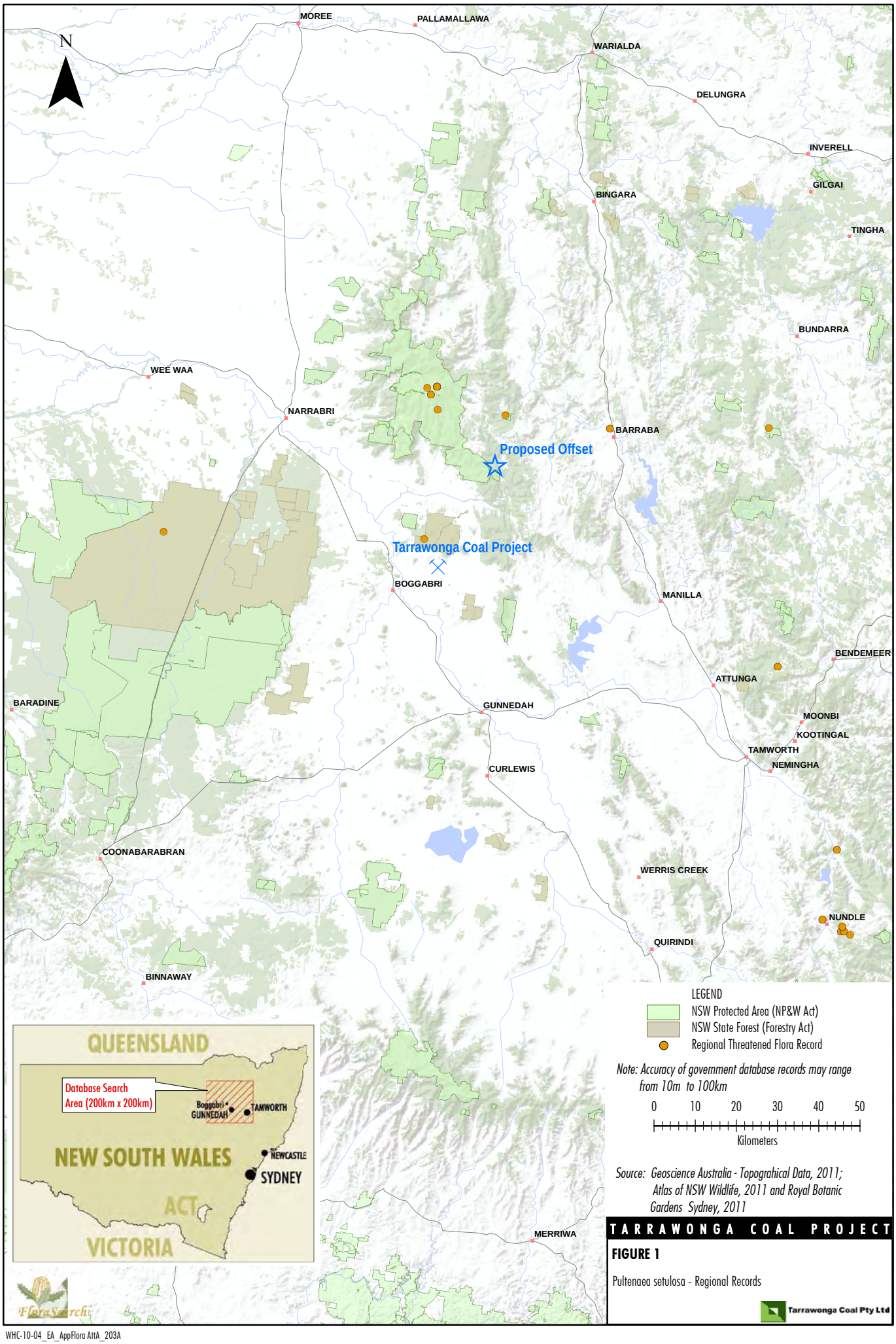
# ATTACHMENT A

# THREATENED SPECIES REGIONAL RECORDS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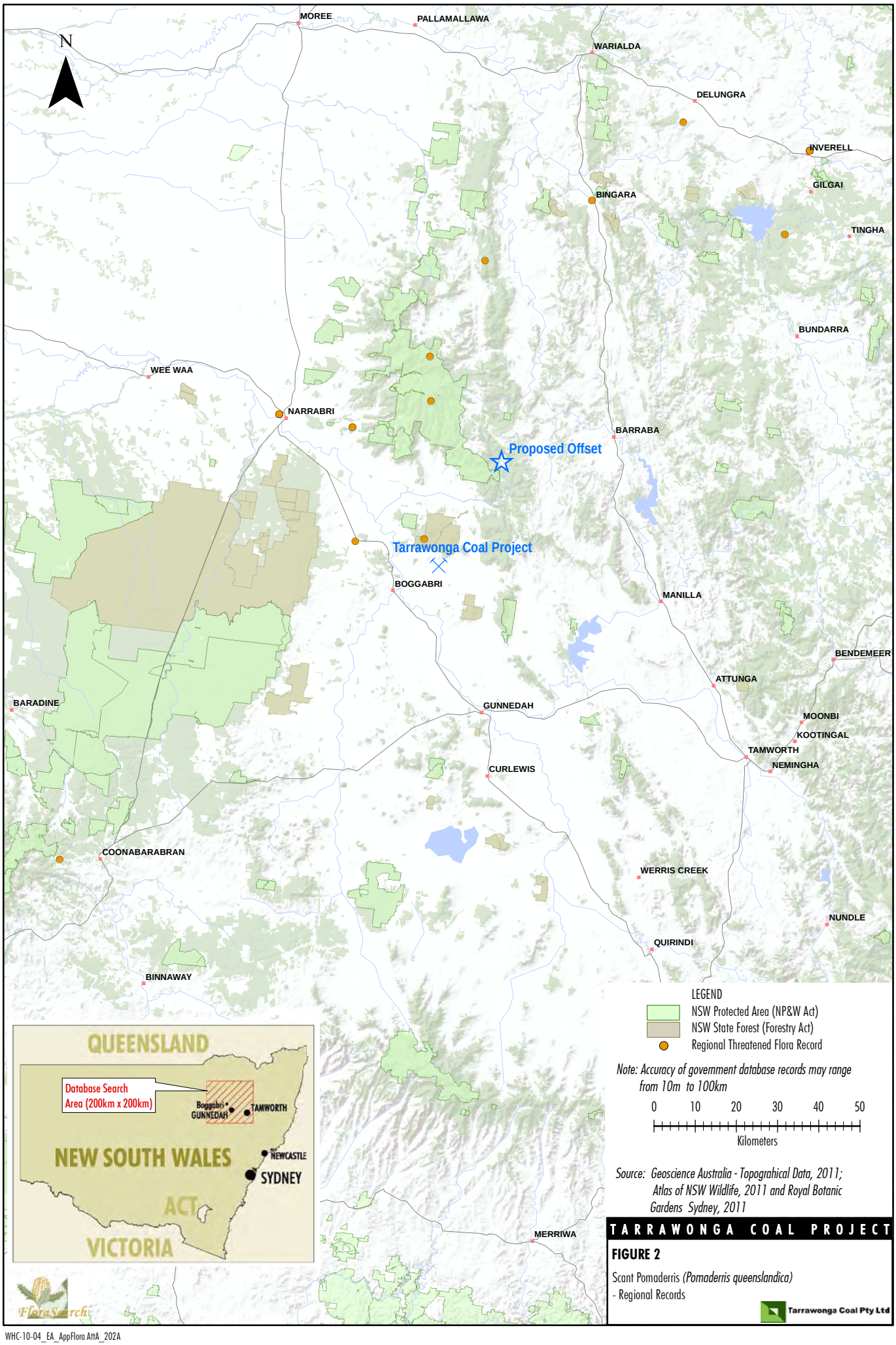
MOREE
PALLAMALLAWA
WARIALDA
DELUNGRA
INVERELL
GILGAI
BINGARA
TINGHA
BUNDARRA
WEE WAA
NARRABRI
BARRABA
Proposed Offset
Tarrawonga Coal Project
BOGGABRI
MANILLA
BENDEMEER
ATTUNGA
BARADINE
GUNNEDAH
MOONBI
KOOTINGAL
TAMWORTH
NEMINGHA
CURLEWIS
COONABARABRAN
WERRIS CREEK
NUNDLE
QUIRINDI
BINNAWAY
MERRIWA
QUEENSLAND
Database Search
Area (200km x 200km)
Boggabri
GUNNEDAH
TAMWORTH
NEWCASTLE
NEW SOUTH WALES
SYDNEY
ACT
VICTORIA
LEGEND
NSW Protected Area (NP&W Act)
NSW State Forest (Forestry Act)
Regional Threatened Flora Record
Note: Accuracy of government database records may range from 10m to 100km
0 10 20 30 40 50
Kilometers
Source: Geoscience Australia - Topographical Data, 2011; Atlas of NSW Wildlife, 2011 and Royal Botanic Gardens Sydney, 2011
TARRAWONGA COAL PROJECT
FIGURE 1
Pultenaea setulosa - Regional Records
FloraSearch
Tarrawonga Coal Pty Ltd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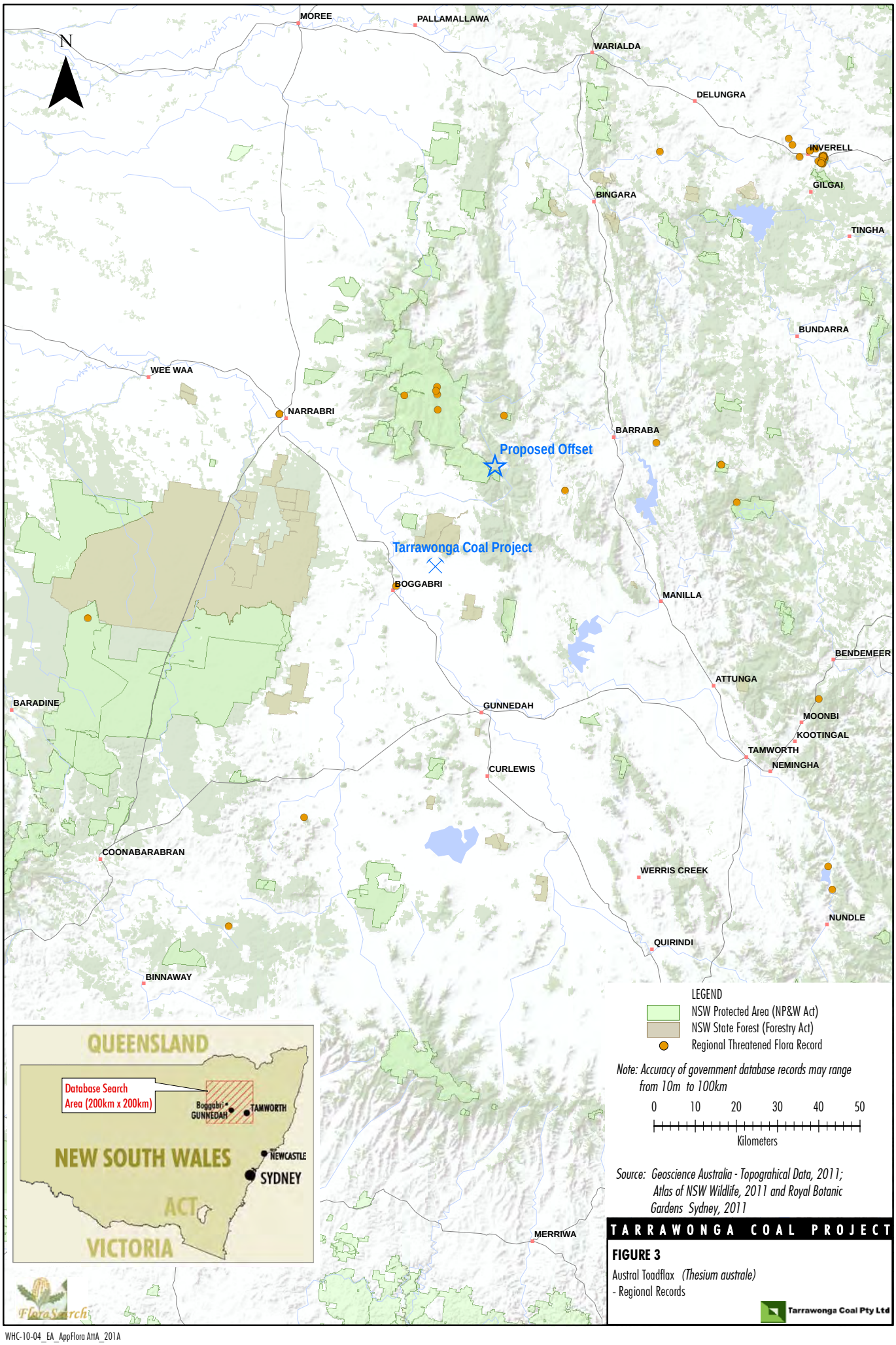
0 10 20 30 40 50
Kilometers
Source: Geoscience Australia - Topographical Data, 2011; Atlas of NSW Wildlife, 2011 and Royal Botanic Gardens Sydney, 2011
TARRAWONGA COAL PROJECT
FIGURE 2
Scant Pomaderris (Pomaderris queenslandica) - Regional Records
FloraSearch
Tarrawonga Coal Pty Ltd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Kilometers
Source: Geoscience Australia - Topographical Data, 2011; Atlas of NSW Wildlife, 2011 and Royal Botanic Gardens Sydney, 2011
TARRAWONGA COAL PROJECT
FIGURE 3
Austral Toadflax (Thesium australe)
- Regional Records
FloraSearch
Tarrawonga Coal Pty Ltd

# ATTACHMENT B

# FLORA SPECIES LIST FOR THE STUDY AREA

## Flora Species Recorded on the Study Area Listed according to the Vegetation Communities in which they Occur

| | Community | 1 | 2 | 3 | 4 | 5 | 6 | Opp |
|---|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | | | | | | | |
| **CLASS FILICOPSIDA** | | | | | | | | |
| **Adiantaceae** | | | | | | | | |
| *Cheilanthes distans* | Bristly Cloak Fern | • | • | • | | | | |
| *Cheilanthes sieberi* subsp. *sieberi* | Poison Rock Fern | • | • | • | | | | |
| **CLASS CONIFEROPSIDA** | | | | | | | | |
| **Cupressaceae** | | | | | | | | |
| *Callitris glaucophylla* | White Cypress Pine | • | • | • | • | • | • | |
| **CLASS MAGNOLIOPSIDA** | | | | | | | | |
| **SUBCLASS MAGNOLIIDAE** | | | | | | | | |
| **Acanthaceae** | | | | | | | | |
| *Brunoniella australis* | Blue Trumpet | • | • | • | | | | |
| *Rostellularia adscendens* var. *adscendens* | Pink Tongues | • | • | • | | | | |
| **Aizoaceae** | | | | | | | | |
| *Zaleya galericulata* subsp. *australis* | | | | • | • | | • | |
| **Amaranthaceae** | | | | | | | | |
| *Alternanthera denticulata* | Lesser Joyweed | | • | • | • | • | • | |
| *Alternanthera nana* | Hairy Joyweed | | | • | | | | |
| **Alternanthera pungens* | Khaki Weed | | | | • | • | • | |
| *Alternanthera* sp. A | | | • | | | | | |
| **Amaranthus retroflexus* | Redroot Amaranth | | | | | • | • | |
| **Gomphrena celosioides* | Gomphrena Weed | • | • | | | • | • | |
| **Anacardiaceae** | | | | | | | | |
| **Schinus areira* | Pepper Tree | | | | | • | | |
| **Apiaceae** | | | | | | | | |
| **Ammi majus* | Bishop's-weed | | | • | | • | | |
| **Cyclospermum leptophyllum* | Slender Celery | • | | • | | • | • | |
| *Daucus glochidiatus* form F | Native Carrot | • | • | • | | | • | |
| *Hydrocotyle* sp. | | • | | | | | | |
| **Apocynaceae** | | | | | | | | |
| *Alstonia constricta* | Quinine Bush | • | • | • | | | | |
| *Parsonsia eucalyptophylla* | Gargaloo | • | • | • | | | | • |
| **Asteraceae** | | | | | | | | |
| **Aster subulatus* | Wild Aster | | | | | • | • | |
| **Bidens pilosa* | Cobblers Pegs | • | | • | | • | • | |
| **Bidens subalternans* | Greater Beggar's Ticks | | | • | • | • | | |
| *Brachyscome ciliaris* var. *lanuginosa* | | | • | | | | | |
| *Brachyscome ciliaris* var. *subintegrifolia* | | | | • | | | | |
| *Brachyscome linearifolia* | | | • | | | | | |
| *Calotis cuneifolia* | Purple Burr-daisy | • | • | • | | | | |
| *Calotis lappulacea* | Yellow Burr-daisy | • | • | • | • | | • | |
| **Carthamus lanatus* | Saffron Thistle | • | | • | • | • | • | |
| *Cassinia laevis* | Cough Bush | • | • | | | | | |
| *Cassinia quinquefaria* | | • | | | | | | |
| **Centaurea melitensis* | Cockspur | | | • | | | | |
| *Centipeda minima* | Spreading Sneezeweed | | • | | | • | | |
| *Centipeda thespidioides* | Desert Sneezeweed | | • | | | | | |
| **Chondrilla juncea* | Skeleton Weed | • | | | • | | • | |
| *Chrysocephalum apiculatum* | Common Everlasting | • | • | • | | | | |
| *Chrysocephalum semipapposum* | Yellow Buttons | • | • | • | | | | |
| **Cichorium intybus* | Chicory | | | | | • | • | |
| **Cirsium vulgare* | Spear Thistle | | | | | • | | |
| **Conyza bonariensis* | Flaxleaf Fleabane | • | • | • | • | • | • | |
| **Conyza sumatrensis* | Tall Fleabane | | | • | | | | |
| *Eclipta platyglossa* | | | | | | • | | |
| *Euchiton involucratus* | Star Cudweed | | | • | | | | |
| *Euchiton sphaericus* | Cudweed | • | • | • | • | • | • | |
| **Gamochaeta americana* | Cudweed | • | | • | | | | |
| *Glossocardia bidens* | Cobbler's Tack | • | • | • | | | • | |
| **Hypochaeris glabra* | Smooth Catsear | • | | | | | | |
| **Hypochaeris microcephala* var. *albiflora* | White Flatweed | • | • | | | • | | |

| | Community | 1 | 2 | 3 | 4 | 5 | 6 | Opp |
|---|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | | | | | | | |
| **Hypochaeris radicata* | Catsear | • | | | | | | |
| **Lactuca serriola* | Prickly Lettuce | • | • | • | • | • | • | |
| *Olearia elliptica* | Sticky Daisy-bush | • | • | | | | | |
| *Ozothamnus diosmifolius* | Rice Flower | | • | | | | | |
| *Pseudognaphalium luteoalbum* | Jersey Cudweed | • | | | | | | |
| *Rhodanthe anthemoides* | Chamomile Sunray | | • | | | | | |
| **Schkuhria pinnata* var *.abrotanoides* | Dwarf Marigold | | | • | | • | • | |
| *Senecio diaschides* | | • | | | | | | |
| *Senecio prenanthoides* | | • | | | | | | |
| *Senecio quadridentatus* | Cotton Fireweed | | • | | | | | |
| *Senecio tenuiflorus* | | • | | | | | | |
| *Sigesbeckia australiensis* | | • | | | | | | |
| **Silybum marianum* | Variegated Thistle | | | • | | | • | |
| **Sonchus oleraceus* | Common Sowthistle | • | • | • | • | • | • | |
| **Tolpis barbata* | Yellow Hawkweed | • | • | | | | | |
| *Triptilodiscus pygmaeus* | Common Sunray | • | | | | | | |
| *Vernonia cinerea* var. *cinerea* | A Vernonia | • | • | | | | | |
| *Vittadinia cervicularis* | | | | • | | | | |
| *Vittadinia cuneata* var. *cuneata* | | | • | | • | | • | |
| *Vittadinia cuneata* var. *hirsuta* | Fuzzweed | • | | | | | | |
| *Vittadinia dissecta* var. *hirta* | | • | • | | | | • | |
| *Vittadinia muelleri* | A Vittadinia | • | | | | | | |
| *Vittadinia pterochaeta* | Winged New Holland Daisy | | | | | | • | |
| *Vittadinia pustulata* | | | | • | | | | |
| *Vittadinia sulcata* | A Vittadinia | • | • | • | • | | | |
| **Xanthium spinosum* | Bathurst Burr | | | | • | • | • | |
| *Xerochrysum bracteatum* | Golden Everlasting | • | • | • | • | • | • | |
| *Xerochrysum viscosum* | Sticky Everlasting | | | | | • | | |
| **Bignoniaceae** | | | | | | | | |
| *Pandorea pandorana* | Wonga Wonga Vine | • | | | | | | |
| **Boraginaceae** | | | | | | | | |
| **Amsinckia* sp. | | | • | | | | | |
| *Cynoglossum australe* | Australian Hound's Tongue | • | • | | | | | |
| **Echium plantagineum* | Paterson's Curse | | • | | | | • | |
| **Heliotropium amplexicaule* | Blue Heliotrope | | | | | • | • | |
| **Brassicaceae** | | | | | | | | |
| **Hirschfeldia incana* | Buchan Weed | | | | | • | • | |
| **Lepidium africanum* | A Peppercress | • | • | • | • | • | • | |
| **Lepidium bonariense* | Hairy Brassica | • | | • | • | • | • | • |
| *Lepidium pseudohyssopifolium* | Peppecress | | | • | | | | |
| **Rapistrum rugosum* | Turnip Weed | | | | | | • | |
| **Sisymbrium irio* | London Rocket | | | • | | | | |
| **Sisymbrium orientale* | Indian Hedge Mustard | | | • | | | | • |
| **Sisymbrium*sp. | | | | | | • | | |
| **Cactaceae** | | | | | | | | |
| **Opuntia stricta* | Common Prickly Pear | • | • | • | • | • | • | |
| **Campanulaceae** | | | | | | | | |
| *Wahlenbergia communis* | Tufted Bluebell | • | • | • | • | | • | |
| *Wahlenbergia gracilenta* | Annual Bluebell | • | • | | | | | |
| *Wahlenbergia gracilis* | Sprawling Bluebell | • | | | | | • | |
| *Wahlenbergia luteola* | | | | | | | | • |
| *Wahlenbergia planiflora* subsp. *longipila* | | • | • | | | | | |
| *Wahlenbergia stricta* subsp. *alterna* | Tall Bluebell | • | • | | | | | |
| **Caryophyllaceae** | | | | | | | | |
| *Gypsophila tubulosa* | Annual Chalkwort | • | • | | | | | • |
| **Petrorhagia nanteuilii* | Proliferous Pink | • | | • | | | | |
| **Polycarpon tetraphyllum* | Four-leaved Allseed | • | • | • | | • | • | |
| **Silene gallica* | Small-flower Catchfly | • | | | | | | |
| **Casuarinaceae** | | | | | | | | |
| *Allocasuarina luehmannii* | Bulloak | | • | | | | | |
| *Casuarina cristata* | Belah | | | | | | | • |
| **Celastraceae** | | | | | | | | |
| *Maytenus cunninghamii* | Yellow-berry Bush | • | | | | | | |

