ASSESSMENT
Pterostylis elegans	Ground orchid that grows among grass and shrubs in tall open eucalypt forest; rare; recorded from the Barrington Tops [TS Website]; an unlikely occurrence at the Study Area; no records from the Study Area; not recorded during field investigations at the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Pterostylis gibbosa	Ground orchid that grows among grass in tall open sclerophyll forest or woodland often with poor drainage; rare; occurs chiefly in the southern part of the Central Coast botanical subdivision with a disjunct population in the Hunter Valley [Harden, 2003, TS Website]; occurs sometimes with paperbarks [Bishop, 1996]; a possible, occurrence at the Study Area; no records from the Study Area; not recorded during field investigations at the Study Area; IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Thesium australe	Erect [perennial herb to 40cm high; grows in grassland or woodland, often in damp sites [Harden, 1992] with Themeda australis [TS Website]; not recorded during field inspection; no records of its presence at the Study Area in the past**;** IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Tasmannia glaucifolia	Bushy shrub to 3m high; usually grows in or near Antarctic Beech rainforest along streams in mountain areas between 1200 and 1500m altitude; also in tall scrub on seepage lines in tall eucalypt forestland in grassy woodlands {TS Website]; recorded from the Barrington Tops; habitat not present at Study Area; not recorded during field inspection; no records of its presence at the Study Area in the past**;** IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Tasmannia purpurascens	Medium to tall shrub; grows in tall moist eucalypt forest, sub-alpine woodland and cool temperate rainforest; recorded from the Barrington Tops; habitat not present at Study Area; not recorded during field inspection; no records of its presence at the Study Area in the past**;** IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT ON THE PROJECT SITE.
Zieria adenodonta	Dense bushy shrub to 3m high and 2m diameter; grows in shrubby vegetation on steep rocky slopes with tes=trees, bottlebrushes and grass-trees; recorded from the top of Mount Warning in the Tweed area, also from southern part of Wollemi National Park [TS Website]; habitat not present at Study Area; not recorded during field inspection; no records of its presence at the Study Area in the past**;** IT IS CONCLUDED THAT THIS SPECIES IS NOT PRESENT AT THE SITE.

8.2 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 [EPBC Act] Online Database Threatened Species Listing

A number of searches of the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* [EPBC Act] Online Database revealed that four plant species listed as threatened flora species under this Act were likely to occur in the 10 km radius of the centre of the Study Area [*date of latest searches 8th November, 2006, 13th March, 2006; previous search 26th May, 2005*].

These species are:

- *Cryptostylis hunteriana;*
- *Diuris sheaffiana;*
- *Eucalyptus glaucina;* and
- *Thesium australe.*

These species are discussed in **Table 3** and **Section 8.6**.

8.3 Endangered Ecological Communities

A search of the Atlas of NSW Wildlife dated 8th November, 2006 [previous searches 13th March, 2006, 26th May, 2005] revealed that a number of Endangered Ecological Communities are predicted to occur within the boundaries of the Camberwell 1: 100 000 Sheet area.

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* [EPBC Act] Schedule of Threatened Ecological Communities also lists the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland [formerly *Grassy White Box Woodlands*] as likely to occur in the region. This community has the status of 'endangered' under the EPBC Act. This community is equivalent to the White Box-Yellow Box-Blakely's Red Gum Woodland Endangered Ecological Community that is listed in the Schedules of the NSW Threatened Species Conservation Act.

The status of each community predicted to occur within the general region of the Study Area is addressed in **Table 4**.

Table 4
Endangered Ecological Communities Likely to be Present within the Boundaries of the Camberwell 1: 100 000 Sheet Area

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ENDANGERED ECOLOGICAL COMMUNITY	ASSESSMENT
NSW TSC Act	
Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion	Not present in the Study Area
Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion	Not present in the Study Area
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps	Not present in the Study Area
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and Southeast Corner bioregions	Not present in the Study Area
Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions	Not present in the Study Area
Warkworth Sands Woodland in the Sydney Basin Bioregion	Not present in the Study Area
Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions	Not present in the Study Area

Table 4 [Cont'd]
Endangered Ecological Communities Likely to be Present within the Boundaries of the Camberwell 1: 100 000 Sheet Area

ENDANGERED ECOLOGICAL COMMUNITY	ASSESSMENT
NSW TSC Act [Cont'd]	
Milton Ulladulla Subtropical Rainforest in the Sydney Basin Bioregion	Not present in the Study Area
Lowland Rainforest on Floodplain in the NSW North Coast Bioregion	Not present in the Study Area
Quorrobolong Scribbly Gum Woodland in the Sydney Basin Bioregion	Not present in the Study Area
Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion	Not present in the Study Area
Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion	Not present in the Study Area
Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion	Not present in the Study Area
Kurri Sand Swamp Woodland in the Sydney Basin Bioregion	Not present in the Study Area
Mount Gibraltar Forest in the Sydney Basin Bioregion	Not present in the Study Area
Robertson Basalt Tall Open-forest in the Sydney Basin Bioregion	Not present in the Study Area
Robertson Rainforest in the Sydney Basin Bioregion	Not present in the Study Area
Southern Highlands Shale Woodlands in the Sydney Basin Bioregion	Not present in the Study Area
Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion	Not present in the Study Area; See discussion within text of this report. [Section 7.6.2]
Sydney Freshwater Wetlands in the Sydney Basin Bioregion	Not present in the Study Area
Shale gravel Transition Forest in the Sydney Basin Bioregion	Not present in the Study Area
Moist Shale Woodland in the Sydney Basin Bioregion	Not present in the Study Area
White Box Yellow Box Blakely's Red Gum Woodland	Not present in the Study Area
Duffys Forest Ecological Community in the Sydney Basin Bioregion	Not present in the Study Area
Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	Not present in the Study Area
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	Not present in the Study Area
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South east Corner Bioregions	Not present in the Study Area
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Not present in the Study Area
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney basin and South East Corner bioregions	Not present in the Study Area
Hunter Valley Weeping Myall Woodland of the Sydney Basin Bioregion	Not present in the Study Area
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Not present in the Study Area
Themeda grassland on seacliffs and coastal headlands in the North Coast, Sydney Basin and South East Corner Bioregions	Not present in the Study Area
Bangalay Sand Forest of the Sydney Basin and South East Corner Bioregions	Not present in the Study Area
Commonwealth EPBC Act	
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Not present in the Study Area

8.4 Endangered Flora Populations

There are two endangered flora populations likely to be present within the boundaries of the Camberwell 1: 100 000 Sheet area and consequently may be present within the Study Area [*Atlas of NSW Wildlife* search 8th November, 2006 [previous searches 13th March, 2006, 26th May, 2005]].

These are:

- *Eucalyptus camaldulensis* in the Hunter catchment; and
- *Acacia pendula* in the Hunter catchment.

These species are discussed in **Section 8.6**.

8.5 Critical Habitat

A search of the Atlas of NSW Wildlife revealed that there is no Critical Habitat present within the boundaries of the Camberwell 1: 100 000 Sheet area and consequently none present within the Study Area [*Atlas of NSW* Wildlife search 8th November, 2006 [previous searches 10th March, 2006 , 26th May, 2005].

8.6 Field Survey Data

8.6.1 Threatened Flora Species

The threatened flora species likely to occur in the general region of the Study Area [Section 7.1] were targeted during the field surveys of the Study Area.

No threatened flora species were recorded during the field surveys that were undertaken over a wide range of seasons.

8.6.2 Endangered Ecological Communities

None of the Endangered Ecological Communities listed in the Schedules of the TSC Act or under the EPBC Act, that are predicted to occur in the general region surrounding the Study Area, are present within the Study Area [**Table 4**].

The *Eucalyptus crebra* [Narrow-leaf Ironbark] - *Corymbia maculata* [Spotted Gum] – *Eucalyptus tereticornis* [Forest Red Gum] Community that is present within the Study Area is representative of the Central Hunter Ironbark – Spotted Gum – Grey Box Forest described by House [2003] and discussed in Umwelt [2003].

This community is not listed as an Endangered Ecological Community in the Schedules of the *NSW Threatened Species Conservation Act, 1995* but is closely related to the listed Lower Hunter Spotted Gum – Grey Box Forest Endangered Ecological Community.

The description of the Lower Hunter Spotted Gum – Grey Box Forest Endangered Ecological Community [House, 2003; Scientific Committee, 2005] indicates that *Corymbia maculata* [Spotted Gum] and *Eucalyptus fibrosa* [Broad-leaved Ironbark] are the dominant tree species with a wide range of other "eucalypts", including *Corymbia gummifera* [Red Bloodwood] and *Eucalyptus punctata* [Grey Gum], present. *Eucalyptus crebra* [Narrow-leaved Ironbark] is also much less prevalent in this endangered ecological community. The shrub species, *Melaleuca nodosa*, is also a key presence in this endangered community.

On the other hand, in the Central Hunter Ironbark – Spotted Gum – Grey Box Forest Community, Broad-leaved Ironbark is less common; Narrow-leaved Ironbark is very common; Grey Gum and Red Bloodwood [among other "eucalypts"], as well as *Melaleuca nodosa*, are absent; *Eucalyptus blakelyi* [Blakely's Red Gum] is present; and *Eucalyptus tereticornis* [Forest Red Gum] is much more common than in the endangered ecological community.