| | Community | 1 | 2 | 3 | 4 | 5 | 6 | Opp |
|---|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | | | | | | | |
| **Chenopodiaceae** | | | | | | | | |
| *Atriplex* sp. | | | | | • | | | |
| *Atriplex spinibractea* | Spiny-fruit Saltbush | | | | | | • | |
| **Chenopodium album* | Fat Hen | | | | | • | | |
| *Chenopodium auricomiforme* | | • | • | • | | | | |
| *Chenopodium carinatum* | Keeled Goosefoot | | | • | • | • | | |
| *Chenopodium melanocarpum* | Black Crumbweed | • | | | • | • | • | |
| *Einadia hastata* | Red Berry Saltbush | • | • | • | | | | |
| *Einadia nutans* subsp *linifolia* | Climbing Saltbush | | | | • | | | |
| *Einadia nutans* subsp. *nutans* | Climbing Saltbush | • | • | • | | | | |
| *Einadia polygonoides* | Knotweed Goosefoot | • | • | • | | • | • | |
| *Einadia trigonos* subsp. *leiocarpa* | Fishweed | • | • | | • | • | • | |
| *Maireana enchylaenoides* | Wingless Bluebush | | | • | • | | | |
| *Maireana microphylla* | Small-leaf Bluebush | • | | • | • | • | • | |
| *Salsola kali* | Soft Roly Poly | | • | • | | | • | |
| *Sclerolaena birchii* | Galvanized Burr | | • | • | • | • | • | |
| *Sclerolaena muricata* var. *villosa* | Black Rolypoly | | | • | • | • | • | |
| **Clusiaceae** | | | | | | | | |
| *Hypericum gramineum* | Small St. John's Wort | • | | | | | | |
| **Commelinaceae** | | | | | | | | |
| *Commelina cyanea* | Native Wandering Jew | | | | | • | | |
| **Convolvulaceae** | | | | | | | | |
| *Convolvulus graminetinus* | | | | • | • | | • | |
| **Cuscuta campestris* | Golden Dodder | | | | | • | | |
| *Dichondra repens* | Kidney Weed | • | • | • | • | • | | |
| *Evolvulus alsinoides* var. *decumbens* | | • | • | • | | | • | |
| **Crassulaceae** | | | | | | | | |
| *Crassula sieberiana* | Australian Stonecrop | • | | • | | | | |
| **Cucurbitaceae** | | | | | | | | |
| **Citrullus lanatus* | Camel Melon | | | | | | • | |
| **Dilleniaceae** | | | | | | | | |
| *Hibbertia obtusifolia* | Hoary Guinea Flower | • | | | | | | |
| **Elatinaceae** | | | | | | | | |
| *Elatine gratioloides* | Waterwort | | | | | • | | |
| **Ericaceae - Styphelioideae** | | | | | | | | |
| *Melichrus urceolatus* | Urn-heath | • | • | | | | | |
| **Euphorbiaceae** | | | | | | | | |
| *Beyeria viscosa* | Pinkwood | • | • | | | | | |
| *Chamaesyce drummondii* | Caustic Weed | • | • | • | • | | • | |
| *Euphorbia eremophila* | Desert Spurge | • | • | | | | | |
| **Fabaceae - Caesalpinioideae** | | | | | | | | |
| *Senna form taxon 'artemisioides'* | Silver Cassia | • | | | | | | |
| *Senna form taxon 'filifolia'* | | | • | | | | | |
| *Senna form taxon 'zygophylla'* | A Cassia | • | • | • | | | | |
| **Fabaceae: Faboideae** | | | | | | | | |
| *Desmodium brachypodum* | Large Tick-trefoil | • | • | • | | • | | |
| *Desmodium varians* | Slender Tick-trefoil | • | • | • | | | | |
| *Glycine canescens* | Silky Glycine | • | • | | | | | |
| *Glycine clandestina* | Love Creeper | • | • | | | | | |
| *Glycine tabacina* | A Glycine | • | • | • | • | • | • | |
| **Medicago laciniata* | Cut-leaved Medic | | | • | | | | |
| **Medicago minima* | Woolly Burr Medic | • | | • | | | | |
| **Medicago polymorpha* | Burr Medic | | | • | | • | • | |
| **Medicago sativa* | Lucerne | | | | | • | • | |
| *Swainsona galegifolia* | Smooth Darling-pea | • | • | • | | | | |
| *Templetonia stenophylla* | Leafy Templetonia | • | | • | | | | |
| **Trifolium arvense* | Haresfoot Clover | • | • | • | | | • | |
| **Trifolium campestre* | Hop Clover | • | | • | | | | |
| **Trifolium dubium* | Yellow Suckling Clover | • | • | | | | | |
| **Trifolium glomeratum* | Clustered Clover | • | | • | • | | • | |
| **Trifolium tomentosum* | Woolly Clover | | | | | | • | |
| **Trifolium vesiculosum* | | • | | | | | • | |
| **Vicia sativa* | | | | | | | • | |

| | Community | 1 | 2 | 3 | 4 | 5 | 6 | Opp |
|---|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | | | | | | | |
| *Zornia dyctiocarpa* | Zornia | • | | | | | | |
| **Fabaceae: Mimosoideae** | | | | | | | | |
| *Acacia cheelii* | Motherumbah | • | | | | | | |
| *Acacia decora* | Western Silver Wattle | • | • | • | | | | |
| *Acacia deanei* | Dean's Wattle | • | • | | | | | |
| *Acacia leiocalyx* subsp. *leiocalyx* | Curracabah | | • | | | | | |
| *Acacia oswaldii* | Umbrella Wattle | | | | | | | • |
| *Acacia salicina* | Cooba | | | | | • | | |
| **Gentianaceae** | | | | | | | | |
| **Centaurium erythraea* | Common Centaury | • | | • | | | • | |
| *Schenkia spicata* | Spike Centaury | • | | | | • | | |
| **Geraniaceae** | | | | | | | | |
| *Erodium crinitum* | Blue Storksbill | • | | | | | • | |
| *Geranium solanderi* subsp. *solanderi* | Native Geranium | • | | | | • | • | |
| **Goodeniaceae** | | | | | | | | |
| *Goodenia cycloptera* | | | • | | | | | |
| *Goodenia hederacea* | Forest Goodenia | • | • | • | | | | |
| *Goodenia fascicularis* | | | • | | | | | |
| *Goodenia pinnatifida* | Scrambled Eggs | | | • | | | | |
| *Goodenia rotundifolia* | A Goodenia | • | | • | | | | |
| *Velleia paradoxa* | Spur Velleia | • | | | | | | |
| **Haloragaceae** | | | | | | | | |
| *Gonocarpus elatus* | | • | | | | | | |
| *Haloragis heterophylla* | Rough Raspwort | • | | | | | • | |
| **Lamiaceae** | | | | | | | | |
| *Ajuga australis* | Austral Bugle | • | • | • | | | | |
| **Marrubium vulgare* | White Horehound | | | | | • | • | |
| *Oncinocalyx betchei* | | • | • | • | | | | |
| **Salvia verbenaca* | Vervain | | | • | | • | | |
| *Scutellaria humilis* | Dwarf Skullcap | • | | | | | | |
| **Stachys arvensis* | Stagger Weed | • | | | | | • | • |
| **Linaceae** | | | | | | | | |
| *Linum marginale* | Native Flax | • | • | • | | | | |
| **Lobeliaceae** | | | | | | | | |
| *Pratia concolor* | Poison Pratia | | | | | • | • | |
| **Loranthaceae** | | | | | | | | |
| *Amyema miquelii* | Stalked Mistletoe | • | • | | | • | | • |
| *Lysiana subfalcata* | | • | | | | | | |
| **Malvaceae** | | | | | | | | |
| *Abutilon* sp. nov. | | | • | | | | | |
| *Abutilon oxycarpum* | Straggly Lantern-bush | | | • | | | | |
| *Hibiscus sturtii* | Hill Hibiscus | • | • | • | | | | |
| **Malva parviflora* | Small-flowered Mallow | | | | | • | • | |
| **Malvastrum americanum* | Spiked Malvastrum | • | • | | | • | • | |
| *Malvastrum coromandelianum* | Prickly Malvastrum | | | | • | | | |
| **Modiola caroliniana* | Red-flowered Mallow | | | | • | • | • | |
| *Sida corrugata* | Corrugated Sida | • | • | • | • | | • | |
| *Sida cuninghamii* | Ridged Sida | • | • | • | | | • | |
| **Sida rhombifolia* | Paddy's Lucerne | • | | • | | • | | |
| *Sida spinosa* | A Sida | | • | • | • | • | • | • |
| *Sida subspicata* | Spiked Sida | • | | • | • | • | • | |
| **Meliaceae** | | | | | | | | |
| *Melia azedarach* | White Cedar | | | | | • | | |
| **Myoporaceae** | | | | | | | | |
| *Eremophila debilis* | Amulla | • | • | • | • | • | | |
| *Eremophila longifolia* | Emubush | | • | | • | | | |
| *Myoporum montanum* | Western Boobialla | | • | • | | | | |
| **Myrsinaceae** | | | | | | | | |
| **Anagallis arvensis* | Scarlet Pimpernel | • | • | • | | • | • | |
| **Myrtaceae** | | | | | | | | |
| *Angophora floribunda* | Rough-barked Apple | | | | | • | • | |
| *Corymbia trachyphloia* subsp. *amphistomatica* | White Bloodwood | • | • | | | | | |
| *Ecualyptus albens* | White Box | • | • | • | | • | • | |

| | Community | 1 | 2 | 3 | 4 | 5 | 6 | Opp |
|---|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | | | | | | | |
| *Eucalyptus beyeriana* | Beyer's Ironbark | | | | | | • | |
| *Eucalyptus blakelyi* | Blakely's Red Gum | | | | | • | | |
| *Eucalyptus chloroclada* | Dirty Gum | | • | | | | | |
| *Eucalyptus crebra* | Narrow-leaved Ironbark | • | | | | | | |
| *Eucalyptus melanophloia* | Silver-leaved Ironbark | | | | | | • | |
| *Eucalyptus melliodora* | Yellow Box | | | | | | | • |
| *Eucalyptus pilligaensis* | Narrow-leaved Grey Box | | | | | | • | |
| *Eucalyptus populnea* | Poplar Box | | | • | • | • | • | |
| *Melaleuca bracteata* | Black Tea-tree | | | | | • | • | |
| **Nyctaginaceae** | | | | | | | | |
| *Boerhavia dominii* | Tarvine | • | • | • | • | • | • | |
| **Oleaceae** | | | | | | | | |
| *Jasminum lineare* | Desert Jasmine | | • | • | | | | |
| *Jasminum suavissimum* | | • | | • | | | | • |
| *Notelaea microcarpa* var. *microcarpa* | Velvet Mock Olive | • | • | | | • | | |
| **Onagraceae** | | | | | | | | |
| *Ludwigia peploides* subsp. *montevidensis* | Water Primrose | | | | | | • | |
| **Oxalidaceae** | | | | | | | | |
| *Oxalis perennans* | An Oxalis | • | • | • | | • | | • |
| *Oxalis radicosa* | An Oxalis | | • | | | | | |
| *Oxalis* sp. | | | | • | | | | |
| **Papaveraceae** | | | | | | | | |
| **Argemone ochroleuca* subsp. *ochroleuca* | Mexican Poppy | | | | | | • | |
| **Phyllanthaceae** | | | | | | | | |
| *Poranthera microphylla* | | • | | | | | | |
| *Phyllanthus virgatus* | A Phyllanthus | • | | • | | | | |
| **Phytolaccaceae** | | | | | | | | |
| **Phytolacca octandra* | Inkweed | | | | | • | • | |
| **Pittosporaceae** | | | | | | | | |
| *Pittosporum angustifolium* | Weeping Pittosporum | • | • | • | | | | • |
| **Plantaginaceae** | | | | | | | | |
| *Plantago debilis* | Slender Plantain | • | • | • | • | • | | |
| **Polygonaceae** | | | | | | | | |
| **Polygonum aviculare* | Wireweed | | | | | • | • | |
| *Rumex brownii* | Swamp Dock | • | • | • | • | • | • | |
| **Rumex crispus* | Curled Dock | | | | | | • | |
| *Rumex tenax* | Shiny Dock | | | | | • | | |
| **Portulacaceae** | | | | | | | | |
| *Portulaca oleracea* | Pig Weed | | | | • | • | • | |
| **Portulacaceae** | | | | | | | | |
| *Calandrinia* sp. | | | • | | | | | |
| **Ranunculaceae** | | | | | | | | |
| *Clematis microphylla* | Small-leaved Clematis | • | | | | • | | |
| **Rubiaceae** | | | | | | | | |
| *Asperula subulifolia* | | | | • | | | | |
| **Galium aparine* | Goosegrass | | | | | • | | |
| *Galium gaudichaudii* | Rough Bedstraw | • | | | | | | |
| *Psydrax odorata* | Shiny-leaved Canthium | • | • | | | • | | |
| **Rutaceae** | | | | | | | | |
| *Geijera parviflora* | Wilga | • | • | • | • | • | • | |
| **Santalaceae** | | | | | | | | |
| *Santalum lanceolatum* | Northern Sandalwood | • | • | | | | | |
| **Sapindaceae** | | | | | | | | |
| *Alectryon oleifolius* | Western Rosewood | | | • | | | • | |
| *Dodonaea sinuolata* subsp. *sinuolata* | | • | • | | | | | |
| *Dodonaea viscosa* | Sticky Hop Bush | • | | | | | | |
| *Dodonaea viscosa* subsp. *angustifolia* | Sticky Hop Bush | • | • | | | | | • |
| *Dodonaea viscosa* subsp. *angustissima* | Narrow-leaved Hopbush | • | | | | | | |
| *Dodonaea viscosa* subsp. *spatulata* | | | • | | | | | |
| **Scrophulariaceae** | | | | | | | | |
| **Linaria arvensis* | | • | • | | | | | |
| **Misopates orontium* | Lesser Snapdragon | • | • | • | | | • | |
| **Verbascum virgatum* | Twiggy Mullein | • | | | | | • | |

| | Community | 1 | 2 | 3 | 4 | 5 | 6 | Opp |
|---|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | | | | | | | |
| **Solanaceae** | | | | | | | | |
| **Cestrum parqui* | Green Cestrum | | | | | • | | |
| **Datura ferox* | Fierce Thornapple | | | | | | | • |
| **Lycium ferocissimum* | African Boxthorn | | | • | | • | • | |
| *Solanum cinereum* | Narrawa Burr | • | | • | | | | |
| **Solanum nigrum* | Black-berry Nightshade | • | • | • | • | • | • | |
| *Solanum parvifolium* | | • | • | • | • | • | | |
| **Stackhousiaceae** | | | | | | | | |
| *Stackhousia muricata* | Western Stackhousia | • | • | • | | | | |
| **Sterculiaceae** | | | | | | | | |
| *Brachychiton populneus* | Kurrajong | • | | | • | | | |
| **Thymelaeaceae** | | | | | | | | |
| *Pimelea neo-anglica* | Poison Pimelea | • | • | • | | • | | |
| **Urticaceae** | | | | | | | | |
| *Parietaria debilis* | Native Pellitory | • | | | | | | |
| *Urtica incisa* | Stinging Nettle | | | | | • | • | |
| **Verbenaceae** | | | | | | | | |
| **Glandularia aristigera* | Mayne's Pest | | | • | | | | |
| **Verbena caracasana* | | | | | | • | • | |
| *Verbena gaudichaudii* | | | • | | | | • | • |
| **Verbena supina* | Trailing Verbena | • | | • | | | | |
| **Zygophyllaceae** | | | | | | | | |
| *Tribulus micrococcus* | Yellow Vine | | | | • | | • | |
| **SUBCLASS LILIIDAE** | | | | | | | | |
| **Amaryllidaceae** | | | | | | | | |
| *Crinum flaccidum* | Darling Lily | | | | | • | | |
| **Anthericaceae** | | | | | | | | |
| *Arthropodium minus* | | • | • | • | | | | |
| *Dichopogon fimbriatus* | Nodding Chocolate Lily | • | • | • | | | | |
| *Laxmannia gracilis* | Slender Wire Lily | • | • | | | | | |
| *Tricoryne elatior* | Yellow Autumn-lily | • | | | | | | |
| **Asphodelaceae** | | | | | | | | |
| *Bulbine semibarbata* | Native Leek | • | | • | | • | | • |
| **Colchicaceae** | | | | | | | | |
| *Wurmbea* sp. | | • | | | | | | |
| **Cyperaceae** | | | | | | | | |
| *Carex appressa* | Tall Sedge | | | | | • | • | |
| *Carex inversa* | Knob Sedge | • | • | • | • | • | • | |
| *Cyperus betchei* | | | | | | | | |
| **Cyperus eragrostis* | Umbrella Sedge | | | | | | | |
| *Cyperus fulvus* | Sticky Sedge | • | | | | • | | |
| *Cyperus gracilis* | Slender Flat-sedge | • | • | • | • | • | • | |
| *Eleocharis acuta* | | | | | | • | | |
| *Fimbristylis dichotoma* | Common Fringe-sedge | • | | | • | | | |
| *Schoenus apogon* | Common Bog-rush | • | | | | | | |
| **Iridaceae** | | | | | | | | |
| **Sisyrinchium sp. A* | Scourweed | • | | | | | | |
| **Juncaceae** | | | | | | | | |
| *Juncus filicaulis* | | | | • | | | | |
| *Juncus remotiflorus* | | • | | | | | | |
| *Juncus subglaucus* | | | • | • | | | • | |
| *Juncus subsecundus* | Finger Rush | • | • | • | | | | |
| **Lomandraceae** | | | | | | | | |
| *Lomandra confertifolia* subsp. *pallida* | | • | • | • | • | | | |
| *Lomandra filiformis* subsp. *filiformis* | Wattle Mat-rush | • | • | • | | | | |
| *Lomandra longifolia* | Spiny-headed Mat-rush | • | • | • | | | | |
| *Lomandra multiflora* | Many-flowered Mat-rush | • | • | • | | | | |
| *Lomandra* sp. | A Mat-rush | • | | | • | | | |
| **Orchidaceae** | | | | | | | | |
| *Cymbidium canaliculatum* | Tiger Orchid | | • | • | | | | |
| *Microtis parviflora* | Slender Onion Orchid | • | | | | | | |
| **Phormiaceae** | | | | | | | | |
| *Dianella longifolia* | Blueberry Lily | | • | • | | • | | |

| | Community | 1 | 2 | 3 | 4 | 5 | 6 | Opp |
|---|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | | | | | | | |
| *Dianella revoluta* | Spreading Flax-lily | • | • | | | | | |
| **Poaceae** | | | | | | | | |
| *Aristida blakei* | | | | • | | | | |
| *Aristida echinata* | | | | | | | • | |
| *Aristida nitidula* | | | | | | | | • |
| *Aristida personata* | Purple Wire-grass | • | • | • | • | • | • | |
| *Austrodanthonia bipartita* | Wallaby Grass | • | • | | • | • | | |
| *Austrodanthonia caespitosa* | Ringed Wallaby Grass | • | | | | | | |
| *Austrodanthonia fulva* | Wallaby Grass | • | • | • | • | • | • | |
| *Austrodanthonia racemosa* var. *obtusata* | Wallaby Grass | • | • | • | | | | |
| *Austrodanthonia setacea* | Smallflower Wallaby Grass | | • | | | | | |
| *Austrostipa aristiglumis* | Plains Grass | | | | | | • | |
| *Austrostipa scabra* subsp. *scabra* | Speargrass | • | • | • | • | • | • | |
| *Austrostipa setacea* | Corkscrew Grass | • | • | • | | | | |
| *Austrostipa verticillata* | Slender Bamboo Grass | • | | • | • | • | • | |
| *Bothriochloa bladhii* | Forest Blue Grass | | | | | | | |
| *Bothriochloa decipiens* | Red Grass | | • | • | | | • | |
| **Briza minor* | Shivery Grass | • | | | | | | |
| **Bromus catharticus* | Prairie Grass | | | | • | • | • | |
| **Bromus molliformis* | Soft Brome | • | | | | | | |
| **Cenchrus spinifex* | Spiny Burrgrass | | | | | | • | |
| **Chloris gayana* | Rhodes Grass | | • | | | | | |
| *Chloris truncata* | Windmill Grass | | | • | • | • | • | |
| *Chloris ventricosa* | Plump Windmill Grass | • | • | • | • | • | • | |
| *Cymbopogon refractus* | Barbwire Grass | • | • | | | | • | |
| *Cynodon dactylon* | Couch | | • | • | | • | • | |
| **Cynodon incompletus* | | | | | | • | | |
| *Dichanthium sericeum* | Queensland Bluegrass | • | • | • | • | • | • | |
| *Dichelachne micrantha* | Shorthair Plumegrass | • | | | | | | |
| *Digitaria breviglumis* | | • | | | | | | |
| *Digitaria brownii* | Cotton Panic Grass | | | • | | | | |
| *Digitaria diffusa* | Open Summer Grass | • | | | | | | |
| *Digitaria divaricatissima* | Umbrella Grass | | | • | | | • | |
| *Echinochloa colona* | Awnless Barnyard Grass | | | | | • | • | |
| *Echinopogon* sp. | | | • | | | | | |
| *Elymus scaber* | | • | | | • | | | |
| *Enneapogon gracilis* | Slender Bottle-washers | • | • | • | | | | |
| *Enteropogon acicularis* | Windmill Grass | | | • | • | | • | |
| *Enteropogon ramosus* | Curly Windmill Grass | | | • | • | | | |
| *Eragrostis alveiformis* | | | | • | • | | • | |
| *Eragrostis brownii* | Brown's Lovegrass | • | | | | | | |
| **Eragrostis cilianensis* | Stinkgrass | | | | | | • | |
| **Eragrostis curvula* | African Lovegrass | | | | • | | | |
| *Eragrostis elongata* | Clustered Lovegrass | • | | • | | | • | |
| *Eragrostis lacunaria* | Purple Love-grass | • | • | | • | | • | |
| *Eragrostis parviflora* | Weeping Lovegrass | • | | | | • | • | |
| *Eriochloa pseudoacrotricha* | Early Spring Grass | | • | • | • | • | • | |
| *Lachnagrostis filiformis* | | | • | • | | | | |
| **Lolium rigidum* | Wimmera Ryegrass | | | • | | | | |
| *Microlaena stipoides* | Weeping Grass | | | | | • | | |
| *Panicum buncei* | Native Panic | | | | | • | | |
| *Panicum decompositum* | Native Millet | | | • | | | | |
| *Panicum effusum* | Hairy Panic | • | | • | • | | • | |
| *Panicum laevinode* | Pepper Grass | | | • | | | | |
| *Panicum simile* | Two Coloured Panic | • | | • | | | | |
| *Paspalidium constrictum* | Knottybutt Grass | • | • | • | | • | • | |
| *Paspalidium distans* | | | | | | | • | |
| **Paspalum dilatatum* | Paspalum | | | | | • | • | |
| *Paspalum distichum* | Water Couch | | | | | | • | |
| *Poa sieberiana* var. *sieberiana* | Snowgrass | • | • | • | | | • | |
| **Sorghum halepense* | Johnson Grass | | | | | • | | |
| *Sporobolus caroli* | Fairy Grass | | | • | | | | |
| *Sporobolus creber* | Slender Rat's Tail Grass | • | | | • | • | • | |