For these reasons the community present within the Study Area is not regarded as being representative of the Lower Hunter Spotted Gum – Grey Box Forest endangered ecological community.

8.6.3 Endangered Flora Populations

Neither of the endangered flora populations predicted to occur within the general region of the Study Area [**Section 7.4**] are present within the Study Area.

8.6.4 Critical Habitat

There are no areas of Critical Habitat listed for the Study Area or its environs.

8.6.5 Introduced Plant Species

Of a total of 126 plant species recorded within the Study Area, forty four [44] are introduced. The percentage of introduced plants is 35% of the total species number.

Of the 102 ground cover [pasture] species recorded within the Study Area, some 43 [or 42%] are introduced.

The proportion of the cover provided by introduced species on most sections of the site is quite significant. This situation would further exacerbated in the cooler months when the introduced annuals are more prevalent. This relatively high proportion of introduced species reflects the past grazing and mining use of the land and its environs.

8.7 Seven Part Test

The likelihood of the occurrence of threatened flora species, Endangered Ecological Communities, Endangered Flora Populations and Critical Habitat within the Study Area has been assessed in previous subsections of **Section 7** as well as in **Tables 3** and **4**. These assessments have been supplemented with the results of field observations.

The Study Area has been highly modified from its original condition and habitat values as a consequence of previous agricultural use including clearing and thinning of the tree cover for grazing

Many sections of the Study Area have been invaded by introduced groundcovers and weed species are prevalent.

There is no suitable habitat present on the Project Site for many of the threatened flora species likely / predicted to occur there.

Field observations recorded no threatened flora species [TSC Act, EPBC Act], threatened flora populations or endangered ecological communities within the Study Area and there are no past records of any threatened flora species on the Project Site.

The outcome of the assessments and field survey observations has been the conclusion that none of the threatened flora species recorded or predicted to occur in the wider region around the Study Area occurs on the Project Site.

For the purposes of the *Environmental Planning and Assessment Act 1999* in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats each of the factors listed in [a] to [g] below, and any assessment guidelines, must be taken into account.

[a] in the case of a 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 flora species have been recorded from the Study Area in the past and none were recorded during field survey. Consequently it is concluded that there would be no adverse affect from the proposed development on the life cycle of any threatened flora species such that a viable local population of the species is likely to be 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 Flora Populations have been recorded from the Study Area in the past and none were recorded during field survey. Consequently it is concluded that there would be no adverse affect from the proposed development on the life cycle of any flora species that constitutes an endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

[c] in the case of an endangered ecological community or critically 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, or

[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 have been recorded from the Study Area in the past and none were recorded during field survey. Consequently it is concluded that there would be no adverse affect from the proposed development on the extent of any Endangered Ecological Community, **and**, no substantial or adverse modification of the composition of any Endangered Ecological Community would occur such that its local occurrence is likely to be placed at risk of extinction.

[d] in relation to the habitat of a threatened species, population or ecological community:

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

[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, and

[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.

There are no threatened flora species, Endangered Flora Populations or Endangered Ecological Communities present within the Study Area.

Consequently, it is concluded that no habitat for any threatened flora species, Endangered Flora Population or Endangered Ecological Community would be removed, modified, fragmented or isolated from any other areas of habitat by the proposed development and there would be no impact on the long-term survival of any threatened flora species, Endangered Flora Population or Endangered Ecological Community in the locality.

[e] whether the action proposed is likely to have an effect on critical habitat [either directly or indirectly].

No Critical Habitat is present within, or adjacent to, the Study Area. Consequently, it is concluded that the proposed development would not have any effect on any Critical Habitat.

[f] whether the action proposed is consistent with the objectives or actions of a species recovery plan or threat abatement plan.

There are no threatened flora species, Endangered Flora Populations or Endangered Ecological Communities present within the Study Area. Consequently, it is concluded that no actions contained in threatened species Recovery Plans or Threat Abatement Plans are specifically relevant to the proposed development.

[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.

Much of the Study Area is already cleared of native vegetation and the remnants of native vegetation communities that are present are invaded by introduced shrub and groundcover species. In the woodland vegetation on many sections of the Study Area young eucalypts and other native trees and shrubs are very common suggesting that these areas were cleared many years ago and are now regenerating.

'Clearing of Native Vegetation' is listed as a key threatening process in the schedules of the TSC Act. Similarly 'land clearance' is listed under the Commonwealth EPBC Act as a key threatening process

Obviously, the removal of native trees to enable mining to proceed in some sections of the Study Area can be classified as 'Clearing of Native Vegetation' or 'land clearance'. However, the overall impact of the clearing needs to be considered in context with the rehabilitation activity planned for the post-mining landscape and compensatory works proposed by the Proponent along Glennies Creek and in an area to the north of the Study Area. This issue is discussed in Section 9 of this report as well as in a separate report, on the proposed biodiversity offset area and its condition [Part 4b of the *Specialist Consultant Studies Compendium*].

It is my opinion that the proposed development and associated native tree / shrub plantings would result in an overall reduction in the impact of the listed key threatening processes of 'Clearing of Native Vegetation' / 'Land Clearance' and result in an enhancement of biodiversity and habitat availability within the Study Area.

8.8 Threatened Species Overview

[i] There are no records of threatened flora species contained in the ‘Atlas of NSW Wildlife’ database for the proposed Glennies Creek Open Cut Coal Mine Study Area.

[ii] No threatened flora species were recorded from proposed Glennies Creek Open Cut Coal Mine Study Area during the field surveys, despite predictions and records that indicated that a number of Threatened flora species might be likely to occur in the region surrounding the site. The likely occurrence of these species has been assessed in **Table 3**.

[iii] Much of the Study Area has been subjected to clearing / thinning of the native tree and shrub cover. The site has been heavily invaded by introduced weed species.

[iv] There are no occurrences within the Study Area of Endangered Ecological Communities or Endangered Flora Populations listed in the Schedules of the Threatened Species Conservation Act 1995 or the under Commonwealth *Environment Protection and Biodiversity Conservation Act 1995*.

[v] There is no Critical Habitat listed for the Study Area or its environs.

[vi] It is concluded that there will be no significant impact on threatened flora species, Endangered Ecological Communities, Endangered Flora Populations or Critical Habitat as a consequence of the development proposed.

[vii] No approvals would be required under the Commonwealth EPBC Act as the Project would not be a controlled action.

9 ISSUES RELATED TO VEGETATION CLEARANCE AT THE PROJECT SITE AND IMPORTANCE OF EXISTING VEGETATION

9.1 General Impact of Native Vegetation Clearance

There are a number of factors relating to vegetation clearance that need to be taken into account as a consequence of the proposed development of the Glennies Creek Open Cut Coal Mine.

These factors relate to the development of compensatory offsets to minimise the impact of clearance of native vegetation present on the Project Site.

The vegetation communities on the site can be grouped into four broad types:

- Native woodland remnants;
- Regenerating native woodlands and shrublands;
- Cleared pastureland; and
- Rehabilitated mined / overburden emplacement areas.

In all some 75.1ha of native vegetation communities are proposed to be cleared to allow mining to occur - namely approximately 68.3ha of **Community 3** *Eucalyptus crebra* [Narrow-leaf Ironbark] - *Corymbia maculata* [Spotted Gum] – *Eucalyptus tereticornis* [Forest Red Gum] Community [equivalent to Central Hunter Ironbark – Spotted Gum – Grey Box Forest].

In addition 0.7ha of Community 2 [Regenerating Native Woodlands / Shrublands] would be cleared along with 6.1ha of Tussock Grassland [Community 1].

The disturbed and rehabilitated lands [Communities 4 and 6] generally are devoid of tree and shrub cover.

As the clearing is essential to the development of the proposed mine and, as no mitigating action can be taken on the cleared land to reduce impacts, offsets would be required. An assessment of the proposed Biodiversity Offset Strategy is provided as the companion report to this report [see Part 4b of the *Specialist Consultant Studies Compendium*].

It should be noted, however, that the footprint of the out-of-pit waste rock emplacement has been reduced through both the design of the emplacement and the placement of a large quantity of waste rock in-pit.

The principles that should be considered in developing the proposal for mitigating the impacts on native vegetation at the Project Site are addressed in a number of documents that relate to New South Wales generally, and to the Hunter Region in particular [see Sections 9.2 and 9.3]

9.2 Green Offsets for Sustainable Development – Concept Paper [EPA, 2002]

The NSW Government issued the *Green Offsets for Sustainable Development Concept Paper* for public comment in April 2002 prior to its finalisation as a policy document.

The paper addresses a number of forms of biodiversity offsets that might be used to reduce environmental impacts associated with development proposals.

The paper defines a green offset as "*action taken outside a development site [but near to it] that reduces pollution or environmental impacts*." It further notes that "*A green offset scheme ensures that there is a net environmental improvement as a result of developmen*t."