| | Community | 1 | 2 | 3 | 4 | 5 | 6 | Opp |
|---|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | | | | | | | |
| *Themeda australis* | Kangaroo Grass | • | | | | | | |
| *Tragus australianus* | Small Burrgrass | | • | | • | | | |
| **Urochloa panicoides* | Urochloa Grass | | | | | • | • | |
| **Vulpia bromoides* | Squirrel Tail Fescue | • | | | | | | |
| **Vulpia muralis* | | • | • | | | | | |
| **Xanthorrhoeaceae** | | | | | | | | |
| *Xanthorrhoea johnsonii* | Johnson's Grass Tree | • | | | | | | |
| | | | | | | | | |
| TOTAL NATIVE SPECIES | 269 | 161 | 132 | 121 | 59 | 70 | 79 | |
| | | | | | | | | |
| TOTAL INTRODUCED SPECIES | 94 | 40 | 20 | 36 | 16 | 48 | 52 | |
| | | | | | | | | |
| GRAND TOTAL SPECIES | 363 | 201 | 152 | 157 | 75 | 118 | 131 | |

* - Introduced species.

Opp - Opportunistic sighting.

# ATTACHMENT C

# OFFSET STRATEGY

# Vegetation of the 'Willeroi' Offset Area.

**Prepared for Whitehaven Coal Pty Ltd**
**by C.C. Bower**
**Principal Consultant Botanist**

**September 2011**

FLORASEARCH

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# SUMMARY AND CONCLUSIONS

### *The Study Area*

1. The 'Willeroi' property has been purchased by Whitehaven Coal Pty. Ltd. as a potential offset for the loss of native vegetation by the proposed Tarrawonga Coal Project.
2. 'Willeroi' comprises a rugged sunken amphitheatre surrounded by a rim of steep wooded hills. The proposed offset area is bordered by Mount Kaputar National Park on its western side and Maules Creek to the east. Altitudes vary from 450 to 850 metres (m) Australian Height Datum (AHD), significantly higher than at Tarrawonga (260 to 370 m AHD).
3. The complex geology comprises Early to Late Carboniferous sedimentary and volcanic rocks of the New England Orogen.
4. The climate is likely to be somewhat cooler and wetter than at Tarrrawonga.
5. 'Willeroi' has been used for grazing sheep and cattle on native pastures in cleared areas, and rough grazing of wooded areas.

### *Flora Communities and Species*

6. A flora survey of 'Willeroi' was conducted over a total of 12 days in May (5 days) and August 2011 (7 days).
7. The surveys employed quadrat plots, spot sampling sites and random meanders.
8. The study area was found to support eight native vegetation communities including shrubby forests and woodlands dominated by combinations of White Box (*Eucalyptus albens*), Narrow-leaved Ironbark (*E. crebra*), Silver-leaved Ironbark (*E. melanophloia*) and White Cypress Pine (*Callitris glaucophylla*) on rugged terrain; grassy woodlands dominated by combinations of White Box, Yellow Box (*E. melliodora*) and/or Rough-barked Apple (*Angophora floribunda*) on more fertile soils and gentler terrain; and riparian forests dominated by River Oak (*Casuarina cunninghamiana*), River Red Gum (*Eucalyptus camaldulensis*) or Bracteate Honeymyrtle (*Melaleuca bracteata*). The floristics of each community is fully described.
9. Four of the vegetation communities at 'Willeroi' also occur on the Tarrawonga Coal Project area while four are absent from Tarrawonga. One vegetation community with small occurrences at Tarrawonga (Community 4 – Narrow-leaved Grey Box – Poplar Box – White Cypress Pine grassy open woodland) is not represented at 'Willeroi'.
10. Four vegetation condition classes are defined and applied to each community where relevant. These include; White Cypress Pine regeneration, Semicleared and regenerating, Derived native grassland and Grassland dominated by exotics.
11. A total of 239 flora species was found on the study area, of which 193 (80.8 percent [%]) are native and 46 (19.2%) are introduced.
12. The plant families with the highest numbers of species were the Grasses, Poaceae (43 species); Daisies, Asteraceae (36 species); Pea Flowers, subfamily Faboideae (15 species); the Eucalypts and related genera in the family Myrtaceae (9 species); the saltbushes and bluebushes, Chenopodiaceae (6 taxa); the Wattles, subfamily Mimosoideae (6 species); the Mistletoes, Loranthaceae (6 species) and the Sedges, Cyperaceae (6 species). In all, some 63 plant families or subfamilies were represented.
13. The highest proportions of introduced species and weeds were found in the disturbed riparian zone of Maules Creek and in the cleared native pasture areas. The least weeds were found in the rugged terrain of the western and southern parts of the study area.

14. Two serious environmental weeds occur on 'Willeroi'; Coolatai Grass (*Hyparrhenia hirta*) and Sweet Briar (*Rosa rubiginosa*). The former is restricted to the northern half of the central range including its eastern and western flanks and adjacent lower slopes. Sweet Briar is largely confined to the derived native grasslands in the north east of the property.

***Condition of the Vegetation***

15. The condition of the native vegetation within the study area varies considerably. In general the most disturbed areas are the riparian zone of Maules Creek and the adjacent alluvial flats and flood terraces. Also highly disturbed is the derived native grassland area in the north east that appears to have been cleared and heavily grazed for many decades with consequent loss of much of its natural resilience. By contrast, large areas of regeneration in the western and southern blocks appear to have retained much of their biodiversity, despite past clearing and grazing. Some areas in the western and southern blocks that appear not to have been cleared in recent decades are considered to be in excellent condition, despite grazing. In addition some remnants of River Oak Forest on Maules Creek are in good condition and are flanked by rare remnants of grassy box woodlands.

***Threatened Flora Species and Populations***

16. No flora species or populations listed in the schedules of the New South Wales (NSW) *Threatened Species Conservation Act, 1995* (TSC Act) or the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act), were found in the study area.

***Threatened Vegetation Communities and Critical Habitat***

17. Two vegetation communities on 'Willeroi' are considered to belong to the White Box - Yellow Box - Blakely's Red Gum Woodland Endangered Ecological Community (EEC) listed under the TSC Act, and the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grasslands Critically Endangered Ecological Community (CEEC) listed under the EPBC Act. These are Community 3 (White Box – White Cypress Pine grassy woodland) and Community 8 (Yellow Box – Rough-barked Apple grassy woodland).

18. No Critical Habitat listed in the schedules of the TSC Act or EPBC Act is found in the study area or surrounds.

***Comparison of 'Willeroi' and Tarrawonga Vegetation***

19. Analysis of the floristic similarity of equivalent vegetation communities between Tarrawonga and 'Willeroi' showed there were differences between the two areas. These are considered to relate primarily to the altitudinal difference between Tarrawonga and 'Willeroi' such that the communities at Tarrawonga support a range of lower Western Slopes and Plains species that are absent at 'Willeroi'. Similarly, the altitudes at 'Willeroi' favour species of the upper Western Slopes. Given that the composition of all plant communities varies on a range of environmental gradients, it is considered that the vegetation at 'Willeroi' is an acceptable match for Tarrawonga.

20. There are 13 hectares (ha) of Box - Gum Woodland EEC/CEEC at Tarrawonga versus 232 ha of the same EEC/CEEC at 'Willeroi'. However, most of the EEC/CEEC at 'Willeroi' is derived native grassland (195 ha) that has been heavily grazed for many decades and has lost much of its original diversity and capacity to recover. If the native grassland is excluded from consideration, 37 ha of intact or regenerating EEC/CEEC remain at 'Willeroi' and 10 ha at Tarrawonga, giving an area ratio of 3.7 between 'Willeroi' and Tarrawonga. When the derived grassland is included, the area ratio is 17.8.

21. The overall offset ratio of native vegetation is 4.1 between 'Willeroi' (offset area of 1,616 ha, excluding the 44 ha of exotic grassland and Tarrawonga (397 ha of native vegetation to be cleared).

22. Offset ratios are calculated for all vegetation types and condition classes between 'Willeroi' and Tarrawonga. All communities shared between Tarrawonga and 'Willeroi' are offset by ratios of 1.8 at the least for Community 5, 2.0 for Community 1, and much more for Communities 2 (8.3) and 3 (16.6) that are dominated by White Box. The offset includes a total of 423 ha of Communities 7, 8, 9 and 10 that are not represented at Tarrawonga.

23. The 'Willeroi' offset is demonstrated to meet the 'maintain and improve' test required by the NSW and Commonwealth governments.

# 1 INTRODUCTION

FloraSearch was commissioned by Whitehaven Coal Pty Ltd (Whitehaven Coal) to document the vegetation on the property 'Willeroi', located approximately 20 kilometres (km) north-east of the Tarrawonga Coal Mine, 39 km north-east of Boggabri and 57 km north of Gunnedah in the Gunnedah Basin, New South Wales (NSW) (Figure 1).

'Willeroi' has been purchased by Whitehaven Coal as a potential offset for the proposed Tarrawonga Coal Project. This report presents the results of a comprehensive flora survey of proposed 'Willeroi' offset area and compares the vegetation with that proposed to be disturbed on the Tarrawonga Coal Project area.

The objectives of the survey and report are to:

- sample the vegetation on the offset (study) area using standard flora survey techniques;
- determine and map the vegetation communities present within the study area;
- compile a comprehensive plant species list for each vegetation community;
- conduct targeted searches for potentially occurring threatened plant species, populations, communities and critical habitat, and map any occurrences; and
- compare the vegetation on the potential offset area with that on the proposed Tarrawonga Coal Project disturbance areas.

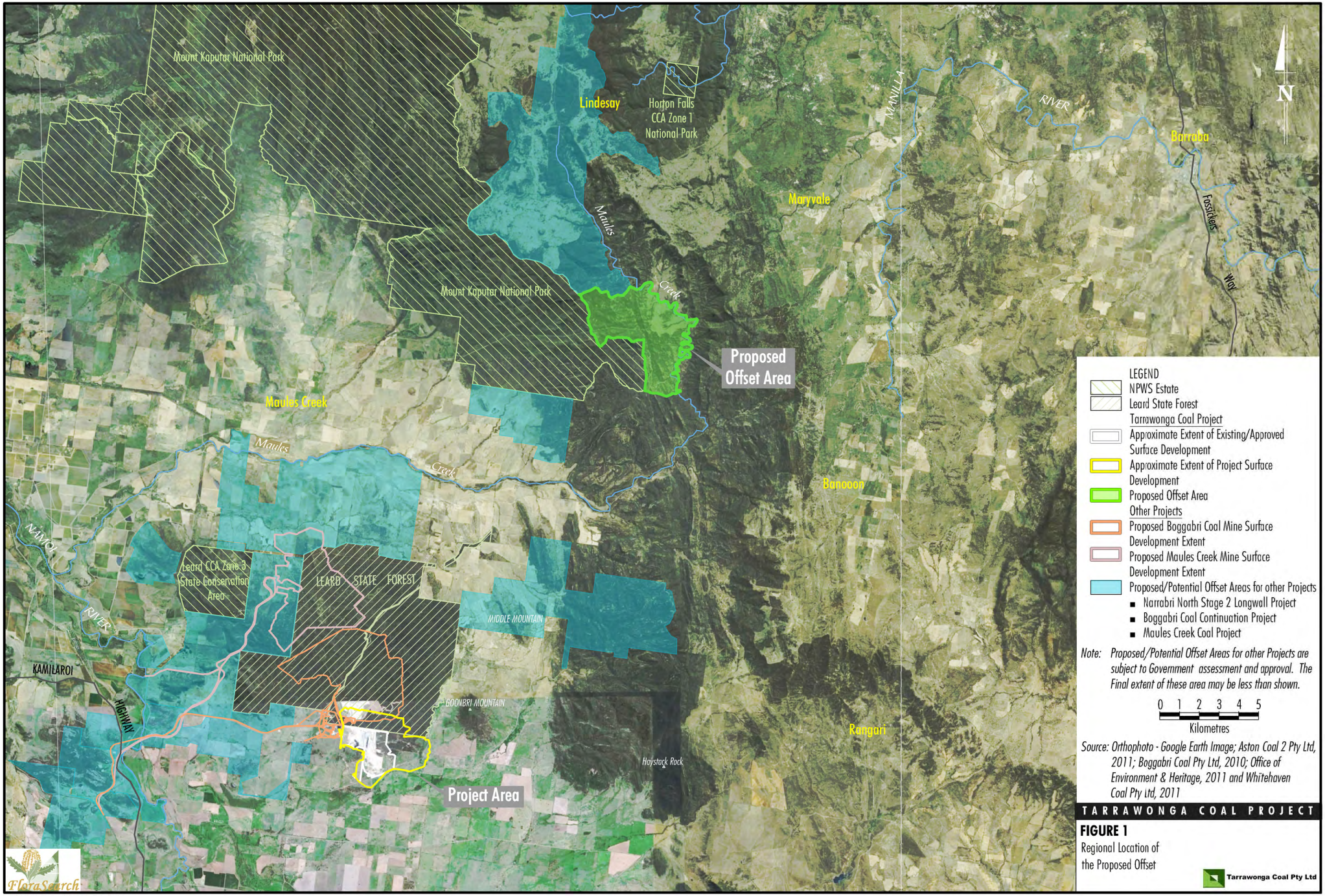
## 1.1 REGIONAL SETTING

The study area occurs on the southern slopes of the Nandewar Range which borders the Gunnedah Basin geological formation on the NSW North West Slopes and Plains. The Gunnedah Basin developed in a trough between the Lachlan Fold Belt to the west and the New England Fold Belt on the eastern side of the Mooki Thrust (Pratt 1998). The Tarrawonga Coal Project area lies within the Gunnedah Basin while 'Willeroi' occurs in an area of complex Carboniferous geology between the Mooki Thrust and the Kelvin Thrust within the New England Orogen. 'Willeroi' is approximately 17 km south-east of Mount Kaputar and borders the Mount Kaputar Volcanic Complex.

## 1.2 DESCRIPTION OF THE STUDY AREA AND SURROUNDS

The study area for the flora survey in this report comprises 1,660 hectares (ha) on the 'Willeroi' property between Maules Creek in the east and Kaputar National Park in the west. Major features of the study area include a long section of Maules Creek on the eastern boundary, a linear north-south range of steep hills (the 'central range') associated with the Kelvin Thrust in the centre, a large area of gently sloping cleared grassland in the north-east and a 132 kilovolt (kV) power line running in an east-west direction through the middle.

The study area is an inverted 'L' shape and is divided into three sub-areas or blocks for ease of description in this report. The western block is bordered by the rugged terrain of Mount Kaputar National Park on its southern and western sides, mainly private property on the northern side and the central range on the eastern side. The southern block is bordered by Mount Kaputar National Park to the west, forested private property to the south, Maules Creek to the east and the 132 kV power line in the north. The north-eastern block of the study area comprises a triangle of mainly cleared grassland bordered by the 132 kV power line in the south, Maules Creek to the north-east and the central range of hills in the west. The 'Willeroi' property continues to the east of Maules Creek where the terrain rises steeply to an escarpment. Similarly, steep terrain occurs to the west of 'Willeroi' in Mount Kaputar National Park and to the north onto cleared land around Lagoon Mountain. In essence, 'Willeroi' comprises an amphitheatre encircled by a rim of steep wooded terrain.

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### 1.2.1 Topography and Drainage

The main watercourses on the study area are Maules Creek and Teatree Gully. Maules Creek drains the eastern side of the central range which includes all of the north east and southern blocks of the study area. Maules Creek has a low gradient throughout the study area, falling only approximately 90 metres (m) from north to south. Teatree Gully parallels the central range on its western side and drains much of the western block. The upper reaches of Stony Creek drain the western third of the western block through Mount Kaputar National Park before joining Maules Creek to the north of Leard State Forest.

Altitudes in the study area range from 450 m Australian Height Datum (AHD) on the exit of Maules Creek from the area, to 850 m AHD in the north-west corner of the western block. The terrain varies from gently sloping in the cleared areas of the north-east block to very steep on the peaks of the central range and the escarpment in the north-west corner. The topography of the study area is generally rugged with a relief of 100 to 150 m between the valley floor and ridgetops in the western and southern blocks. The highest points within the study area reach 700 m on the divide between Stony Creek and Teatree Gully in the western block, 680 to 700 m in the northern parts of the central range and 630 m in the south of the central range. The rugged topography and steep slopes provide a range of edaphic conditions for plant communities owing to varying exposure to solar radiation and consequent variation in soil moisture retention.

### 1.2.2 Geology and Soils

The geology of the study area is complex and dominated by units of the Carboniferous New England Orogen (NSW Department of Mines 1973). Between Maules Creek and the central range, including the cleared area in the north, the substrate comprises sandstone, minor lenticular oolitic limestone and magnetite sandstone, succeeded by coarse fluvial litharenite, conglomerate, shale and thin coal of the Early Carboniferous Caroda Formation (Pratt 1998). The central range and large parts of the western block are dominated by the Late Carboniferous Rocky Creek Conglomerate comprising orthoconglomerate, minor feldspathic arenite and litharenite, siltstone and intermediate ashflow tuff. Within the Rocky Creek Conglomerate on the western block of the study area are patches of the Playgan Rhyodacite Tuff Member comprising beds of rhyolitic to andesitic crystal and vitric tuff. The Rocky Creek Conglomerate is a major formation in the Mooki – Playgan thrust block between the Namoi River and the Kaputar Range (Pratt 1998). Also present in the western block overlying the Rocky Creek Conglomerate is a large area of the Lark Hill Formation made up of feldspathic arenite, litharenite, subordinate orthoconglomerate and paraconglomerate, siltstone, rhyodacite and dacitic ashflow and airflow tuff. Minor occurrences of the Tertiary Nandewar Volcanic Complex impinge on the study area along the northern margin of the western block. This may include basalt, dolerite, teschenite, nephelenite or trachyte.

### 1.2.3 Climate

The study area lies within the eastern sub-humid region of Australia which has a hot summer and no dry season (NSW National Parks and Wildlife Service [NPWS] 2003). Table 1 gives climate statistics for Barraba Post Office, which at approximately 27 km to the east, is the closest Bureau of Meteorology weather station to 'Willeroi'. Barraba is also similar in altitude (500 m) to Willeroi, whereas the more distant weather stations at Narrabri (50 km west-northwest) and Gunnedah (56 km south-southwest) are at lower altitudes, 212 m and 307 m, respectively. The average annual rainfall of 687.7 millimetres (mm) is higher in summer than in winter with autumn and spring intermediate (Table 1). However, significant rainfall may occur at any time of the year. Relative humidities are moderately high and do not vary greatly through the year (Table 1). In January the 9 am and 3 pm relative humidities average 65 and 39 percent (%), respectively, while the comparable figures for June are 88 and 53%.

Summers are warm to hot with mean daily maximum temperatures of 31.7 degrees Celsius ($^{o}$C) in January, the hottest month. July is the coldest month with a mean minimum temperature of 0.2$^{o}$C. Frosts are common in winter.

**Table 1**
**Climate Statistics for Barraba, NSW (Bureau of Meteorology site number 054003)**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean rainfall (mm) | 87.7 | 77.1 | 54.1 | 39.6 | 42.5 | 46.7 | 43.8 | 39.8 | 43.8 | 63.3 | 72.6 | 77.4 | 687.7 |
| Mean maximum temperature (˚C) | 31.7 | 30.9 | 28.9 | 25.0 | 20.4 | 16.8 | 16.0 | 17.9 | 21.4 | 25.0 | 27.8 | 30.5 | 24.4 |
| Mean minimum temperature (˚C) | 16.4 | 16.1 | 12.7 | 7.9 | 4.3 | 1.6 | 0.2 | 1.1 | 4.2 | 8.3 | 11.8 | 14.6 | 8.3 |
| Mean 9 am relative humidity (%) | 65 | 72 | 72 | 74 | 84 | 88 | 86 | 76 | 67 | 60 | 63 | 61 | 72 |
| Mean 3 pm relative humidity (%) | 39 | 44 | 44 | 41 | 46 | 53 | 50 | 43 | 43 | 43 | 42 | 40 | 44 |

### 1.2.4 Land Use

'Willeroi' appears to have been a grazing property predominantly. The presence of an old shearing shed suggests it was used mainly for wool production for much of its farming history. In more recent years, the main enterprise was cattle grazing. There is no extant evidence of pasture improvement or cropping having taken place. The grassland areas remain dominated by native grass species indicating grazing was based on native pastures. There are many farm dams scattered across the entire property showing that grazing occurred throughout. The central flatter parts of the property have been permanently cleared of the original native tree and shrub cover, and now comprise extensive native grasslands with remnant trees and shrubs largely confined to the watercourses. The more rugged surrounding areas have been subject to periodic cycles of clearing and regeneration, with evidence of considerable felling and windrowing of trees by bulldozers around 15 to 20 years ago in the western and southern blocks. Older windrows, perhaps 30 to 50 years old, occur in some places. Consequently, much of the vegetation in the western and southern blocks comprises 15 to 20 year old regeneration. Within the regeneration are small patches of generally flat native grassland where regeneration has been suppressed by grazing and/or machinery.

**Plates 1 and 2. Windrows of felled timber in regenerating woodland.**

## 1.3 BOTANICAL/BIOGEOGRAPHIC REGIONS

The study area occurs in the east of the North West Slopes Botanical Division (Anderson 1968; Harden [Ed.] 1990-2002) close to the southern side of the Nandewar Range extension of the Northern Tablelands Botanical Division. It also lies just within the western side of the Nandewar Bioregion near the border with Brigalow Belt South Bioregion as defined originally by Thackway and Cresswell (1995). The Nandewar Bioregion occupies much of the higher parts of the North West Slopes of NSW from the upper Hunter Valley into southern Queensland. It occupies 2.7 million ha, with 2.07 million ha in NSW. The site also occurs within the Maules sub-catchment of the Namoi Catchment Management Authority (CMA) area.

# 2 METHODS

The vegetation survey was carried out over 12 days in the periods 25 to 29 May 2011 and 1, 4, 6, 8 to 11 August 2011. The survey encompassed all patches of native vegetation within the study area in order to sample and identify all communities present. All habitat types were surveyed to maximise the chances of finding populations of any threatened species. Complete coverage of the area was facilitated by aerial photography showing remnant vegetation and access tracks. Four wheel drive access was available via farm access tracks through most of the area. Areas inaccessible by vehicle were traversed on foot.

## 2.1 VEGETATION SAMPLING

Three methods of documenting the vegetation were employed; quadrat sampling, spot sampling and random meanders. These methods are detailed below. Figure 2 shows the locations of flora sample sites.

### 2.1.1 Quadrat Sampling

Twenty-five quadrat sites were sampled over the study area (Figure 2). Within these, the dominant species in each vegetation stratum were recorded, with an estimate of the percentage of the ground surface covered by their canopies. A list of all vascular plant species present within the quadrat was also made with each being assigned a cover abundance rating using a modified Braun-Blanquet scale (Table 2). Details recorded for each site included its Global Positioning System (GPS) position, landform, physiography, soil characteristics, disturbance, vegetation structural formation and general comments. Quadrat plots were stratified across all predominantly native vegetation communities in proportion to their representation on the study area (Table 3).

**Table 2**
**Modified Braun-Blanquet Cover Abundance Rating Scale**

| Rating | Percent Ground Cover |
|---|---|
| 1 | <1 (and rare) |
| 2 | <1 (and common) |
| 3 | 1 - 5 |
| 4 | 6 - 25 |
| 5 | 26 - 50 |
| 6 | 51 - 75 |
| 7 | 76 - 100 |

### 2.1.2 Spot Sampling

Spot samples were used as a rapid means of documenting sites of interest, for example around occurrences of uncommon species or niche habitats. Some 21 spot samples were conducted (Figure 2, Table 3). Spot samples listed all vascular plants within an approximately 15 m radius of the central point at which a GPS reading was taken. The dominant tree and shrub species were also noted. Brief notes were taken on site characteristics, the condition of the vegetation and any disturbance.

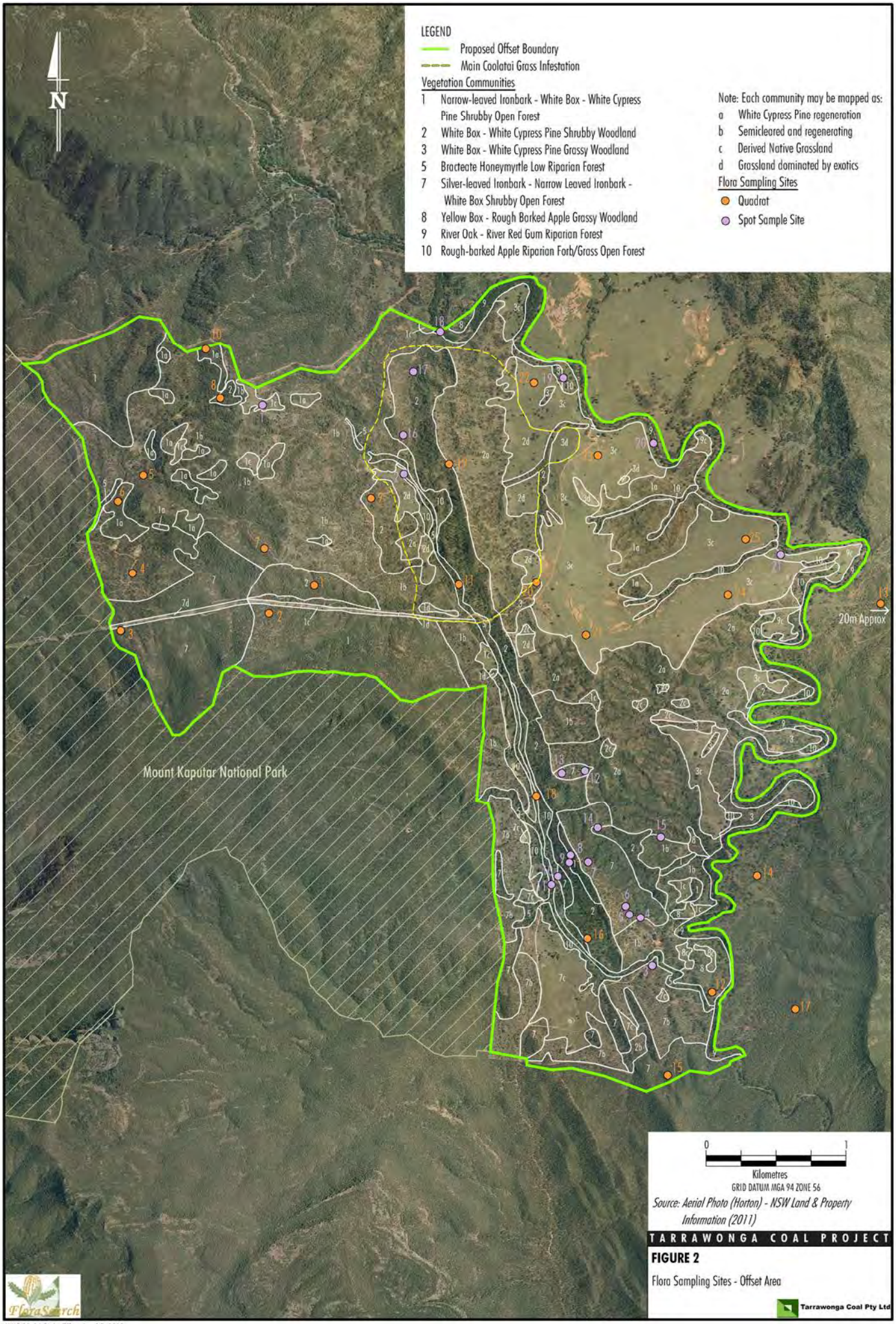


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**Table 3**
**Sampling Effort per Vegetation Community**

| Community Number[1] | Community Name | Quadrat Numbers | Spot Samples |
|---|---|---|---|
| 1 | Narrow-leaved Ironbark - White Box - White Cypress Pine shrubby open forest | 2, 13, 17 | 8 |
| 1a | Narrow-leaved Ironbark - White Box - White Cypress Pine shrubby open forest (White Cypress Pine regeneration) | 6, 10 | |
| 1b | Narrow-leaved Ironbark - White Box - White Cypress Pine shrubby open forest (Semicleared and regenerating) | 4, 5, 7 | |
| 1c | Narrow-leaved Ironbark - White Box - White Cypress Pine shrubby open forest (Derived Native Grassland) | | 1 |
| 2 | White Box - White Cypress Pine shrubby woodland | 1, 8, 9, 16, 19 | 9, 14, 16, 17 |
| 2a | White Box - White Cypress Pine shrubby woodland (White Cypress Pine regeneration) | | 15 |
| 3 | White Box - White Cypress Pine grassy woodland | 20 | |
| 3c | White Box - White Cypress Pine grassy woodland (Derived Native Grassland) | 21, 22, 23, 24, 25 | |
| 5 | Bracteate Honeymyrtle low riparian forest | 11, 18 | 11 |
| 7 | Silver-leaved Ironbark - Narrow-leaved Ironbark - White Box shrubby open forest | 3, 15 | 4, 5, 6, 7, 10, 12, 13 |
| 7b | Silver-leaved Ironbark - Narrow-leaved Ironbark - White Box shrubby open forest (Semicleared and regenerating) | | 3 |
| 8 | Yellow Box - Rough-barked Apple grassy woodland | 12, 14 | |
| 9 | River Oak - River Red Gum riparian forest | | 18, 20, 21 |
| 10 | Rough-barked Apple riparian forb/grass open forest | | 2, 19 |

[1] Communities are numbered to correspond with equivalent vegetation types on the Tarrawonga Coal Project area. Community numbers 4 and 6 that occur on the Tarrawonga Coal Project area are absent from 'Willeroi'.

### 2.1.3 Random Meanders

Random meanders were used for threatened flora species (DEC 2004). 'Random meander' describes the nature of the search which is a randomly directed walk through habitat considered likely to support populations of the targeted species. The random meanders in this survey were targeted to the known habitats described in fact sheets and profiles of threatened species published on the websites of the NSW Office of Environment and Heritage (OEH) and Commonwealth Department of Environment, Water, Population and Communities (DSEWPaC), as well as on the website of the Royal Botanic Gardens Sydney. The species targeted are given in Table 4. Random meanders were conducted by one person walking through the larger blocks of bushland and extended for 30 minutes or more duration. In all meanders, any species not previously seen were recorded as opportunistic sightings.

## 2.2 VEGETATION MAPPING

The approximate distribution of each vegetation community was mapped onto high resolution colour aerial photos of the study area as each part was visited in May 2011. The field mapping was later refined by air photo interpretation in the office. The draft mapping was ground truthed and further refined in the field in August 2011.

## Table 4
## Threatened Plant Species that may Potentially Occur on the Study Area

| Family Name | Scientific Name | Conservation Status | | Habitat | Distribution | Likelihood of Occurrence |
|---|---|---|---|---|---|---|
| | | TSC Act[1] | EPBC Act[2] | | | |
| Apocynaceae | *Tylophora linearis* | V | E | Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla* and *Allocasuarina luehmannii* (NSW Department of Environment and Conservation [DEC] 2005a). On coarse-grained sediments. | Distributed to the west of the study area from the Pilliga Scrub to Peak Hill and Dubbo. | Low (Known communities and soils absent from study area) |
| Brassicaceae | *Lepidium aschersonii* | V | V | In NSW, the Spiny Peppercress is usually found on grey loam gilgai soils, on ridges between the gilgai depressions (Bower, unpublished; DEC 2005b). Around Narrabri it is found in open to dense Brigalow (*Acacia harpophylla*) communities with a sparse grassy understorey (*ibid.*). In Central Western NSW it occurs mainly in communities dominated by Belah (*Casuarina cristata*), but also in Bull Mallee (*Eucalyptus behriana*) woodland and Grey Box (*Eucalyptus microcarpa*)/Buloke (*Allocasuarina luehmannii*) woodland (Bower unpublished). | Distributed on the Central West Slopes in the Barmedman - West Wyalong - Lake Cowal area (Bower, unpublished) and near Narrabri on the North West Plains (DEC 2005b). Recorded recently in the Leard State Conservation Area to the west of the study area (OEH 2011). | Low (Habitat absent from study area) |
| Cyperaceae | *Cyperus conicus* | E | - | In NSW this species is known from open woodland on sandy soils where it grows with other dryland sedges (DEC 2005c). | It occurs in the Pilliga Scrub, North east of Narrabri and near the Queensland border in the eastern parts of the NSW North West Plains Botanical Division (NSW Flora Online 2011). | Low (Suitable habitat does not appear to occur on the study area) |
| Fabaceae | *Pultenaea setulosa* | - | V | This species (as *Pultenaea* sp. I) is reported to occur on volcanic soils (Weston 1991). Parsons Brinkerhoff (2010) recorded extensive populations in the centre and west of Leard State Forest. The habitat of *P. setulosa* in Leard State Forest is steep south-facing gullies which are more shaded and retain more moisture than the surrounding gentler terrain. | Occurs in the Nandewar Range (Mount Kaputar National Park) (Weston 1991) and the southern slopes of the Willowtree Range in Leard State Forest (Parsons Brinkerhoff 2010). Scattered records occur in the wider region including a concentration near Nundle. | High (Lack of preferred soils and steep sheltered terrain, but proximity of other records suggests it may have potential to occur) |
| | *Swainsona murrayana* | V | V | Occurs on flat inland floodplains and depressions on clay-based soils, ranging from grey, red and brown cracking clays to red-brown earths and loams (DEC 2005d). | Occurs principally on the NSW South West Plains with a few records on the margins of the NSW North West Plains and NSW North West Slopes Botanical Divisions (NSW Flora Online 2011). There appear to be no records from the Liverpool Plains. | Low (Habitat absent from study area) |
| Orchidaceae | *Diuris tricolor* | V | - | It occurs in Box - Gum Woodlands and White Cypress Pine forests, generally on sandy soils derived from granite or sandstone. The understorey is usually grass dominated with a variety of native herbs (DEC 2005e). | Found sporadically on the western slopes and upper Hunter Valley of NSW from south of Narranderra to the Queensland border (DEC 2005e). A search of various databases in June 2011 (OEH Atlas of NSW Wildlife and Royal Botanic Gardens Sydney 2010) did not return any records for this species within 200 km of the study area. | Low (A widespread species, but favours coarse-grained sandy soils which are absent from the study area) |
| | *Prasophyllum* sp. Wybong | - | CE | Occurs on generally fertile soils in native grasslands and grassy woodlands (Threatened Species Scientific Committee [TSSC] 2009a). Soils on the study area have generally low fertility, except on the valley floor, where farming practices would likely have eliminated the species. | Known from seven populations between Tenterfield and Yeoval. Study area is within the species' distribution. | Low (Lack of suitable soils) |

## Table 4 (Continued)
## Threatened Plant Species that may Potentially Occur on the Study Area

| Family Name | Scientific Name | Conservation Status | | Habitat | Distribution | Likelihood of Occurrence |
|---|---|---|---|---|---|---|
| | | TSC Act[1] | EPBC Act[2] | | | |
| Orchidaceae | *Pterostylis cobarensis* | V | V | Habitats are eucalypt woodlands, open mallee or *Callitris* shrublands on low stony ridges and slopes in skeletal sandy-loam soils (DEC 2005f). Such habitats are absent from the study area. | Recorded mainly west of the study area, although there is a record from Narrabri (DEC 2005f). | Low (Lack of suitable soils) |
| Poaceae | *Dichanthium setosum* | V | V | The main populations are on heavy black soils derived from basalt (DEC 2005g). It has also been recorded from stony red-brown hard-setting loams over a clay subsoil (TSSC 2008a). It is often found in disturbed areas including roadsides, cleared woodlands, grazing paddocks or highly disturbed sites. It is known to occur with White Box (*Eucalyptus albens*), which occurs on the study area. | Principally known from the New England Tableland, but also occurs on the NSW North West Slopes, NSW North West Plains and NSW Central West Slopes (TSSC 2008a). | Low (Lack of suitable soils) |
| | *Digitaria porrecta* | E | E | Soils are usually fertile, dark and fine textured with some degree of seasonal cracking (TSSC 2008b). Favours native grassland, woodlands or open forest with a grassy understorey (DEC 2005h). Suitable soils for this species are most likely derived from erosion of basalt and are absent from the study area. | On the North West Slopes and Plains from near Moree south to Tambar Springs and from Tamworth to Coonabarabran (DEC 2005h). | Low (Lack of suitable soils) |
| | *Homopholis belsonii* | - | V | Occurs in a variety of landscape positions and soil types from rocky hills to alluvial flats (TSSC 2008c). | Occurs between Wee Waa, Goondiwindi and Glen Innes (TSSC 2008c), well outside the study area. | Low (Lack of suitable soils) |
| Rhamnaceae | *Pomaderris queenslandica* | E | - | There is little information available on this species. According to DEC (2005i), it is found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks. | Known from a few locations on the New England Tablelands and North West Slopes and several locations on the NSW north coast. It is reported by Royal Botanic Gardens Sydney and OEH to occur in Leard State Forest and Mount Kaputar National Park. | High |
| Rutaceae | *Philotheca ericifolia* | - | V | Occurs chiefly in dry sclerophyll forest and heath on damp sandy flats and gullies (Weston and Porteners 1991 [as *Eriostemon ericifolius*]). Habitats include heath, open woodland, dry sandy creek beds, and rocky ridge and cliff tops (TSSC 2008d). Tends to occur on coarse-grained sediments, which are absent from the study area. | Occurs from the upper Hunter Valley and Pilliga to the Peak Hill, Dubbo and West Wyalong districts of NSW. The study area is east of its known range. | Low (lack of suitable soils and habitat) |
| Santalaceae | *Thesium australe* | V | V | Occurs in grassland or grassy woodland. Often found in damp sites in association with Kangaroo Grass (*Themeda australis*) (DEC 2005j). Can be found on a wide variety of soils derived from sedimentary, igneous and metamorphic rocks as well as recent alluvium (Victorian Department of Sustainability and Environment [DSE] 2003). | Occurs in small populations scattered across the western slopes, tablelands and coast of NSW (DEC 2005j). In the wider region, there are concentrations in Kaputar National Park and around Inverell. | Medium (Main host plant is rare in the study area, but may once have been more abundant) |
| Surianaceae | *Cadellia pentastylis* | V | V | Grows in dry rainforest, semi-evergreen vine thickets and sclerophyll ecological communities forming a closed or open canopy with eucalypt and cypress pine species (TSSC 2008e). Grows on low to medium nutrient soils of sandy clay or clayey consistencies, with a typical soil profile having a sandy loam surface layer, grading from a light clay to a medium clay with depth (DEC 2005k). | Western edge of the NSW North West Slopes including the Gunnedah and Narrabri areas. | Low (There are no records for this obvious species close to the study area) |

[1] Threatened species status under the NSW *Threatened Species Conservation Act, 1995* (TSC Act) (current to 8 September 2011).

[2] Threatened species status under the Commonwealth *Environment Protection and Biodiversity Conservation Act*, *1999* (EPBC Act) (current to 8 September 2011).

CE Critically Endangered

E Endangered

V Vulnerable

## 2.3 SPECIES LISTING

All observed plant species were recorded, whether identified on formal sample sites or not. Some less common plants were only observed on one occasion whilst moving between sample sites or on random meanders. Where plants could not be quickly identified in the field, a sample was taken for later examination. Samples were preserved in a plant press and identified later using a binocular microscope and flora keys. The principal reference was the Flora of New South Wales (Harden [Ed.] 1990-2002) and it is used as the basis for nomenclature in this report along with any updates on the PlantNet web site of the Royal Botanic Gardens Sydney Trust. Any specimens that could not be conclusively identified were sent to the Royal Botanic Gardens Sydney for specialist diagnosis.

## 2.4 POTENTIAL THREATENED FLORA SPECIES AND COMMUNITIES

Tables 4 and 5 are adapted from the Tarrawonga Coal Project Flora Assessment and provide information on potential threatened flora species and communities that may occur on 'Willeroi' (FloraSearch 2011). The lists of potential species and communities were derived from database searches as described in FloraSearch (2011).