The Concept Paper lists the following as the *'Principles of Offsets'*.

- *Environmental impacts must be avoided first by using all cost-effective prevention and mitigation measures.*
- *Offsets are then only used to address remaining environmental impacts.*
- *All standard regulatory requirements must still be met.*
- *Offsets must never reward ongoing poor environmental performance.*
- *Offsets will complement other government programs.*
- *Offsets must result in a net environmental improvement.*

It further notes that offsets must be:

- **Enduring** [offset the impact of the development for the period that the impact occurs];
- **Quantifiable** [impacts and benefits must be reliably estimated];
- **Targeted** [must offset the impacts on a 'like for like or better' basis];
- **Located Appropriate** [must offset the impact in the same area];
- **Supplementary** [beyond existing requirements and not already being funded under another scheme]; and
- **Enforceable** [through development consent condition, licence conditions, covenants or a contract].

While the concepts espoused in the paper have not been finalised, the above principles should be taken into account when considering the overall means of reducing the environmental impact of development of the proposed Glennies Creek Open Cut Coal Mine.

The Concept Paper targets actions for offsetting the impacts of native vegetation clearing and lists the following as suggested ways to offset the impacts of development.

- Fencing off an area of bushland to exclude sheep for most of the year.
- Encouraging bushland to regenerate by controlling weeds.
- Planting or regenerating locally indigenous trees, shrubs and grasses to link up isolated patches of bush.
- Planting trees on previously cleared land.
- Entering into a conservation agreement, property agreement or covenant to protect vegetation.
- Including areas of vegetation in the conservation reserve system.

The stated aim of the native vegetation offsets policy when it is developed will be "..*to provide farmers and others wishing to clear native vegetation with greater flexibility in how they account for the environmental impacts of clearing, while producing real gains for the environment*."

While the offsets policy has not been finalised, the offset principle is well embedded in the requirements for development consent imposed by NSW Government agencies.

9.3 Compliance with the NSW Government's Guidelines for Biodiversity Certification of Environmental Planning Instruments

In April, 2007 the Department of Environment and Climate Change [DECC] issued a publication titled '*Guidelines for Biodiversity Certification of Environmental Planning Instruments'*.

Appendix II of this DECC document lists thirteen principles that are used to assess the level of achievement of conservation outcomes in situations where a loss of biodiversity is expected.

These principles are as follows.

1. Impacts must be avoided first by using prevention and mitigation measures;
2. All regulatory requirements must be met;
3. Offsets must never reward ongoing poor performance;
4. Offsets will complement other government programs;
5. Offsets must be underpinned by sound ecological principles;
6. Offsets should aim to result in a net improvement in biodiversity over time;
7. Offsets must be enduring – they must offset the impact of the development for the period that the impact occurs;
8. Offsets should be agreed prior to the impact occurring;
9. Offsets must be quantifiable – the impacts and benefits must be reliably estimated;
10. Offsets must be targeted;
11. Offsets must be located appropriately;
12. Offset must be supplementary; and
13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

The application of Principles 5, 6, 7, 9, 10 and 11 is discussed in **Part 4b** of the *Specialist Consultant Studies Compendium*. The remaining conditions are addressed in the *Environmental Assessment* itself.

9.4 Compliance with the Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of NSW [Andrews. Neil [1999]

The Synoptic Plan for the Hunter Valley does not discuss the role of the lands within the Study Area in detail. The Plan in its Figure 38 , however, shows the Glennies Creek lands, in total, [at date 2020] comprising a critical series of local habitat corridors linking the rehabilitated pasture lands on Camberwell lease with the remnant and rehabilitated areas on the Mount Owen, Glendell and Ravensworth leases.

As a consequence it would be essential to ensure that the post mining landscape is rehabilitated to form a native woodland community that provides the linkage and habitat values envisaged in the Synoptic Plan's 2020 scenario.

The availability of the remnant native vegetation that will remain untouched by mining combined with the proposed rehabilitation measures and the lands to be set aside in the Biodiversity Offset proposal discussed elsewhere would ensure that by 2020 there is an adequate amount of native vegetation available to form the corridors envisaged in the Synoptic Plan.

9.5 Cumulative impact of Native Vegetation Clearing

It should be noted that it difficult to find any compatible published information on the extent of native vegetation community clearing in the Hunter Valley region that would allow a meaningful assessment of the cumulative impact of the clearing associated with the proposed Glennies Creek Open Cut Coal Mine.

The Proponent intends to ensure that the native vegetation woodland communities contained within the combined biodiversity offset area and the rehabilitated post mining landscape would adequately minimize the cumulative impact of the clearing associated with the proposed development.

It is not proposed that any of the rehabilitated post mining landscape would be designated as pasture land as the need to re-establish native woodland communities on the post mining landscape is of greater importance and would fit well with the Synoptic Plan.

Areas being rehabilitated would be fenced to exclude domestic stock and feral animals would be controlled.

9.6 Use of Cleared Woody Vegetation in Rehabilitation

The cleared woody vegetation [including upper branches] from the area to be mined would be initially removed and stockpiled outside the area of the proposed pit and then relocated to the surface of rehabilitated sections of the post mining landform. Later in the rehabilitation process it may be possible to directly relocate cleared material to a rehabilitated area.

Understorey shrubs would be removed with the topsoil material and stockpiled in preparation for respreading.

9.7 Conservation Value of Species Recorded at the Study Area

The *Hunter Bushland Resource Kit* [HCMT, 2003] identifies 18 flora species of the 'Forests and Woodlands of the Valley Lowlands' country in the Hunter Valley – the area as being of conservation significance. This is the landform within which the Study Area lies.

These species are listed in **Table 5** along with details of their significance and occurrence in the Study Area.

Table 5
Flora Species of the 'Forests and Woodlands of the Valley Lowlands' Country in the Hunter Valley

SPECIES	SIGNIFICANCE	PRESENCE OR ABSENCE IN STUDY AREA
Angophoa bakeri	Db	Absent
Daphnandra sp. A	Db	Absent
Diospyros australis	Db	Absent
Elaeocarpus obovatus	Db	Absent
Eucalyptus albens / moluccana intergrade	?L	Absent
Eucalyptus canaliculata	Db, L	Absent
Eucalyptus dawsonii	?L	Absent
Eucalyptus fergusonii ssp. *fergusonii*		Absent
Eucalyptus glaucina	TSc – V; ROTAP; Db	Absent
Ficus watkinsiana	Db	Absent
Melaleuca decora	Db	Absent
Acacia decora	T	Present
Grevillea Montana	ROTAP; ?L	Absent
Oxylobium pultenaea	L	Absent
Sorghum leiocladum	R	Absent
Ripogonum album	T	Absent
Asplenium australasicum	Db	Absent
Cymbidium canaliculatum	R	Absent

NOTE:

Db – Disjunct occurrence in the Valley but widespread and common in the catchment
L – endemic to the Hunter catchment
R – Rare in the Hunter catchment
ROTAP – listed as a Rare or Threatened Australian Plant [Briggs and Leigh [1996]
T – Threatened in the Hunter catchment
TSC – V – listed as vulnerable in the Schedules to the NSW Threatened Species Conservation Act 1995
? – indicates uncertain coding

Of these species, only one, *Acacia decora* occurs within the Study Area. This species is designated as being threatened in the Hunter catchment but I would question this assessment. It is proposed that this species would be included in the listing of species to be planted on the rehabilitated lands.

10 SUMMARY OF DIRECTOR-GENERAL'S REQUIREMENTS

The issues required to be addressed in this study as outlined in the Director-General's Requirements are noted in **Table 6** along with details of the section[s] of this document where they are addressed.

Table 6
Coverage of Environmental Assessment Requirements and Environmental Issues in the Flora Report

ENVIRONMENTAL REQUIREMENTS RAISED BY THE DIRECTOR-GENERAL RELATING TO FLORA [25.01.07]		
		Relevant Section[s]
Key Assessment Requirements, namely: • *Flora* - Determine impacts on critical habitats, threatened species, population, ecological communities, groundwater dependent ecosystems and native vegetation. • Include a comprehensive offset strategy as part of the mitigation measures for the project to ensure that there is no net loss of flora and fauna values in the area in the medium to long term. **References** • Draft *Guidelines for Threatened Species Assessment* [DEC]. • *Threatened Biodiversity Survey and Assessment: Guidelines for Development and Activities* [DEC]. • *Guidelines for Developments Adjoining Department of Environment and Conservation Land* [DEC]. • *NSW Wetlands Management Policy 1996* [DNR]. • *NSW Groundwater Dependent Ecosystem Policy* [DNR].		Section 8 Part 4b of the *Specialist Consultant Studies Compendium*
ENVIRONMENTAL REQUIREMENTS RAISED BY GOVERNMENT AGENCIES RELATING FLORA		
Government Agency	**Paraphrased Requirement**	**Relevant Section[s]**
Department of Primary Industries [Undated]	The proposal area contains a significant area of native vegetation. This area links to native vegetation corridors that Camberwell mine has ear-marked as its contribution to the Synoptic Plan. Revegetation methods for this area should be detailed in the EA and offsets should be considered.	Section 8.3
Department of Environment and Conservation [22/12/04]	Provide a detailed assessment of vegetation communities including: • their conservation significance at both a local and regional scale; • the habitat values of the vegetation; • the extent and impact of clearing, earthworks and other disturbances; and • the extent and nature of revegetation, rehabilitation and/or landscaping proposed.	Section 8.4, 8.6, Part 4b of the *Specialist Consultant Studies Compendium*