**Table 5**
**Potential Threatened Plant Communities on the Study Area**

| Community name | | Conservation Status | | Known Distribution | Potential Habitats | Likelihood of Occurrence |
|---|---|---|---|---|---|---|
| TSC Act[1] | EPBC Act[2] | TSC Act[1] | EPBC Act[2] | | | |
| Cadellia pentastylis (Ooline) community in the Nandewar and Brigalow Belt South bioregions | - | E | - | Seven main locations on the North West Slopes in NSW, between Narrabri and the Queensland border, and also in Queensland (DEC 2005l). | Occurs on undulating terrain on a variety of soil types, between 300 to 450 m altitude (DEC 2005l).<br>The southern limit is Black Jack Mountain, 7.5 km west-southwest of Gunnedah (Curran and Curran 2005). | Low<br>(Not known on or near the study area despite numerous studies) |
| Fuzzy Box on alluvials of the South West Slopes, Darling Riverine Plains and the Brigalow Belt South Bioregions | - | E | - | Mainly in the Dubbo-Narromine-Parkes-Forbes area (DEC 2005m). | Occurs on brown loam or clay, alluvial or colluvial soils on prior streams and abandoned channels or slight depressions on undulating plains or flats of the western slopes, often upslope of frequently inundated River Red Gum communities. It also occurs on colluvial soils on lower slopes and valley flats (DEC 2005m). | Low<br>(Not known on or near the study area despite numerous studies) |
| Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (Inland Grey Box Woodland) | Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of Eastern Australia (equivalent to Inland Grey Box Woodland) | E | E | Lower western slopes and plains from the Victorian border to Queensland (DEC 2005n). At a Commonwealth level it also occurs in Victoria and South Australia (TSSC 2009b). | Inland Grey Box Woodland occurs on fertile soils of the western slopes and plains of NSW (DEC 2005n). It often occurs on productive soils derived from alluvial or colluvial materials but may occur on a range of other substrates (TSSC 2009b). | Moderate |
| Native vegetation on Cracking Clay Soils of the Liverpool Plains | Natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Queensland | E | CE | NSW community is located around Coonabarabran, Gunnedah, Murrurundi, Narrabri, Tamworth and Quirindi on the North West Slopes and Plains (DEC 2005o). | Occurs on the highly fertile cracking clay soils of the Liverpool Plains (DEC 2005o). Generally occurs on flat to low slopes, of no more than 5% (or less than 1 degree) inclination (TSSC 2009c). | Low<br>(Suitable soils are absent or rare on the study area) |
| Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray Darling Depression, Riverina and NSW South western Slopes Bioregions | Weeping Myall Woodlands | E | E | Scattered across the eastern parts of the alluvial plains of the Murray-Darling river system (DEC 2005p) on the NSW western slopes and plains. | Occurs on red-brown earths and heavy textured grey and brown alluvial soils (DEC 2005p) that become waterlogged in winter. | Low<br>(The study area is upslope of landscapes suitable for this community) |

**Table 5 (Continued)**
**Potential Threatened Plant Communities on the Study Area**

| Community name | | Conservation Status | | Known Distribution | Potential Habitats | Likelihood of Occurrence |
|---|---|---|---|---|---|---|
| TSC Act[1] | EPBC Act[2] | TSC Act[1] | EPBC Act[2] | | | |
| White Box, Yellow Box, Blakely's Red Gum Woodland (Box - Gum Woodland) | White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grasslands (equivalent to Box - Gum Woodland) | E | CE | Occurs mainly on the tablelands and western slopes of NSW (DEC 2005q). This community has been identified on or near the study area by previous studies (Geoff Cunningham Natural Resource Consultants [GCNRC] 2005; Ecological Australia 2010; Parsons Brinkerhoff 2010). | Generally occurs on fertile lower parts of the landscape where resources such as water and nutrients are abundant. | High |

[1] Threatened Ecological Community status under NSW *Threatened Species Conservation Act, 1995* (current to 8 September 2011).

[2] Threatened Ecological Community status under Commonwealth *Environment Protection and Biodiversity Conservation Act*, *1999* (current to 8 September 2011).

E Endangered

CE Critically Endangered

# 3 RESULTS AND DISCUSSION

## 3.1 VEGETATION COMMUNITIES

The survey revealed the presence on the study area of eight native vegetation communities (Table 6, Figure 3). The vegetation communities in Table 6 are numbered to correspond to the numbering of equivalent vegetation types on the Tarrawonga Coal Project area, where present. Communities 4 and 6 at Tarrawonga are absent from 'Willeroi'. Conversely, Communities 7 to 10 at 'Willeroi' do not occur at Tarrawonga. The distribution of each community at 'Willeroi' is shown on Figure 3. Table 6 shows the nearest equivalent communities in the most recently developed regional classification for the Namoi CMA area (NSW Department of Environment, Climate Change and Water [DECCW] 2008) and for the Nandewar Bioregion (Benson *et al*. 2010).

Variants are recognised within several communities (Table 6) and represent condition classes reflecting past disturbance and the nature of the regeneration currently present (Figure 3). These condition classes may be widespread on the study area, and are designated by the letters a, b, c and d after the community number, as follows:

a. This vegetation condition class comprises dense monocultural regeneration of White Cypress Pine. Most patches comprise trees of relatively uniform age suggesting large patches underwent uniform regeneration following single clearing events.

b. This condition class comprises regeneration of diverse components of the original community following clearing or semi-clearing, such that, in time, full recovery of the original diversity can be expected.

c. Vegetation condition class 'c' comprises derived native grasslands that have resulted from clearing of the original community and long-term suppression of tree and shrub regeneration by grazing or management.

d. Communities designated 'd' are grassland dominated by Coolatai Grass (*Hyparrhenia hirta*).

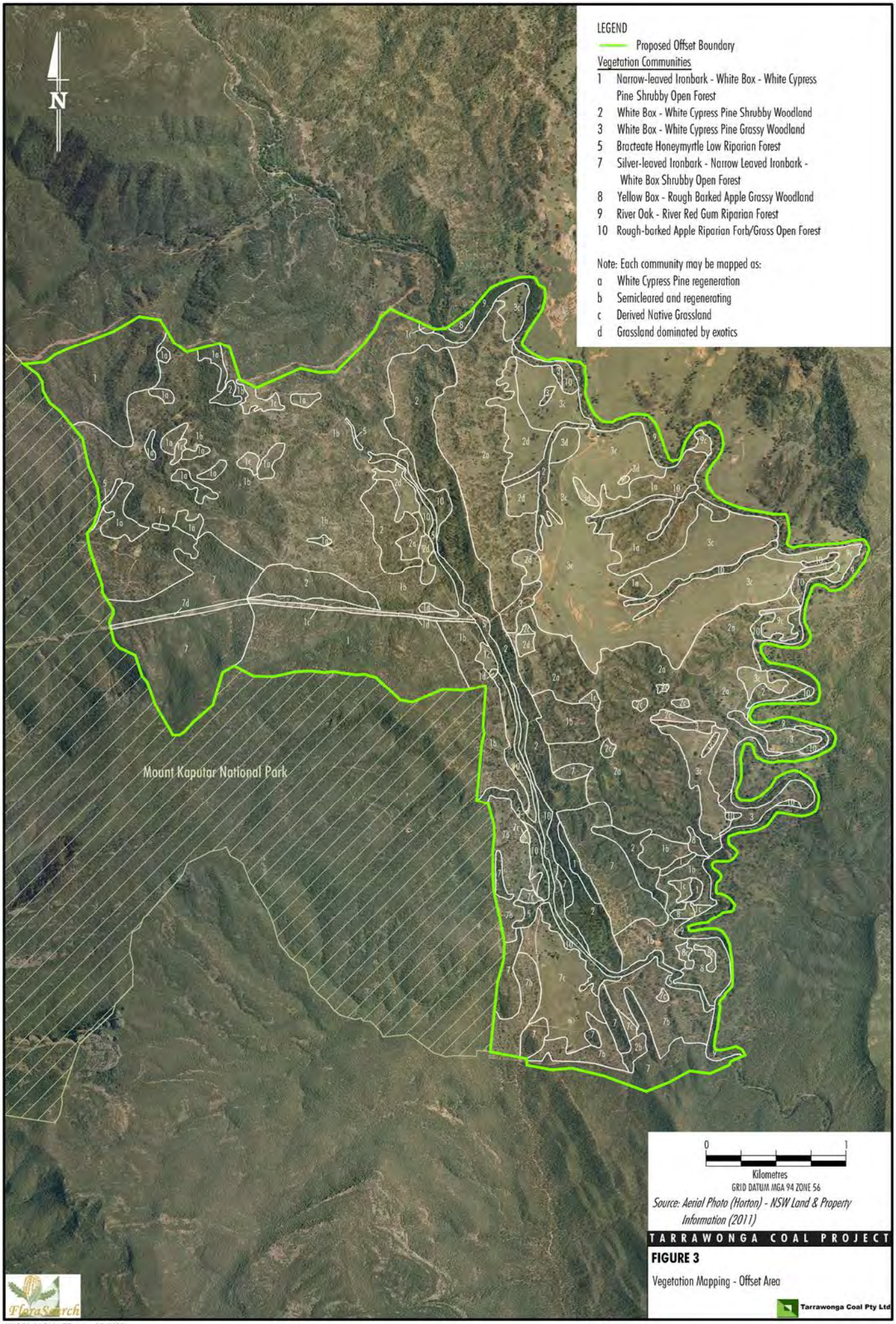
Vegetation patches considered in good condition with high native plant diversity and high resilience are shown in Figure 3 without a letter suffix.

## 3.2 GENERAL DESCRIPTION OF THE VEGETATION ON 'WILLEROI'

The vegetation of 'Willeroi' is shaped by the landscape, geology, altitude and climate. The study area comprises four major elements:

1. The straight north-south trending 'central range' divides the property physically and geologically into eastern and western sections. The central range comprises sandstones of the Middle Carboniferous Clifden Formation.
2. Between the central range and Maules Creek the soils are derived from Lower Carboniferous rocks of the Caroda Formation in the north east and southern blocks.
3. In the western block is a complex mosaic of the Middle Carboniferous Rocky Creek Conglomerate and the sandstones, conglomerates and pyroclastics of the Lark Hill Formation.
4. Superimposed on the above are the alluvial soils associated with Maules Creek and Teatree Gully.

The following general description of the 'Willeroi' vegetation should be read in conjunction with Figure 3.


N
LEGEND
Proposed Offset Boundary
Vegetation Communities
1 Narrow-leaved Ironbark - White Box - White Cypress Pine Shrubby Open Forest
2 White Box - White Cypress Pine Shrubby Woodland
3 White Box - White Cypress Pine Grassy Woodland
5 Bracteate Honeymyrtle Low Riparian Forest
7 Silver-leaved Ironbark - Narrow Leaved Ironbark - White Box Shrubby Open Forest
8 Yellow Box - Rough Barked Apple Grassy Woodland
9 River Oak - River Red Gum Riparian Forest
10 Rough-barked Apple Riparian Forb/Grass Open Forest
Note: Each community may be mapped as:
a White Cypress Pine regeneration
b Semicleared and regenerating
c Derived Native Grassland
d Grassland dominated by exotics
Mount Kaputar National Park
0
1
Kilometres
GRID DATUM MGA 94 ZONE 56
Source: Aerial Photo (Horton) - NSW Land & Property Information (2011)
TARRAWONGA COAL PROJECT
FIGURE 3
Vegetation Mapping - Offset Area
Tarrawonga Coal Pty Ltd
FloraSearch

## Table 6
## Vegetation Communities Recognised within the Study Area

| Community Number | Community Name | | | Vegetation Formation | Comment |
|---|---|---|---|---|---|
| | FloraSearch (this report) | Nearest Equivalent Biometric Vegetation Type (DECCW 2008) | Nearest Equivalent NSWVCA Community (Benson *et al*. 2010) | | |
| 1 | Narrow-leaved Ironbark - White Box - White Cypress Pine shrubby open forest | White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | Narrow-leaved Ironbark - Cypress Pine - White Box shrubby open forest in the Brigalow Belt South and Nandewar Bioregions (NSWVCA community 592) | Dry Sclerophyll Forests (Shrubby sub formation) | |
| 1a | | | | | |
| 1b | | | | | |
| 1c | | | | | |
| 1d | | | | | |
| 2 | White Box - White Cypress Pine shrubby woodland | White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions | White Box - White Cypress Pine shrubby hills open forest mainly in the Nandewar Bioregion (NSWVCA community 588) | Dry Sclerophyll Forests (Shrub/grass sub formation) | |
| 2a | | | | | |
| 2b | | | | | |
| 2c | | | | | |
| 2d | | | | | |
| 3 | White Box - White Cypress Pine grassy woodland | White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South and Nandewar Bioregions (NSWVCA community 435) | Grassy Woodlands | This community is part of the Box - Gum Woodland endangered ecological community (EEC) (TSC Act) and the Box - Gum Grassy Woodland and Derived Grassland critically endangered ecological community (CEEC) (EPBC Act). |
| 3c | | | | | |
| 3d | | | | | |
| 5 | Bracteate Honeymyrtle low riparian forest | Bracteate Honey Myrtle riparian low forest/shrubland of rich soil depressions in the Brigalow Belt South Bioregion | Bracteate Honey Myrtle riparian low forest/shrubland of rich soil depressions in the Brigalow Belt South Bioregion (NSWVCA community 112) | Forested Wetlands | No vegetation type equivalent to Community 5 in this report is documented in the Namoi CMA area by DECCW (2008), although a similar community is documented for the Border Rivers/Gwydir CMA area [DECCW 2008]). Similarly, the nearest equivalent NSWVCA community Black Tea-tree - River Oak - Wilga riparian low forest/shrubland wetland of rich soil depressions in Brigalow Belt South Bioregion, NSWVCA community 112 [Benson *et al*. 2010]), it differs significantly from that on the study area. |
| 7 | Silver-leaved Ironbark - Narrow-leaved Ironbark - White Box shrubby open forest | White Box - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion | White Box - Cypress Pine - Silver-leaved Ironbark shrub grass open forest/woodland of the northern Brigalow Belt South and Nandewar Bioregions (NSWVCA community 597). | Dry Sclerophyll Forests (Shrubby subformation) | |
| 7b | | | | | |
| 7c | | | | | |
| 7d | | | | | |
| 8 | Yellow Box - Rough-barked Apple grassy woodland | Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion | Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion (NSWVCA community 437) | Grassy Woodlands | NSWVCA community 599 (Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South and Nandewar Bioregions) may also fit this vegetation type.<br>This community is part of the Box - Gum Woodland EEC (TSC Act) and the Box - Gum Grassy Woodland and Derived Grassland CEEC (EPBC Act). |
| 8c | | | | | |

## Table 6 (Continued)
## Vegetation Communities Recognised within the Study Area

| Community Number | Community Name | | | Vegetation Formation | Comment |
|---|---|---|---|---|---|
| | FloraSearch (this report) | Nearest Equivalent Biometric Vegetation Type (DECCW 2008) | Nearest Equivalent NSWVCA Community (Benson *et al*. 2010) | | |
| 9 | River Oak - River Red Gum riparian forest | River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84) | River Oak - Rough-barked Apple - Red Gum - Box riparian tall woodland (wetland) of the Brigalow Belt South and Nandewar Bioregions (NSWVCA community 84) | Forested Wetlands | |
| 9c | | | | | |
| 10 | Rough-barked Apple riparian forb/grass open forest | Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion | Rough-barked Apple - Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South West Slopes and Brigalow Belt South Bioregions (NSWVCA community 281) | Grassy Woodlands | NSWVCA community 544 (Rough-barked Apple ± Cypress Pine ± Blakely's Red Gum riparian open forest/woodland of the Nandewar and New England Tableland Bioregions) may also fit this vegetation type. |

a - White Cypress Pine regeneration.

b - Semicleared and regenerating.

c - Derived Native Grassland.

d - Grassland dominated by exotics.

NSWVCA = NSW Vegetation Classification and Assessment.

The most common trees on the study area are White Box, White Cypress Pine, Narrow-leaved Ironbark and Silver-leaved Ironbark. Various combinations of the three eucalypt species define the major vegetation communities on the study area (Table 6). White Cypress Pine occurs throughout in combination with all three eucalypt species. Similarly, White Box is prominent throughout the study area and with White Cypress Pine forms a simple two species association over large areas. The latter two species also associate commonly with Narrow-leaved Ironbark in a co-dominant relationship. However, White Box is usually a sub-dominant with Silver-leaved Ironbark, which most often associates with Narrow-leaved Ironbark.

Most of the western block is dominated by Community 1 in which White Box and White Cypress Pine associate with Narrow-leaved Ironbark. Exceptions are a large block of Community 7 (Silver-leaved Ironbark – Narrow-leaved Ironbark – White Box shrubby open forest) in the south-west corner and a steep south-facing slope dominated by Community 2 (White Box – White Cypress Pine shrubby woodland) just north of the 132 kV power line easement.

The central range of the study area slopes steeply to the east and west. It is dominated by White Box – White Cypress Pine shrubby woodland (Community 2) on its upper slopes, along with small occurrences of Community 1.

Woodland areas of the north-east block are also dominated by White Box and White Cypress Pine. The original trees have been thinned on the steeper slopes of the central range and remnant patches are Community 2 (White Box – White Cypress Pine shrubby woodland). However, the flatter, lower slopes have been almost completely cleared and are considered to originally have been Community 3 (White Box – White Cypress Pine grassy woodland). Some climax remnants of this community exist around the margins of the grassland and also within it.

The northern half of the southern block, east of the central range, is also dominated by White Box and White Cypress Pine. The terrain is rugged, dissected and supports Community 2 (White Box – White Cypress Pine shrubby woodland) with some areas of Community 1. As in the north-east block on the same geology, Community 2 (shrubby White Box) grades into Community 3 (grassy White Box) towards Maules Creek, although the areas of grassy woodland are much smaller than further north. The southern parts of the southern block are dominated by Community 7 (Silver-leaved Ironbark – Narrow-leaved Ironbark – White Box shrubby open forest) with some Community 1 and Community 2.

Quite different communities occupy the alluvial flats and riparian zones of the major watercourses, Maules Creek and Teatree Gully. The much larger Maules Creek is lined by Community 9 (River Oak – River Red Gum), while Teatree Gully and tributaries are dominated by Bracteate Honeymyrtle (Community 5). The alluvial flats beside both creeks and some of their tributaries may be dominated by a grassy Rough-barked Apple Riparian Forb/Grass open forest (Community 10) which may extend up the sheltered west facing lower slopes of the central range. Scattered along Maules Creek on alluvial flats, tributary gullies and colluvial lower slopes are patches of Yellow Box – Rough-barked Apple grassy woodland (Community 8).

Tables 7 to 14 provide descriptions of each plant community specific to the study area using sample data collected in this survey. Plates 3 to 12 provide indicative photos of the vegetation communities. Figure 2 provides the location of quadrats within each of the vegetation communities and therefore also the photo locations referred to in the plates.

**Table 7**
**Community 1. Narrow-leaved Ironbark - White Box - White Cypress Pine Shrubby Open Forest**

**No. of quadrats: 8**
**No. of spot samples: 2**

**Landscape position:** This community principally occupies hilly terrain. It is the dominant community in the western block with smaller occurrences in the southern block and on the higher ridgetops of the central range.

**Dominant species**

***Trees:*** The community is dominated by Narrow-leaved Ironbark *(Eucalyptus crebra)*, White Cypress Pine *(Callitris glaucophylla)* and White Box *(Eucalyptus albens)* in various proportions. On sites with shallow or skeletal soils, Hill Red Gum (*Eucalyptus dealbata*) may be locally common.

***Shrubs:*** Characteristic and common shrubs of Community 1 are Cough Bush *(Cassinia laevis), Cassinia quinquefaria,* Sticky Daisy-bush *(Olearia elliptica),* Hoary Guinea Flower *(Hibbertia obtusifolia),* Urn-heath *(Melichrus urceolatus),* Large Tick-trefoil *(Desmodium brachypodum),* Velvet Mock Olive *(Notelaea microcarpa* var. *microcarpa),* Sticky Hop Bush *(Dodonaea viscosa* subsp*. angustifolia)* and Poison Pimelea *(Pimelea neo-anglica).* Shrubs may form sparse to dense thickets throughout the community.

***Ground covers:*** Ground cover tends to be relatively sparse in this community. The most frequent species are Bristly Cloak Fern *(Cheilanthes distans),* Poison Rock Fern *(Cheilanthes sieberi* subsp. *sieberi),* Native Carrot *(Daucus glochidiatus* Form F*),* Yellow Burr-daisy *(Calotis lappulacea),* Cudweed *(Euchiton sphaericus),* Cobbler's Tack *(Glossocardia bidens),* Fuzzweed *(Vittadinia cuneata* var. *hirsuta),* Small St. John's Wort *(Hypericum gramineum),* Kidney Weed *(Dichondra repens), Geranium* sp., *Galium leptogonium,* Wattle Mat-rush *(Lomandra filiformis* subsp. *filiformis),* Many-flowered Mat-rush *(Lomandra multiflora),* Purple Wire-grass *(Aristida personata),* Wallaby Grass *(Austrodanthonia racemosa* var. *obtusata),* Speargrass *(Austrostipa scabra* subsp. *scabra),* Barbwire Grass *(Cymbopogon refractus),* Slender Bottle-washers *(Enneapogon gracilis),* Brown's Lovegrass *(Eragrostis brownii),* Paddock Lovegrass *(Eragrostis leptostachya)* and Two Coloured Panic *(Panicum simile).*

***Introduced species:*** Introduced species are infrequent in Community 1, the most common being Common Centaury *(Centaurium erythraea).*

**Equivalent Biometric Vegetation Type (DECCW 2008):** White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion.

**Equivalent NSWVCA Vegetation Type (Benson *et al.* 2010):** Narrow-leaved Ironbark - Cypress Pine - White Box shrubby open forest in the Brigalow Belt South and Nandewar Bioregions (NSWVCA community 592).

**Variants:** Community 1 has four variants on the study area:

***Community 1a:*** Regeneration of Community 1 dominated by dense, even-aged White Cypress Pine.

***Community 1b:*** Semicleared and regenerating. Regeneration of Community 1 including all typical canopy dominants.

***Community 1c:*** Derived Native Grassland from Community 1.

***Community 1d:*** Grassland dominated by exotics. Derived from Community 1, but invaded by Coolatai Grass (*Hyparrhenia hirta*).

**Plate 3. Community 1 (Quadrat 17)**

**Plate 4. Community 1a (Quadrat 6)**

**Plate 5. Community 1b (Quadrat 5)**

**Table 8**
**Community 2. White Box - White Cypress Pine Shrubby Woodland**

**No. of quadrats: 5**
**No. of spot samples: 5**

**Landscape position:** Community 2 is the dominant community on the steep slopes of the central range. It also occurs sparingly on steep south-facing slopes and gully sides in the south of the western block and in the southern block. It also occurs in steep-sided gullies in grassland areas of the north east block.

**Dominant species**

***Trees:*** Community 2 is dominated by White Box *(Eucalyptus albens)* and White Cypress Pine *(Callitris glaucophylla).* Other tree species that may occur include Hill Gum (*Eucalyptus dealbata*) on steep rocky slopes at the northern end of the central ridge, occasional small patches of Narrow-leaved Ironbark (*Eucalyptus crebra*) throughout the communities range and Rough-barked Apple (*Angophora floribunda*) which may associate with the community on steep sheltered west facing slopes of the central range and in gully lines.

***Shrubs:*** This community is characterised by high but variable levels of shrubs. The shrubs tend to be most abundant on south or west facing slopes and in steep-sided gullies. The most frequent shrubs are similar to those in Community 1 and include Cough Bush *(Cassinia laevis), Cassinia quinquefaria,* Sticky Daisy-bush *(Olearia elliptica),* Hoary Guinea Flower *(Hibbertia obtusifolia),* Urn-heath *(Melichrus urceolatus),* Large Tick-trefoil *(Desmodium brachypodum),* Western Silver Wattle *(Acacia decora),* Velvet Mock Olive *(Notelaea microcarpa* var*. microcarpa),* Sticky Hop Bush *(Dodonaea viscosa* subsp*. angustifolia)* and Poison Pimelea *(Pimelea neo-anglica).*

***Ground covers:*** The ground cover is generally relatively sparse, although can be more dense on north facing gully sides. Common species include Bristly Cloak Fern *(Cheilanthes distans),* Small St. John's Wort *(Hypericum gramineum),* Kidney Weed *(Dichondra repens),* Smooth Darling-pea *(Swainsona galegifolia), Oncinocalyx betchei,* Wattle Mat-rush *(Lomandra filiformis* subsp. *filiformis),* Blueberry Lily *(Dianella longifolia),* Purple Wire-grass *(Aristida personata),* Speargrass *(Austrostipa scabra* subsp*. scabra),* Barbwire Grass *(Cymbopogon refractus)* and Two Coloured Panic *(Panicum simile).*

***Introduced species:*** Few introduced species occur in Community 2. Common Prickly Pear *(Opuntia stricta)* is widespread in low numbers.

**Equivalent Biometric Vegetation Type (DECCW 2008):** White Box – White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions.

**Equivalent NSWVCA Vegetation Type (Benson *et al.* 2010):** White Box - White Cypress Pine shrubby hills open forest mainly in the Nandewar Bioregion (NSWVCA community 588).

**Variants:** Community 2 has four variants on the study area:

***Community 2a:*** Regeneration of Community 2 dominated by dense, even-aged White Cypress Pine.

***Community 2b:*** Semicleared and regenerating. Regeneration of Community 2 including all typical canopy dominants.

***Community 2c:*** Native Grassland derived from Community 2.

***Community 2d:*** Grassland dominated by exotics. Derived from Community 2, but invaded by Coolatai Grass (*Hyparrhenia hirta*).

**Plate 6. Community 2 (Quadrat 16)**

**Table 9**
**Community 3. White Box - White Cypress Pine Grassy Woodland**

| |
|---|
| **No. of quadrats: 6** |
| **Landscape position:** Community 3 occupies gently sloping terrain principally in the north east block. Most of Community 3 has been cleared historically and is now mainly a derived native grassland. Scattered remnants of the mature community occur within the grassland in the north, and around its margins. Small patches of mature Community 3 occur close to Maules Creek in the east of the southern block, along with some derived grasslands. |
| **Dominant species**<br>**Trees:** Mature examples of Community 3 are dominated by White Box (*Eucalyptus albens*) with White Cypress Pine (*Callitris glaucophylla*).<br>***Shrubs:*** Shrubs are uncommon and scattered in this community. The main species recorded were Small-leaf Bluebush *(Maireana microphylla)* and Poison Pimelea *(Pimelea neo-anglica)*. Less common were Western Silver Wattle (*Acacia decora*), Cooba (*Acacia salicina*) and Sticky Hop-bush (*Dodonaea viscosa* subsp. *angustifolia*).<br>***Ground covers:*** Ground covers tend to be dense in this community, especially in the derived grasslands. The dominant species include Poison Rock Fern *(Cheilanthes sieberi* subsp. *sieberi),* Native Carrot *(Daucus glochidiatus* Form F*),* Common Everlasting *(Chrysocephalum apiculatum),* Carrot Weed *(Cotula australis), Cymbonotus* sp., Cudweed *(Euchiton sphaericus),* Cotton Fireweed *(Senecio quadridentatus),* A Vittadinia *(Vittadinia muelleri),* Kidney Weed *(Dichondra repens),* Native Geranium *(Geranium solanderi* subsp. *solanderi), Goodenia* sp., Ferny Buttercup *(Ranunculus pumilio),* Common Woodruff *(Asperula conferta),* Purple Wire-grass *(Aristida personata),* Speargrass *(Austrostipa scabra* subsp. *scabra),* Windmill Grass *(Chloris truncata),* Queensland Bluegrass *(Dichanthium sericeum),* Paddock Lovegrass *(Eragrostis leptostachya),* Two Coloured Panic *(Panicum simile)* and Slender Rat's Tail Grass *(Sporobolus creber).* The grasses tend to dominate the grassland forms of this community, especially Queensland Bluegrass, Windmill Grass, Purple Wire-grass, Paddock Lovegrass and Slender Rat's Tail Grass.<br>***Introduced species:*** The grassland forms of this community have been heavily grazed in the past and support relatively high numbers of introduced species including Saffron Thistle *(Carthamus lanatus),* Skeleton Weed *(Chondrilla juncea),* Flaxleaf Fleabane *(Conyza bonariensis),* Smooth Catsear *(Hypochaeris glabra),* Flatweed *(Hypochaeris radicata),* Proliferous Pink *(Petrorhagia nanteuilii),* Burr Medic *(Medicago polymorpha),* Narrow-leaved Clover *(Trifolium angustifolium),* Common Centaury *(Centaurium erythraea),* Sweet Briar *(Rosa rubginosa)* and *Verbena caracasana.* |
| **Equivalent Biometric Vegetation Type (DECCW 2008):** White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions. |
| **Equivalent NSWVCA Vegetation Type (Benson *et al.* 2010):** White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South and Nandewar Bioregions (NSWVCA community 435). |
| **Variants:** Community 3 has two variants on the study area:<br>***Community 3c:*** Native Grassland derived from Community 3.<br>***Community 3d:*** Grassland dominated by exotics. Derived from Community 3, but invaded by Coolatai Grass (*Hyparrhenia hirta*). |

**Plate 7. Community 3 (Quadrat 20)**

**Plate 8. Community 3c (Quadrat 23)**

**Table 10**
**Community 5. Bracteate Honeymyrtle Low Riparian Forest**

**No. of quadrats: 2**
**No. of spot samples: 1**

**Landscape position:** Community 5 occurs along the riparian zone of Teatree Gully and its major tributaries on the west side of the central range.

**Dominant species**

The dominant and most characteristic species of this community is Bracteate Honeymyrtle which forms dense thickets over the creek providing close to 100% foliage cover. Below the dense, ten metre high canopy is an open grassy understory with scattered shrubs.

***Trees:*** Emergent or overhanging trees include principally Rough-barked Apple *(Angophora floribunda).* White Box *(Eucalyptus albens),* Kurrajong *(Brachychiton populneus)* and White Cypress Pine *(Callitris glaucophylla)* are also commonly present.

***Low trees:*** Bracteate Honeymyrtle *(Melaleuca bracteata)* is dominant and Velvet Mock Olive *(Notelaea microcarpa var. microcarpa)* may also be present.

***Shrubs:*** Shrubs are usually sparsely distributed. The most characteristic species in this community is Tree Violet *(Melicytus dentatus)*. Other shrubs may include Cough Bush *(Cassinia laevis),* Sticky Daisy-bush *(Olearia elliptica),* Large Tick-trefoil *(Desmodium brachypodum)* and Sticky Hop Bush *(Dodonaea viscosa subsp. angustifolia).*

***Vines:*** Vines are more common in this community than others on the study area and include Headache Vine *(Clematis glycinoides)* and Wombat Berry *(Eustrephus latifolius).*

***Creepers:*** Native Raspberry *(Rubus parvifolius)* is a scrambler that is largely confined to this community. Love Creeper *(Glycine clandestina)* and Glycine *(Glycine tabacina)* are widespread species that may also be present.

***Ground covers:*** The ground cover in this community tends to be dense and grassy. Heavy shading provided by Bracteate Honeymyrtle creates a humid environment favouring species such as Sickle Fern *(Pellaea falcata),* Barbwire Weed *(Nyssanthes diffusa),* Stinging Nettle *(Urtica incisa),* Tussock Grass *(Poa labillardierei)*, Weeping Grass *(Microlaena stipoides)* and Creeping Beard Grass *(Oplismenus imbecillis)*. More widespread species that are also common include Poison Rock Fern *(Cheilanthes sieberi subsp. sieberi),* Kidney Weed *(Dichondra repens), Geranium* sp., Trailing Speedwell *(Veronica plebeia), Carex incomitata,* Spiny-headed Mat-rush *(Lomandra longifolia),* Many-flowered Mat-rush *(Lomandra multiflora),* Wallaby Grass *(Austrodanthonia racemosa* var. *obtusata)* and Slender Bamboo Grass *(Austrostipa verticillata)*.

***Introduced species:*** Community 5 often has large infestations of Greater Beggar's Ticks *(Bidens subalternans)*. Flaxleaf Fleabane *(Conyza bonariensis)* and Sweet Briar *(Rosa rubginosa)* may also be present.

**Equivalent Biometric Vegetation Type (DECCW 2008):** Bracteate Honey Myrtle riparian low forest/shrubland of rich soil depressions in the Brigalow Belt South Bioregion.

**Equivalent NSWVCA Vegetation Type (Benson *et al.* 2010):** Bracteate Honey Myrtle riparian low forest/shrubland of rich soil depressions in the Brigalow Belt South Bioregion (NSWVCA community 112).

**Variants:** None.

**Plate 9. Community 5 (Quadrat 11)**

**Table 11**
**Community 7. Silver-leaved Ironbark - Narrow-leaved Ironbark - White Box Shrubby Open Forest**

| |
|---|
| **No. of quadrats: 2**<br>**No. of spot samples: 8** |
| **Landscape position:** Community 7 occupies undulating to hilly terrain, mainly in the southern half of the southern block and in the south-west corner of the western block. |
| **Dominant species**<br>***Trees:*** The most characteristic species of this community is Silver-leaved Ironbark *(Eucalyptus melanophloia)* which associates commonly with Narrow-leaved Ironbark *(Eucalyptus crebra)* and White Cypress Pine *(Callitris glaucophylla).* White Box (*Eucalyptus albens*) is a less common associate.<br>***Shrubs:*** Most examples of this community on the study area have rather sparse shrub and ground cover layers. The most frequently encountered shrubs are Cough Bush *(Cassinia laevis),* Sticky Daisy-bush *(Olearia elliptica),* Hoary Guinea Flower *(Hibbertia obtusifolia),* Urn-heath *(Melichrus urceolatus),* Large Tick-trefoil *(Desmodium brachypodum),* Western Silver Wattle *(Acacia decora),* Velvet Mock Olive *(Notelaea microcarpa var. macrocarpa)* and Poison Pimelea *(Pimelea neo-anglica).*<br>***Ground covers:*** The sparse ground cover includes Bristly Cloak Fern *(Cheilanthes distans),* Kidney Weed *(Dichondra repens),* Wattle Mat-rush *(Lomandra filiformis* subsp. *filiformis),* Many-flowered Mat-rush *(Lomandra multiflora),* Purple Wire-grass *(Aristida personata),* Speargrass *(Austrostipa scabra* subsp. *scabra),* Barbwire Grass *(Cymbopogon refractus)* and Paddock Lovegrass *(Eragrostis leptostachya).*<br>***Introduced species:*** Introduced species are uncommon in Community 7. Common Prickly Pear *(Opuntia stricta)* is the most frequent. |
| **Equivalent Biometric Vegetation Type (DECCW 2008):** White Box - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion. |
| **Equivalent NSWVCA Vegetation Type (Benson *et al.* 2010):** White Box - Cypress Pine - Silver-leaved Ironbark shrub grass open forest / woodland of the northern Brigalow Belt South and Nandewar Bioregions (NSWVCA community 597). |
| **Variants:** Community 7 has three variants on the study area:<br>***Community 7b:*** Semicleared and regenerating. Regeneration of Community 7 including all typical canopy dominants.<br>***Community 7c:*** Native Grassland derived from Community 7.<br>***Community 7d:*** Grassland dominated by exotics. Derived from Community 7, but invaded by Coolatai Grass (*Hyparrhenia hirta*). |

**Plate 10. Community 7 (Quadrat 3)**

**Table 12**
**Community 8. Yellow Box – Rough-barked Apple Grassy Woodland**

| |
|---|
| **No. of quadrats: 2** |
| **Landscape position:** Community 8 occurs on alluvial flats, side gullies, lower hill slopes and some ridge tops close to Maules Creek, mainly in the southern block. |
| **Dominant species**<br>***Trees:*** The dominant and characteristic tree species is Yellow Box *(Eucalyptus melliodora)*, usually in association with Rough-barked Apple and White Cypress Pine *(Callitris glaucophylla).*<br>***Shrubs:*** Shrubs are sparse in this community and may include Cough Bush *(Cassinia laevis), Cassinia quinquefaria,* Hoary Guinea Flower *(Hibbertia obtusifolia),* Urn-heath *(Melichrus urceolatus),* Large Tick-trefoil *(Desmodium brachypodum)* and Velvet Mock Olive *(Notelaea microcarpa* var. *microcarpa).*<br>***Creepers:*** Frequent creepers are Slender Tick-trefoil *(Desmodium varians),* Love Creeper *(Glycine clandestina)* and Glycine *(Glycine tabacina).*<br>***Ground covers:*** Ground cover is usually moderate to dense and commonly includes Poison Rock Fern *(Cheilanthes sieberi* subsp. *sieberi),* Stinking Pennywort (*Hydrocotyle laxiflora),* Native Carrot *(Daucus glochidiatus* Form F*),* Yellow Burr-daisy *(Calotis lappulacea),* Cudweed *(Euchiton sphaericus),* Cobbler's Tack (*Glossocardia bidens*), *Picris angustifolia* subsp. *caolorum-henricorum,* Cotton Fireweed (*Senecio quadridentatus*), *Sigesbeckia australiensis,* Vernonia (*Vernonia cinerea*), Fuzzweed (*Vittadinia cuneata* var. *cuneata)*, Sprawling Bluebell *(Wahlenbergia gracilis),* Climbing Saltbush (*Einadia nutans* subsp. *linifolia),* Small St. Johns Wort (*Hypericum gramineum),* Kidney Weed *(Dichondra repens), Geranium* sp., Austral Bugle (*Ajuga australis*), Creeping Mint (*Mentha satureoides),* Slender Flat-sedge (*Cyperus gracilis),* Many-flowered Mat-rush *(Lomandra multiflora),* Blueberry Lily *(Dianella longifolia),* Purple Wire-grass *(Aristida personata)*, Speargrass (*Austrostipa scabra* subsp. *scabra),* Wallaby Grass (*Austrodanthonia racemosa* var. *obtusata)* Queensland Bluegrass (*Dichantheum sericeum),* Weeping Grass (*Microlaena stipoides)* and Barbwire Grass *(Cymbopogon refractus).*<br>***Introduced species:*** Introduced species were not common and included mainly Greater Beggar's Ticks *(Bidens subalternans)*, Common Prickly Pear (*Opuntia stricta*) and Flaxleaf Fleabane *(Conyza bonariensis).* |
| **Equivalent Biometric Vegetation Type (DECCW 2008):** Yellow Box – Blakely's Red Gum grassy woodland of the Nandewar Bioregion. |
| **Equivalent NSWVCA Vegetation Type (Benson *et al.* 2010):** Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion (NSWVCA community 437). |
| **Variants:** Community 8 has one variant on the study area:<br>***Community 8c:*** Native Grassland derived from Community 8. |

**Plate 11. Community 8 (Quadrat 12)**

**Table 13**
**Community 9. River Oak - River Red Gum Riparian Forest**

| |
|---|
| **No. of spot samples: 3** |
| **Landscape position:** Community 9 occurs in the riparian zone along Maules Creek. |
| **Dominant species**<br>***Trees:*** River Oak *(Casuarina cunninghamiana)* is the dominant tree species, occurring continuously along the creek from the north to the south of the 'Willeroi' property. In places where the flow path is wide and little incised, a broad riparian zone may support a broad band of River Oak forest whose dense canopy provides heavy shading of the ground. Where the channel is narrower and more incised, River Oak forms a narrow band on each side of the watercourse, often with River Red Gum *(Eucalyptus camaldulensis).* Other tree species that frequently occur with River Oak are Rough-barked Apple (*Angophora floribunda*) and Yellow Box (*Eucalyptus melliodora*).<br>***Low Trees:*** Black Tea-tree *(Melaleuca bracteata)* commonly occurs below the River Oaks on the edge of the creek bank. Velvet Mock Olive *(Notelaea microcarpa* var. *microcarpa)* occurs regularly in Community 9.<br>***Shrubs:*** Shrubs are generally sparsely distributed in River Oak forest. Tree Violet *(Melicytus dentatus)* is a characteristic species and Poison Pimelea *(Pimelea neo-anglica)* is a regular associate.<br>***Ground covers:*** The ground cover in Community 9 is dominated by shade and moisture dependent grasses and herbs including Barbwire Weed (*Nyssanthes diffusa)*, Kidney Weed *(Dichondra repens),* Native Geranium *(Geranium solanderi* subsp. *solanderi),* Stinging Nettle *(Urtica incisa),* Stiff Flat-sedge (*Cyperus vaginatus*), Spiny-headed Mat-rush *(Lomandra longifolia),* Slender Bamboo Grass *(Austrostipa verticillata),* Couch (*Cynodon dactylon),* Erect Hedgehog Grass (*Echinopogon intermedius*), Weeping Grass *(Microlaena stipoides)* and Tussock (*Poa labillardierei*).<br>***Introduced species:*** The moist fertile soil conditions of the riparian zone favour a wide range of introduced species including Narrow-leaved Cotton Bush *(Gomphocarpus fruticosus),* Cobblers Pegs *(Bidens pilosa),* Common Sowthistle *(Sonchus oleraceus),* Skeleton Weed (*Chondrilla juncea*), Stinking Roger *(Tagetes minuta),* Noogoora Burr (*Xanthium occidentale)*, Mexican Tea (*Chenopodium ambrosioides*), Hop Clover (*Trifolium campestre)*, Common Chickweed *(Stellaria media),* Lamb's Tongues *(Plantago lanceolata),* Sweet Briar *(Rosa rubginosa)* and *Verbena caracasana.* |
| **Equivalent Biometric Vegetation Type (DECCW 2008):** River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84). |
| **Equivalent NSWVCA Vegetation Type (Benson *et al.* 2010):** River Oak - Rough-barked Apple - Red Gum - Box riparian tall woodland (wetland) of the Brigalow Belt South and Nandewar Bioregions (NSWVCA community 84). |
| **Variants:** Community 9 has one variant on the study area:<br>***Community 9c:*** Native Grassland derived from Community 9. |

**Plate 12. Community 9 (Maules Creek)**

**Table 14**
**Community 10. Rough-barked Apple Riparian Forb/Grass Open Forest**

**No. of spot samples: 2**

**Landscape position:** Community 10 occurs mainly on alluvial soils next to the riparian zone, on flood terraces and adjoining lower slopes along Maules Creek and Teatree Gully.

**Dominant species**

***Trees:*** The trees most characteristic of this community are Rough-barked Apple *(Angophora floribunda)* and Blakely's Red Gum *(Eucalyptus blakelyi)*. White Box *(Eucalyptus albens),* White Cypress Pine *(Callitris glaucophylla)* and occasional Kurrajong *(Brachychiton populneus)* also occur.

***Low Trees:*** The main low trees are Cooba *(Acacia salicina)* and Velvet Mock Olive *(Notelaea microcarpa* var. *macrocarpa).*

***Shrubs:*** Shrubs are relatively infrequent and may include Sticky Daisy-bush *(Olearia elliptica),* Large Tick-trefoil *(Desmodium brachypodum), Hovea apiculata,* Sticky Hop Bush *(Dodonaea viscosa* subsp. *angustifolia)* and Poison Pimelea *(Pimelea neo-anglica).*

***Vines:*** *Jasminum suavissimum* is a sporadic vine in Community 10.

***Ground covers:*** Community 10 characteristically has a dense grassy ground layer with a variety of native forbs including Poison Rock Fern *(Cheilanthes sieberi* subsp. *sieberi),* Native Geranium *(Geranium solanderi* subsp. *solanderi),* Slender Bamboo Grass *(Austrostipa verticillata),* Cotton Fireweed *(Senecio quadridentatus), Sigesbeckia australiensis,* Small St. John's Wort *(Hypericum gramineum),* Smooth Darling-pea *(Swainsona galegifolia), Acaena agnipila,* Stiff Flat-sedge *(Cyperus vaginatus),* Many-flowered Mat-rush *Lomandra multiflora),* Blueberry Lily *(Dianella longifolia),* Purple Wire-grass *(Aristida personata),* Red Grass *(Bothriochloa* sp.*),* Plump Windmill Grass *(Chloris ventricosa),* Forest Hedgehog Grass *(Echinopogon ovatus),* Paddock Lovegrass (*Eragrostis leptostachya)* and Slender Rat's Tail Grass (*Sporobolous creber).*

***Introduced species:*** Introduced species are not common in this community except for Coolatai Grass *(Hyparrhenia hirta)* in some places along Teatree Creek. The more common introduced species include Narrow-leaved Cotton Bush *(Gomphocarpus fruticosus),* Greater Beggar's Ticks *(Bidens subalternans),* Flaxleaf Fleabane *(Conyza bonariensis),* Tall Fleabane *(Conyza sumatrensis),* Smooth Catsear *(Hypochaeris glabra),* Proliferous Pink *(Petrorhagia nanteuilii),* Common Centaury *(Centaurium erythraea)* and Sweet Briar *(Rosa rubginosa).*

**Equivalent Biometric Vegetation Type (DECCW 2008):** Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion

**Equivalent NSWVCA Vegetation Type (Benson *et al.* 2010):** Rough-barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South West Slopes and Brigalow Belt South Bioregions (NSWVCA community 281).