Table 6 [Cont'd]
Coverage of Environmental Assessment Requirements and Environmental Issues in the Flora Report

ENVIRONMENTAL REQUIREMENTS RAISED BY GOVERNMENT AGENCIES RELATING FLORA		
Government Agency	**Paraphrased Requirement**	**Relevant Section[s]**
Department of Environment and Conservation [22/12/04] [Cont'd]	The description of vegetation communities should wherever possible be correlated with known classifications, such as those used in the Lower Hunter Central Coast Regional Environmental Management Strategy [REMS] [NPWS 2000].	Section 8.6.2
	Provide a detailed assessment of threatened flora species and endangered ecological communities and their conservation significance including: • those listed as ROTAP [Rare or Threatened Australian Plants]; • listings under the Commonwealth Environment Protection and *Biodiversity Conservation Act*; • listings under the *NSW Threatened Species Conservation Act* [including preliminary listings and/or determinations]; and • regionally significant flora.	Section 8
	Provide a plan showing the distribution of any threatened or ROTAP species and vegetation communities on the subject site.	Figure 4
	Where threatened species, populations or their habitats or communities exist the effect of the development should be determined pursuant to Section 5A of the *Environmental Planning and Assessment Act 1979*.	Section 8.7
	Describe the measures proposed to mitigate and/or ameliorate the impact of the development on the plant communities, threatened and ROTAP species.	Part 4b of the *Specialist Consultant Studies Compendium*
	Conclusions drawn in surveys and assessments should be substantiated by evidence.	Sections 5, 8

11 REFERENCES

Andrews. Neil [1999] - Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of NSW. Department of Mineral Resources, St. Leonards

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EPA [2002] – Green Offsets for Sustainable Development. Concept Paper for Public Consultation Environment Protection Authority. Sydney South

GCNRC [1998a] – Flora Survey of Part of the Lands to Be Incorporated Within the Proposed Glennies Creek Coal Mine. Geoff Cunningham Natural Resource Consultants Pty Ltd, Killara

GCNRC [1998b] – Report on Possible Occurrence of Endangered Flora Species at Maitland Main Collieries Pty Ltd Proposed Mining Venture, Glennies Creek via Singleton. Geoff Cunningham Natural Resource Consultants Pty Ltd, Killara

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TS Website – *http:/www.threatened species.environment.nsw.gov.au/tsprofile*

Appendix 1

Listing of Plant Species Recorded from the Study Area

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APPENDIX 1 - Listing of Plant Species Recorded from the Study Area

NOTE: * denotes introduced species

Acacia decora [Western Golden Wattle]
Acacia falcata
Acacia paradoxa [Kangaroo Thorn]
Acacia parvipinnula [Silver-stemmed Wattle]
Acacia pravifolia [Fan Wattle]
Agrostis avenacea [Blown Grass]
Ajuga australis [Australian Bugle]
Allocasuarina luehmannii [Bull Oak]
*Ammi majus** [Queen Anne's Lace]
*Anagallis arvensis** [Blue Pimpernell]
Angophora floribunda [Rough-barked Apple]
Aristida sp. [Wiregrass]
Asperula sp. [Woodruff]
Austrodanthonia linkii var. *linkii* [Wallaby Grass]
Austrodanthonia sp. [Wallaby Grass]
Austrostipa sp. [Speargrass]
Austrostipa verticillata [Slender Bamboo Grass]
*Bidens pilosa** [Cobbler's Pegs]
Bothriochloa macra [Red Grass]
Brachiaria sp.
*Brassica napus** [Canola]
Brunoniella australis [Blue Trumpets]
Calocephalus citreus [Lemon Beauty Heads]
Calotis lappulacea [Yellow Burr-daisy]
*Carthamus lanatus** [Saffron Thistle]
Cassinia laevis [Cough Bush]
Cassinia arcuata [Chinese Shrub]
*Centaurium erythrea** [Centaury]
*Cestrum parqui** [Green Cestrum]
Cheilanthes sieberi ssp. *sieberi* [Rock Fern]
Chenopodium sp.
*Chloris gayana** [Rhodes Grass]
Chloris ventricosa [Tall Chloris]
Chrysocephalum apiculatum [Yellow Buttons]
*Cirsium vulgare** [Spear Thistle]
*Conyza bonariensis** [Flax-leaf Fleabane]
Cotula sp.
Cymbopogon refractus [Barbed-wire Grass]
*Cynodon dactylon** [Couch Grass]
Daucus glochidiatus [Australian Carrot]
Daviesia genistifolia [Broom Bitter-pea]
Daviesia ulicifolia [Gorse Bitter-pea]
Desmodium sp.
Dianella laevis [Smooth Flax-lily]
Dianella revoluta [Spreading Flax-lily]