**Variants:** None.

## 3.3 FLORA SPECIES

A complete flora species list for the study area is provided in Attachment A. A total of 239 plant species were identified by the quadrat plots, spot samples, random meanders and in general movement around the study area (Table 15). Of these, 193 (80.7%) are native to the natural communities of the study area and 46 (19.2%) are introduced exotic species. The sampling intensity varied among communities, consequently it is difficult to validly compare the numbers of species between communities (Table 15). The highest number of species was found in Community 2 with 123 species from 10 samples. High numbers were also found in Community 1, 107 species from 9 samples and Community 3, 100 species from 7 samples.

The plant families with the highest numbers of species (Attachment A) were the Grasses, Poaceae (43 species); Daisies, Asteraceae (36 species); Pea Flowers, subfamily Faboideae (15 species); the Eucalypts and related genera in the family Myrtaceae (9 species); the saltbushes and bluebushes, Chenopodiaceae (6 taxa); the Wattles, subfamily Mimosoideae (6 species); the Mistletoes, Loranthaceae (6 species) and the Sedges, Cyperaceae (6 species). In all, some 63 plant families or subfamilies were represented.

**Table 15**
**Numbers and Percentages of Native and Introduced Vascular Plant Species Identified in the Vegetation Communities within the Study Area**

| Community | No. Samples (Table 3) | Total Flora Species | Native Species | | Introduced Species | |
|---|---|---|---|---|---|---|
| | | | Number | Percent | Number | Percent |
| 1 | 10 | 107 | 99 | 92.5 | 8 | 7.5 |
| 2 | 10 | 123 | 111 | 90.2 | 12 | 9.8 |
| 3 | 6 | 100 | 68 | 68.0 | 32 | 32.0 |
| 5 | 3 | 82 | 67 | 81.7 | 15 | 18.3 |
| 7 | 10 | 94 | 86 | 91.5 | 8 | 8.5 |
| 8 | 2 | 58 | 51 | 87.9 | 7 | 12.1 |
| 9 | 3 | 51 | 31 | 60.8 | 20 | 39.2 |
| 10 | 2 | 41 | 32 | 78.0 | 9 | 22.0 |
| **Total** | **46** | **239** | **193** | **80.7** | **46** | **19.2** |

## 3.4 INTRODUCED SPECIES AND WEEDS

Table 15 shows the numbers and percentages of introduced species found by the survey. Overall, just under one fifth (46 species, 19.2%) of the flora species are introduced. The highest proportions of introduced species, 39.2% and 32%, were found in the disturbed riparian zone of Maules Creek (Community 9) and in the derived native grasslands (Community 3), respectively. However, all areas nevertheless retained higher proportions of native than introduced species.

Introduced species were least abundant in the less disturbed habitats of the southern and western blocks; Communities 1, 2 and 7 had the least introduced species, 7.5%, 9.8% and 8.5%, respectively. Intermediate levels of introduced species occur in Community 5 (18.3%), which occupies the relatively moist, fertile riparian zones of Teatree Creek and its tributaries, and Community 10 (22%), that occurs on alluvial and colluvial soils beside Maules Creek and Teatree Creek.

Three introduced species recorded in this survey are listed as noxious weeds in the Narrabri Shire Council area (Table 16) under the NSW *Noxious Weeds Act 1993*. None were abundant anywhere within the study area, although Prickly Pear is widespread (Table 16, Attachment A).

**Table 16**
**Noxious Weeds Recorded on the Study Area**

| Common Name | Scientific Name | Noxious Weed Class | Communities in which Present |
|---|---|---|---|
| Galvanized Burr[1] | *Sclerolaena birchii* | 4 | 3 |
| Noogoora Burr[2] | *Xanthium occidentale* | 4 | 9 |
| Prickly Pear[2] | *Opuntia stricta* | 4 | 1, 2, 3, 5, 7, 9 |

Legal requirements (NSW Department of Primary Industries 2011):

[1] The plant must be controlled where it impacts on normal agricultural practices including cropping and pasture management.

[2] The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed.

### 3.4.1 Environmental Weeds

Two serious environmental weeds are common on parts of 'Willeroi'; Coolatai Grass (*Hyparrhenia hirta*) and Sweet Briar (*Rosa rubiginosa*).

***Coolatai Grass***

Coolatai Grass infestations are common north of the 132 kV power line on the central range as far as its northern extremity near Maules Creek, including the crest and slopes on both sides (Plate 13). The approximate extent of the infestation is shown on Figure 2. Within this area the density of Coolatai Grass varies from large continuous patches with close to 100% cover of the ground to occasional small patches. It particularly infests Community 2 and 2b and more or less dominates grassland areas shown as Community 2d (Figure 2) on both sides of the central range. This grass, known for its invasiveness and ability to exclude other ground cover species, is likely to be expanding its distribution within 'Willeroi'. It is a significant management problem for the property.

**Plate 13. Coolatai Grass infestation in Community 2 (Quadrat 19)**

***Sweet Briar***

Sweet Briar is well established in the derived grasslands in the north-east block of 'Willeroi' (Plate 14). The infestations range from isolated plants to dense patches in some areas. It is also likely to be expanding its range within the property.

**Plate 14. Sweet Briar in Community 3c (near Quadrat 23)**

## 3.5 THREATENED FLORA SPECIES

No flora species listed in the schedules of the TSC Act or EPBC Act, were found in the targeted searches or other sampling conducted over the study area.

## 3.6 ROTAP SPECIES

No flora species listed in the Rare or Threatened Australian Plants (ROTAP) (Briggs and Leigh 1996) classification were found in the targeted searches or other sampling conducted over the study area.

## 3.7 THREATENED ECOLOGICAL COMMUNITIES

Two threatened ecological communities were considered to have potential to occur on the study area; the Inland Grey Box Woodland EEC (moderate potential to occur) and the Box - Gum Woodland EEC/CEEC (high potential to occur) (Table 5). No Inland Grey Box (*Eucalyptus microcarpa*), or its derived grasslands, were found on or near the study area by this survey. It is concluded that the Inland Grey Box Woodland EEC is absent from the study area.

### 3.7.1 Box - Gum Woodland EEC/CEEC

Communities 3 and 8 identified by this study (Table 6, Figure 4) are part of the Box - Gum Woodland EEC (TSC Act) and the Box - Gum Grassy Woodland and Derived Grassland CEEC (EPBC Act). The communities occupy generally low positions in the landscape along and west of Maules Creek, and have generally low gradients and predominantly grassy understoreys.

***Community 3. White Box – White Cypress Pine grassy woodland.***

This community is restricted to flat to gently sloping land above alluvial creek flats and the riparian zone. The majority of Community 3 has been cleared historically and comprises most of the derived native grasslands in the north east block of the study area (Figure 4). All of the remnant paddock trees within this area are White Box, indicating the original community was a White Box woodland. This, and the low landscape relief, indicates the original community was most likely a grassy woodland. As such, it would have been targeted for clearing by the early settlers of the area. Some small remnants of uncleared or semi-cleared grassy White Box woodland occur around the margins and within the cleared area (e.g. the patch containing Quadrat 20, Figure 2). Further small patches of grassy White Box woodland occur within three of the looping bends of Maules Creek on the eastern side of the southern block (Figure 4). Two further patches of grassland derived from grassy White Box woodland occupy flat terrain immediately to the west of Maules Creek (Figure 4).

***Community 8. Yellow Box – Rough-barked Apple grassy woodland.***

Community 8 occupies a number of small, discrete, scattered locations on the study area, all within close proximity to Maules Creek (Figure 4). It is mostly associated with deep alluvial or colluvial soils beside the creek or on side gullies draining into it, although the southernmost patch in the southern block extends from the valley floor of the creek onto a broad flat ridgetop.

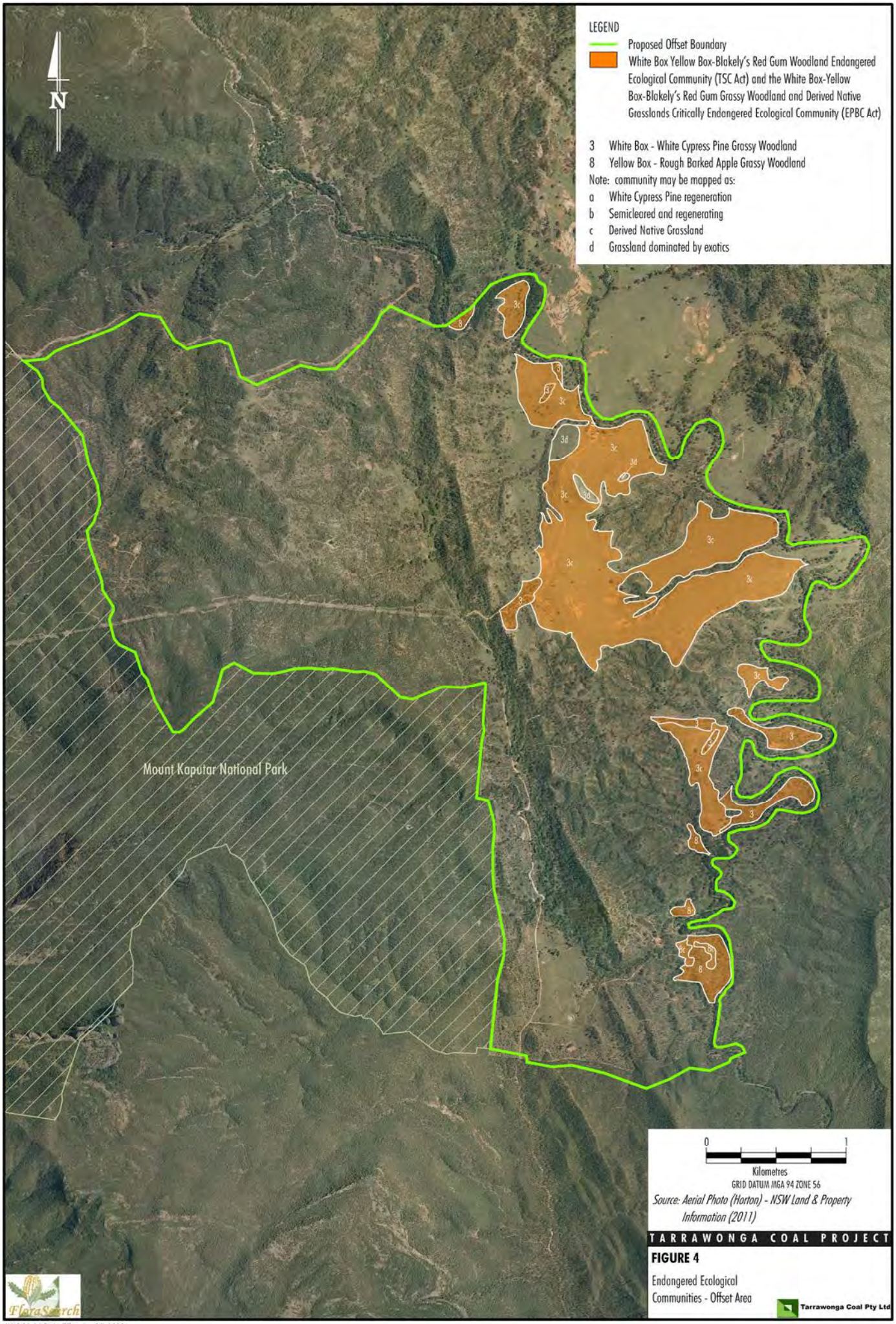
## 3.8 SEPP 44 – POTENTIAL KOALA HABITAT

Narrabri Shire is listed in Schedule 1 of NSW State Environmental Planning Policy (SEPP) No. 44 – Koala Habitat Protection, as land to which the policy applies. Narrabri Shire is therefore considered to have potential koala habitat, which is defined as the presence of any of the koala food trees listed in Schedule 2 of the Policy. These tree species must constitute 15% of more of the total number of trees in the upper or lower strata of the tree component.

One eucalypt species listed in Schedule 2 of SEPP 44 occurs on the study area: White Box (*Eucalyptus albens*). White Box is a dominant in Community 2 and its variant 2b (Figure 3). These vegetation types constitute potential koala habitat in the meaning of SEPP 44.

## 3.9 CONDITION OF THE VEGETATION

The 'Willeroi' study area encompasses varied geology, soils and topography that have strongly influenced past land use and, consequently, the condition of the native vegetation. Historic disturbance factors on the study area have included clearing of native vegetation, logging, grazing by livestock and introduced feral herbivores including rabbits and goats, and the construction of a large network of tracks.


N
LEGEND
Proposed Offset Boundary
White Box Yellow Box-Blakely's Red Gum Woodland Endangered Ecological Community (TSC Act) and the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grasslands Critically Endangered Ecological Community (EPBC Act)
3 White Box - White Cypress Pine Grassy Woodland
8 Yellow Box - Rough Barked Apple Grassy Woodland
Note: community may be mapped as:
a White Cypress Pine regeneration
b Semicleared and regenerating
c Derived Native Grassland
d Grassland dominated by exotics
Mount Kaputar National Park
0
1
Kilometres
GRID DATUM MGA 94 ZONE 56
Source: Aerial Photo (Horton) - NSW Land & Property Information (2011)
TARRAWONGA COAL PROJECT
FIGURE 4
Endangered Ecological Communities - Offset Area
Tarrawonga Coal Pty Ltd
FloraSearch

Few, if any, areas of native vegetation on the study area have escaped clearing at some time in the past. Areas not cleared in recent decades include the following parts of the western block, the north-west corner and south of the 132 kV power line, the southern peak of the central range north of the 132 kV power line, the southern end of the central range in the southern block and areas adjacent to the southern boundary of the southern block. These areas are considered to be in excellent condition.

The flatter parts of the north east block have likely been cleared for a very long time, possibly 60 to 100 years or more. Similarly, smaller cleared areas on flatter terrain in the southern block and elsewhere appear to have been cleared for long periods, for example around an old shack and along the access road to it. They are dominated by native grasses, although this habitat has a greater variety of introduced species, albeit in relatively low abundance, than any other vegetation type on the study area. Because of the probable long period of intensive livestock grazing on the derived native grasslands, the larger areas are likely to have lost the soil seed banks of most of their original native species. Consequently, the large grassland areas in the north east block are considered to have a low capacity for recovery of the original community. The cleared areas not infested by Coolatai Grass are considered to be in moderate condition.

The remaining rugged areas have been clear-felled by bulldozer in the last 10 to 20 years even on relatively steep slopes, as evidenced by windrows of timber throughout the study area. However, most of the more recently cleared areas are regenerating and appear likely to return to near their original condition. Except for the Coolatai Grass infestations on the northern half of the central range and its flanks, there are no significant weed problems. Feral goats are common on 'Willeroi' and, although not yet having a noticeable deleterious effect, present a medium term threat to the vegetation.

The vegetation map (Figure 3) distinguishes the more recently cleared and regenerating areas with an 'a' or 'b' suffix after the community number. Polygon labels without a suffix are considered to have been relatively undisturbed in the last 30 years or so, except by grazing, and are classified as being in excellent condition, as above. Relatively large areas of regeneration labelled 'a' are dominated by dense, monospecific, even-aged stands of White Cypress Pine, sometimes referred to as 'locked' vegetation because only part of the community is regenerating and may stay in that state for a very long time. Only areas of close to 100% White Cypress Pine have been mapped as 'a' on Figure 3. However, significant areas labelled 'b' with regeneration of all canopy species, may also comprise predominantly White Cypress Pine. 'Locked' White Cypress Pine is considered to be in poor condition, while areas labelled 'b' are classed as moderate to good condition.

Grasslands dominated by Coolatai Grass are considered to be in very poor condition. Coolatai Grass infested areas of Community 2 are rated as being in poor to moderate condition.

Much of the watercourse vegetation on 'Willeroi' has been reduced by past clearing to narrow strips along the edges of the main flow path, especially on long stretches of Maules Creek. These reaches also tend to have high levels of introduced species in the understorey. However, there are wide patches of River Oak forest (Community 9) that form impressive stands in the far north of the study area and in parts of the southern block. These stands also have good representations of the adjoining riparian Rough-barked Apple (Community 10) and Yellow Box woodlands (Community 8) providing rare examples of relatively undisturbed riverine vegetation. In some areas the River Oak forests are relatively weed-free and appear close to pristine. Similarly, the Bracteate Honeymyrtle low riparian forest on Teatree Creek varies in the degree of disturbance and weed levels. Overall, the watercourse vegetation varies in condition from poor to very good.

Despite past disturbances, most of the vegetation on 'Willeroi' is considered to have retained its biodiversity values and has the resilience to recover fully in the long-term, with the provisos that feral goats and Coolatai Grass can be controlled.

# 4 VEGETATION COMPARISON BETWEEN THE PROPOSED 'WILLEROI' OFFSET AND THE TARRAWONGA COAL PROJECT AREA

## 4.1 COMPARISON OF THE PHYSICAL CHARACTERISTICS OF 'WILLEROI' AND TARRAWONGA

Although approximately only 20 km apart, 'Willeroi' and Tarrawonga differ in many physical characteristics. The most important are summarised in Table 17 to assist in understanding the similarities and differences in the vegetation of the two sites. 'Willeroi' is significantly higher in altitude than Tarrawonga, which affects its weather, especially rainfall and temperature. 'Willeroi' is expected to have higher rainfall than Tarrawonga and lower temperatures. The weather data in Table 17 are taken from the nearest Bureau of Meteorology weather stations at similar altitudes to each area and are indicative only.

Rainfall at 'Willeroi is likely to be significantly higher than indicated in Table 17 owing to much of its area being greatly in excess of the 500 m at the Barraba weather station. However, the mean maximum temperatures for the two indicative weather stations are the same, while the minimums differ in line with expectation. The geologies of the two areas also differ, with 'Willeroi' having somewhat better soils than the Permian substrates at Tarrawonga. There are also differences in topography with 'Willeroi' having steeper, more dissected terrain over much of its area. The resulting steep slopes and deep gullies create more potential habitat niches than at Tarrawonga.

**Table 17**
**Comparative Physical Characteristics between 'Willeroi' and Tarrawonga.**

| Feature | 'Willeroi' | Tarrawonga |
|---|---|---|
| **Altitude** | 450 to 850 m AHD. | 260 to 370 m AHD. |
| **Rainfall** | Approx. 688 mm per annum[1]. | Approx. 642 mm per annum[2]. |
| **Temperature** | Mean maximum of approx. 24.4˚C per annum[1].<br>Mean minimum of approx. 8.3˚C per annum. | Mean maximum of approx. 24.5˚C per annum[2].<br>Mean minimum of approx. 12.1˚C per annum. |
| **Geology** | Early to Middle Carboniferous sediments and volcanics. | Quaternary and Permian sediments. |
| **Topography** | Gently undulating to rugged and precipitous. | Flat to undulating. |
| **Soil characteristics** | Skeletal soils on hills with exposed bedrock; deeper soils on lower slopes and valley floors. Generally clay soils; but with stones on conglomerate substrates. | Relatively deep soils with and without pebbles and stones. Light dispersive soils on Permian substrates to heavier soils on Quaternary sediments. |

[1] From Bureau of Meteorology weather station 054003 – Barraba (altitude 500 m AHD).

[2] From Bureau of Meteorology weather station 055024 – Gunnedah (altitude 307 m AHD).

## 4.2 FLORA SPECIES

A higher number of flora species was recorded at Tarrawonga than on 'Willeroi', 363 versus 239, respectively, despite 'Willeroi' being larger and having more vegetation communities (see below). There are several reasons for this result:

1. More sampling was conducted at Tarrawonga than at 'Willeroi', 60 and 46 survey sites, respectively.
2. Leard State Forest at Tarrawonga is relatively undisturbed and appears to have retained most of its original biodiversity. It especially lacks the intensive grazing history of 'Willeroi' that has likely reduced floral diversity over much of the property.

3. Much of the sampling at Tarrawonga occurred in spring and summer when ephemeral herbs and flowering grasses are most detectable and easiest to identify. By contrast, sampling at 'Willeroi' took place in autumn and winter when ephemeral species are undetectable and grasses are more difficult to distinguish.

## 4.3 VEGETATION COMMUNITIES

Table 18 compares the number of flora species recorded in equivalent communities at 'Willeroi' and Tarrawonga and assesses the degree of floristic similarity between them. Table 19 compares the vegetation communities at 'Willeroi' and Tarrawonga using the same community numbers for the most equivalent communities between the two areas.

In terms of numbers of vegetation communities, the native vegetation on the proposed 'Willeroi' offset area is more diverse than at Tarrawonga. Eight native vegetation types occur at 'Willeroi, versus five at Tarrawonga (Table 19). All except one of the native communities (Community 4) at Tarrawonga is represented on the proposed 'Willeroi' offset. [Community 6 (cleared farmland) at Tarrawonga is an anthropogenic community that is also absent from 'Willeroi']. Conversely, four communities at 'Willeroi' (Communities 7, 8, 9 and 10) have no equivalents at Tarrawonga.

Table 18 compares the number of flora species recorded in equivalent communities at 'Willeroi' and Tarrawonga and assesses the degree of floristic similarity between them. Owing to the disparity in the numbers of species recorded in each community at 'Willeroi' and Tarrawonga, the percentages of species recorded on one site and found on the other is asymmetric (Table 18). The data show that Community 1 has by far the highest floristic similarity between 'Willeroi' and Tarrawonga, i.e. 41.3% of the species found at Tarrawonga also occur at 'Willeroi' and 78.5% of the species recorded on 'Willeroi' occur at Tarrawonga.

**Table 18**
**Sharing of Flora Species between Equivalent Communities at 'Willeroi' and Tarrawonga**

| Percent species shared | Community | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 5 |
| **No. of species at Tarrawonga** | 201 | 152 | 157 | 118 |
| **% of Tarrawonga species at 'Willeroi'** | 41.3 | 31.6 | 28.7 | 23.7 |
| **No. of species at 'Willeroi'** | 107 | 122 | 100 | 82 |
| **% of 'Willeroi' species at Tarrawonga** | 78.5 | 42.6 | 50.0 | 37.8 |

Floristic similarity is less strong between the two sites for the other three communities, with the percentage of species shared at or below 50% for all. However, other comparisons are revealing. For example, Community 2 at 'Willeroi' is much more similar to Community 1 at 'Willeroi' than it is to Community 2 at Tarrawonga; 77 species are shared between the two communities at 'Willeroi', or 72% and 63% of Community 1 and Community 2 species, respectively. This is not surprising, given the two communities at 'Willeroi' share similar habitats and occur in mosaics with each other. It would not be unjustified to regard them as variants of the same community, i.e. NSWVCA community 592 (Benson *et al.* 2010). If this view is taken, then Community 2 at 'Willeroi' and Tarrawonga represent different shrubby White Box communities. The Tarrawonga community is closer to NSWVCA community 588 (Table 19) (see also below).