Dichanthium sericeum [Queensland Bluegrass]
Dichondra repens [Kidney Weed]
Digitaria brownii [Cotton Panic]
*Dittrichia graveolens** [Stinkwort]
*Echinochloa utilis** [Japanese Millet]
Echinopogon caespitosum [Tufted Hedgehog Grass]
Einadia nutans [Climbing Saltbush]
Eleocharis sp. [Spike Rush]
Enteropogon acicularis [Curly Windmill Grass]
Eragrostis brownii [Brown's Lovegrass]
Eragrostis sp.[Lovegrass]
Eremophila debile [Amulla]
Eucalyptus blakelyi [Blakely's Red Gum]
Eucalyptus crebra [Narrow-leaf Ironbark]
Eucalyptus fibrosa [Broad-leaf Ironbark]
Eucalyptus maculata [Spotted Gum]
Eucalyptus moluccana [Grey Box]
Exocarpos aphyllus [Leafless Cherry]
Fimbristylis sp. [Fringe-rush]
*Galenia pubescens** [Galenia]
Glycine sp. *[Glycine]*
*Gnaphalium americanum** [Cudweed]
Gomphrena celosioides [Gomphrena Weed]*
Goodenia heterophylla [Variable-leaved Goodenia]
Goodenia sp.
Hardenbergia violacea [False Sarsaparilla]
*Hypochaeris glabra** [Smooth Catsear]
*Hypochaeris radicata** [Flatweed]
Juncus sp. [Rush]
*Lactuca serriola** [Prickly Lettuce]
Linum marginale [Native Flax]
Lissanthe strigosa [Peach Heath],
*Lolium perenne** [Perennial Ryegrass]
*Lolium rigidum** [Annual or Wimmera Ryegrass]
Lomandra filiformis ssp*. coriacea* [Matrush]
Lomandra sp. [Matrush]
Ludwigia peploides ssp*. montevidensis* [Water Primrose]
*Lycium ferocissimum** [African Boxthorn]
Maireana microphylla [Eastern Cottonbush]
*Medicago polymorpha** [Burr Medic]
*Medicago sativa** [Lucerne]
*Melinis repens** [Red Natal Grass]
*Modiola caroliniana** [Red-flowered Mallow]
Myoporum montanum [Western Boobialla]
Notelaea microcarpa [Native Olive]
*Opuntia stricta** [Prickly Pear]
Ottelia ovalifolia [Swamp Lily]
Oxalis sp.[Oxalis]
Panicum laevinode [Pepper Grass]

Panicum sp. [Panic]
*Paspalum dilatatum** [Paspalum]
*Pennisetum clandestinum** [Kikuyu Grass]
Phyllanthus hirtellus [Thyme Spurge]
*Phytolacca octandra** [Inkweed]
Pittosporum angustifolium [Butterbush]
*Plantago lanceolata** [Ribwort]
Poa sp.? *bulbosa** [Bulbous Poa]
Pomax umbellata [Pomax]
Pultenaea sp.
Rapistrum sp.*
*Romulea rosea** [Onion Grass]
*Senecio madagascariensis** [Fireweed]
Senecio quadridentatus [Cotton Fireweed]
*Setaria sphacelata var. sericea** [Setaria cultivar Narok]
*Sida rhombifolia** [Paddy's Lucerne]
Sisymbrium sp.* [Mustard Weed]
Solanum cinereum [Narrawa Burr]
*Solanum nigrum** [Black Nightshade]
*Sonchus oleraceus** [Sowthistle]
Sorghum sp.* [Sorghum]
Sporobolus sp.[Rat's-tail Grass]
Stackhousia sp. [Stackhousia]
Themeda australis [Kangaroo Grass]
*Trifolium campestre** [Hop Clover]
*Trifolium repens** [White Clover]
*Trifolium subterraneum** [Subterranean Clover]
Typha sp. [Cumbungi]
*Verbena bonariensis** [Wild Stattice]
*Vicia villosa** [Woolly Pod Vetch]
Wahlenbergia sp. [Bluebell]
Xerochrysum bracteatum [Golden Everlastings]

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