## Table 19
## Comparison of Vegetation Communities at 'Willeroi' and the Tarrawonga Coal Project Area

| Community Number | Community Name | | Equivalent Communities | | Comment |
|---|---|---|---|---|---|
| | 'Willeroi' | Tarrawonga | Biometric Vegetation Type (DECCW 2008) | NSWVCA (Benson *et al*. 2010) | |
| 1 | Narrow-leaved Ironbark - White Box - White Cypress Pine shrubby open forest | White Cypress Pine - Narrow-leaved Ironbark shrubby open forest | White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (Namoi CMA community NA228) | Narrow-leaved Ironbark - Cypress Pine - White Box shrubby open forest in the Brigalow Belt South and Nandewar Bioregions (NSWVCA community 592) | |
| 1a | | | | | |
| 1b | | | | | |
| 1c | | | | | |
| 1d | | | | | |
| 2 | White Box - White Cypress Pine shrubby woodland | White Box - White Cypress Pine shrubby woodland | White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions (Namoi CMA community NA225) | White Box - White Cypress Pine shrubby hills open forest mainly in the Nandewar Bioregion (NSWVCA community 588) | Community 2 on 'Willeroi' is floristically closer to Community 1 at 'Willeroi' than to Community 2 at Tarrawonga (see text) and is part of NSWVCA 592. Community 2 at Tarrawonga is closer to NSWVCA 588. |
| 2a | | | | | |
| 2b | | | | | |
| 2c | | | | | |
| 2d | | | | | |
| 3 | White Box - White Cypress Pine grassy woodland | White Box - White Cypress Pine grassy woodland | White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (Namoi CMA community NA226) | White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South and Nandewar Bioregions (NSWVCA community 435) | NSWVCA community 435 is the best floristic fit for Community 3, but is not considered to be part of the Box - Gum Woodland EEC/CEEC by Benson *et al*. (2010). |
| 3a | | | | | |
| 3b | | | | | |
| 3c | | | | | |
| 3d | | | | | |
| 4 | [Not present] | Narrow-leaved Grey Box - Poplar Box - White Cypress Pine grassy open woodland | Pilliga Box - Poplar Box - White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Namoi CMA community NA179) | Pilliga Box - Poplar Box - White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (NSWVCA community 88) | Not at 'Willeroi'. |
| 4c | | | | | |
| 5 | Bracteate Honeymyrtle riparian shrubland | Bracteate Honeymyrtle low riparian forest | Bracteate Honey Myrtle riparian low forest/shrubland of rich soil depressions in the Brigalow Belt South Bioregion (Border Rivers/Gwydir CMA community 22) | Bracteate Honey Myrtle riparian low forest/shrubland of rich soil depressions in the Brigalow Belt South Bioregion (NSWVCA community 112) | |
| 6 | [Not present] | Cleared farmland | No equivalent | Not Applicable | Not at 'Willeroi'. |
| 7 | Silver-leaved Ironbark - Narrow-leaved Ironbark - White Box shrubby open forest | [Not present] | White Box - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion | White Box - Cypress Pine - Silver-leaved Ironbark shrub grass open forest/woodland of the northern Brigalow Belt South and Nandewar Bioregions (NSWVCA community 597) | Not at Tarrawonga. |
| 7b | | | | | |
| 7c | | | | | |
| 7d | | | | | |

## Table 19 (Continued)
## Comparison of Vegetation Communities at 'Willeroi' and the Tarrawonga Coal Project Area

| Community Number | Community Name | | Equivalent Communities | | Comment |
|---|---|---|---|---|---|
| | 'Willeroi' | Tarrawonga | Biometric Vegetation Type (DECCW 2008) | NSWVCA (Benson *et al*. 2010) | |
| 8<br>8c | Yellow Box - Rough-barked Apple grassy woodland | [Not present] | Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion | Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion (NSWVCA community 437) | Not at Tarrawonga. |
| 9<br>9c | River Oak riparian forest | [Not present] | River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84) | River Oak - Rough-barked Apple - Red Gum - Box riparian tall woodland (wetland) of the Brigalow Belt South and Nandewar Bioregions (NSWVCA community 84) | Not at Tarrawonga. |
| 10<br>10c | Rough-barked Apple riparian forb/grass open forest | [Not present] | Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion | Rough-barked Apple - Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSWSWS and Brigalow Belt South Bioregions (NSWVCA community 281) | Not at Tarrawonga. |

a - White Cypress Pine regeneration.

b - Semicleared and regenerating.

c - Derived Native Grassland.

d - Grassland dominated by exotics.

The moderate similarity between the 'Willeroi' and Tarrawonga versions of Community 3 relates to the bias in sampling at 'Willeroi' towards derived grasslands (5 quadrats) rather than the climax community (1 quadrat) owing to the rarity of the climax community.

In the case of Community 5, its habitats at Tarrawonga are much more disturbed than at 'Willeroi' and have a much higher proportion of introduced species, 40.7% at Tarrawonga and 18.3% at 'Willeroi'.

The following sections compare key similarities and differences between each of the four shared native communities at Tarrawonga and 'Willeroi'.

***Community 1.*** **White Cypress Pine - Narrow-leaved Ironbark ± White Box Shrubby Open Forest**

Despite the differences in altitude, geology and weather, Community 1 at 'Willeroi' is very similar to Community 1 at Tarrawonga with a high overlap in species between the two sites (Table 18). The main differences relate to the presence at Tarrawonga of a range of lower altitude species more characteristic of the lower Western Slopes and Plains. These include Gargaloo (*Parsonsia eucalyptophylla*), Quinine Bush (*Alstonia constricta*), Yellow Berry-bush (*Maytenus cunninghamii*), a number of species in the Chenopodiaceae including *Chenopodium auricomiforme* and several *Einadia* species, Desert Spurge (*Euphorbia eremophila*), two Senna taxa, Dean's Wattle (*Acacia deanei*), Hill Hibiscus (*Hibiscus sturtii*), Amulla (*Eremophila debilis*), Weeping Pittosporum (*Pittosporum angustifolium*) and Wilga (*Geijera parviflora*). In general, the flora on 'Willeroi' is more representative of the upper Western Slopes and lacks species, such as the above, that are more typically found at lower altitudes on flatter terrain.

***Community 2.*** **White Box - White Cypress Pine shrubby woodland.**

As indicated above, the floristics of Community 2 are more dissimilar than similar between 'Willeroi' and Tarrawonga (Table 18). It is concluded that Community 2 at 'Willeroi' is most similar to Community 1 at 'Willeroi' and together they comprise part of NSWVCA community 592 (Benson *et al*. 2010). Community 2 at Tarrawonga is closer to NSWVCA community 588 (Benson *et al*. 2010) (see above). However, it should be noted that both are shrubby woodlands dominated by White Box and White Cypress Pine.

The pronounced differences between Community 2 at 'Willeroi' and Tarrawonga reflect differences not only in altitude, weather and geology between the two sites, but also topography. Community 2 at 'Willeroi' occurs on steeper slopes than at Tarrawonga which is likely to affect drainage, exposure to solar radiation and soil properties.

As for Community 1, there is a suite of similar lower Western Slopes and Plains species in Community 2 at Tarrawonga that do not occur at 'Willeroi' in addition to a wide range of other more widespread species that may not be suited to 'Willeroi'. These include Pink Tongues (*Rostellularia adscendens* var. *adscendens*), Gargaloo (*Parsonsia eucalyptophylla*), Quinine Bush (*Alstonia constricta*), *Brachyscome ciliaris* and *B. linearifolia*, Chamomile Sunray (*Rhodanthe anthemoides*), the Fuzzweeds (*Vittadinia cuneata* var. *cuneata*, *V. dissecta* var. *hirta* and *V. sulcata*), Golden Everlasting (*Xerochrysum bracteatum*), several species of Chenopodiaceae (*Chenopodium auricomiforme*, Soft Roly Poly (*Salsola kali*) and several species of *Einadia*), Desert Spurge (*Euphorbia eremophila*), two Senna taxa, Dean's Wattle (*Acacia deanei*), Ironwood (*Acacia excelsa*), two *Goodenia* species (*Goodenia cycloptera* and *G. fascicularis*), Hill Hibiscus (*Hibiscus sturtii*), Amulla (*Eremophila debilis*), Emubush (*Eremophila longifolia*), Western Boobialla (*Myoporum montanum*), Weeping Pittosporum (*Pittosporum angustifolium*), Wilga (*Geijera parviflora*), two Sida species (*Sida corrugata* and *S. cunninghamii*) and Sticky Hopbush (*Dodonaea viscosa* subsp*. spatulata*).

***Community 3.*** **White Box - White Cypress Pine grassy woodland**

The marked floristic divergence between Community 3 at 'Willeroi' and Tarrawonga (Table 18) is at least partly due to a lack of undisturbed climax sites for sampling at 'Willeroi' where most of the original community has been converted to a derived native grassland. Even allowing for this, there are also likely to be floristic differences related to the altitudinal, climatic and geological variation between the two sites.

Native species represented in Community 3 at Tarrawonga that were absent from 'Willeroi' include *Zaleya galericulata* subsp. *australis*, Gargaloo (*Parsonsia eucalyptophylla*), Quinine Bush (*Alstonia constricta*), *Brachyscome ciliaris*, the Fuzzweeds (*Vittadinia cervicularis*, *V. pustulata* and *V. sulcata*), Golden Everlasting (*Xerochrysum bracteatum*), several species of Chenopodiaceae (*Chenopodium auricomiforme*, Soft Roly Poly (*Salsola kali*) and several species of *Einadia*), a Senna (*Senna* form taxon *'zygophylla*'), Leafy Templetonia (*Templetonia stenophylla*), Straggly Lantern Bush (*Abutilon oxycarpum*), Hill Hibiscus (*Hibiscus sturtii*), two Sida species (*Sida corrugata* and *S. cunninghamii*), Amulla (*Eremophila debilis*), Western Boobialla (*Myoporum montanum*), Weeping Pittosporum (*Pittosporum angustifolium*), Wilga (*Geijera parviflora*) and Rosewood (*Alectryon oleifolius*).

***Community 5.*** **Bracteate Honeymyrtle low riparian forest**

Marked floristic differences also occur in Community 5 between Tarrawonga and 'Willeroi'. This is partly due to the more highly disturbed condition of the community at Tarrawonga with consequent higher levels of introduced species. However, as for the other communities it is likely that variation in altitude, climate and geology play a part in determining its floristics in the two areas.

Native species present in Community 5 at Tarrawonga and not at 'Willeroi' include Spreading Sneezeweed (*Centipeda minima*), *Eclipta platyglossa*, Golden Everlasting (*Xerochrysum bracteatum*), various species of Chenopodiaceae including Keeled Goosefoot (*Chenopodium carinatum*), Black Crumbweed (*Chenopodium melanocarpum*), Knotweed Goosefoot (*Einadia polygonoides*) and Fishweed (*Einadia trigonos* subsp. *leiocarpa*), Native Wandering Jew (*Commelina cyanea*), Poison Pratia (*Pratia concolor*), White Cedar (*Melia azedarach*), Amulla (*Eremophila debilis*), Wilga (*Geijera parviflora*), Darling Lily (*Crinum flaccidum*), Native Leek (*Bulbine semibarbata*) and a range of grasses.

## 4.4 DISCUSSION AND CONCLUSION

From the above data it is clear that Communities 1, 2, 3 and 5 change in species composition with altitude, which is to be expected. The occurrences at Tarrawonga represent lower altitude forms of the communities including a suite of species characteristic of the lower Western Slopes and Plains that are lacking at 'Willeroi'. Conversely, the communities at 'Willeroi' include a range of taxa representative of the upper western slopes. It is generally recognised that the compositions of plant communities change along various environmental gradients including latitude, altitude, soil moisture levels, temperature, etc. Consequently, it is unlikely that complete replication of community composition can be achieved between two areas, even when relatively close together. In this broader context, it is considered that the vegetation communities of the proposed 'Willeroi' offset, are acceptable matches for the Tarrawonga Coal Project area.

# 5 THREATENED SPECIES AND COMMUNITIES

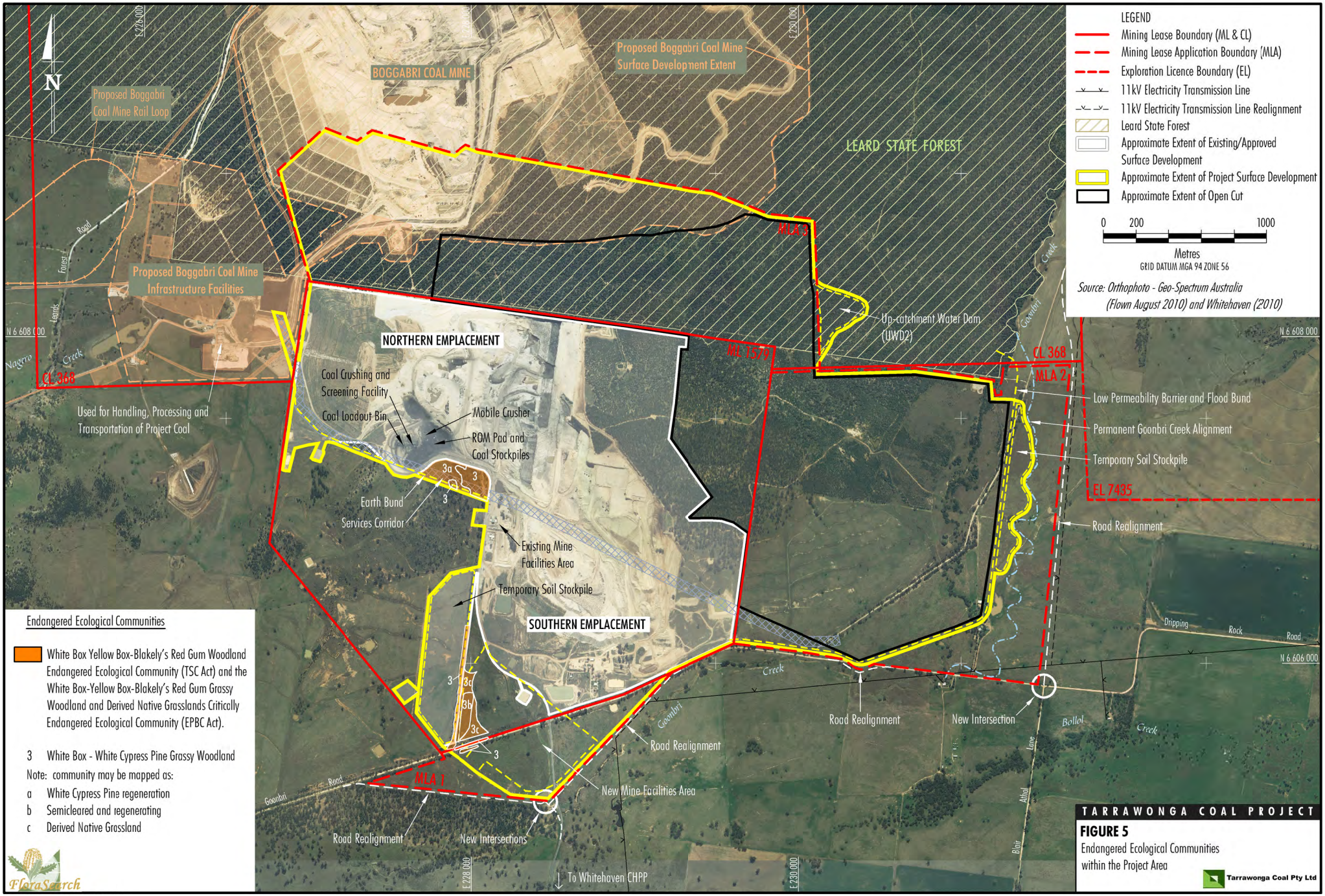
No threatened flora species were identified on the Tarrawonga Coal Project area or on the proposed 'Willeroi' offset area.

However, both areas support examples of the Box - Gum Woodland EEC (TSC Act) and the Box - Gum Grassy Woodland and Derived Grassland CEEC (EPBC Act). Box - Gum Woodlands are broadly defined under both NSW and Commonwealth legislation and encompass all or parts of a large number of more narrowly defined Biometric (DECCW 2008) or NSWVCA (Benson *et al*. 2010) ecological communities. The communities in Table 20 at 'Willeroi' and Tarrawonga are part of the Box - Gum Woodland EEC/CEEC.

**Table 20**
**Vegetation Communities in the Box - Gum Woodland EEC/CEEC at 'Willeroi' and Tarrawonga**

| Community Number | Community Name | Area (ha) | | |
|---|---|---|---|---|
| | | Tarrawonga | Willeroi | Ratio |
| **3** | White Box - White Cypress Pine grassy woodland | 5 | 23 | 4.6 |
| **3a** | White Box - White Cypress Pine grassy woodland - White Cypress regeneration | 3 | 0 | 0.0 |
| **3b** | White Box - White Cypress Pine grassy woodland - Semicleared and regenerating | 2 | 0 | 0.0 |
| **3c** | White Box - White Cypress Pine grassy woodland - Derived native grassland | 3 | 193 | 64.3 |
| **8** | Yellow Box - Rough-barked Apple grassy woodland | 0 | 14 | - |
| **8c** | Yellow Box - Rough-barked Apple grassy woodland - Derived native grassland | 0 | 2 | - |
| | **Total (including 3c and 8c)** | 13 | 232 | 17.8 |
| | **Total (excluding 3c and 8c)** | 10 | 37 | 3.7 |

Table 20 shows there are 13 ha of Box - Gum Woodland EEC/CEEC at Tarrawonga versus 232 ha of the same EEC/CEEC at 'Willeroi'. The distributions of the EEC/CEEC at 'Willeroi' and Tarrawonga are shown on Figures 4 and 5, respectively. However, most of the EEC/CEEC at 'Willeroi' is derived native grassland (195 ha) that has been heavily grazed for many decades and has lost much of its original diversity and capacity to recover. If the native grassland is excluded from consideration, 37 ha of intact or regenerating EEC/CEEC remain at 'Willeroi' and 10 ha at Tarrawonga, giving an area ratio of 3.7 between 'Willeroi' and Tarrawonga. When the derived grassland is included, the area ratio is 17.8.

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# 6 OVERALL OFFSET AREAS AND RATIOS

A summary of the areas of each community and their offset ratios is presented in Table 21. The actual area of the proposed offset is 1,660 ha. However, for the purpose of ratio calculations the following area has been excluded from the 1,660 ha:

- 44 ha (combined) of Communities 1 (2 ha), 2 (33 ha), 3 (6 ha) and 7 (3 ha), variant 'd' (i.e. Grassland dominated by exotics).

Accounting for the above the total area of native vegetation within the proposed 'Willeroi' offset is 1,616 ha, or 4.1 times larger than the area of native vegetation proposed to be disturbed by the Tarrawonga Coal Project. All communities shared between Tarrawonga and 'Willeroi' are offset by ratios of 1.8 at the least for Community 5, 2.0 for Community 1, and much more for Communities 2 (8.3) and 3 (16.6) that are dominated by White Box. The offset includes a total of 423 ha of Communities 7, 8, 9 and 10 that are not represented at Tarrawonga.

## 6.1 DISCUSSION AND CONCLUSIONS

The proposed 'Willeroi' offset will ensure that biodiversity values would be maintained and improved in the region in the long term as required by the Requirements for the Project of the Director General of the NSW Department of Planning and Infrastructure. A similar requirement is also expressed in the DSEWPaC's *Environmental Offsets Policy* (Consultation Draft), which states that an offset must '*deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environmental law and affected by the proposed development.'*

The 'Willeroi' offset has a number of features that ensure it meets the 'maintain and improve' test. These include:

- The offset removes a substantial area of native vegetation from the deleterious effects of livestock grazing, thereby allowing it to recover and improve over time.
- The offset supports samples of all natural vegetation communities from the highest positions in the subcatchments to the largest watercourse in the nearby region, consequently sampling all the local vegetation communities.
- The offset comprises a single large (1,660 ha) block of land that includes the threatened Box – Gum Woodland EEC/CEEC within its full natural landscape context. That is, the offset encompasses the complete upper catchments of several drainage systems and the full complement of natural communities within them.
- By encompassing whole catchments, the likelihood of deleterious influences on the offset from outside is substantially reduced.
- The offset is surrounded on three sides by largely undisturbed natural vegetation. Consequently, it is not isolated in the landscape and its high connectivity helps to ensure its long term viability.
- It is connected on its western side to Mount Kaputar National Park (36,816 ha) and the Mount Kaputar volcanic complex. The large block of natural vegetation to which the offset is connected further guarantees its long term viability. Conversely, the addition of this new protected area to the existing reserved area enhances nature conservation over the whole area.

## Table 21
## Areas and Offset Ratios of Native Vegetation Communities at Tarrawonga and 'Willeroi'
**(Community 6 [Cleared farmland] at Tarrawonga is excluded and variants d [Exotic grassland] is excluded for Tarrawonga and 'Willeroi')**

| Community Number | Community Name and Variant | Area (ha) | | Offset Ratio |
|---|---|---|---|---|
| | | Tarrawonga | Willeroi | |
| **1** | **White Cypress Pine - Narrow-leaved Ironbark ± White Box Shrubby Open Forest** | 189 | 128 | 0.7 |
| **1a** | White Cypress Pine Regeneration | 55 | 67 | 1.2 |
| **1b** | Narrow-leaved Ironbark - White Cypress Pine ± White Box Regeneration | 9 | 358 | 39.8 |
| **1c** | Derived Native Grassland | 25 | 15 | 0.6 |
| **Total** | | 278 | 568 | 2.0 |
| **2** | **White Box - White Cypress Pine Shrubby Woodland** | 41 | 141 | 3.4 |
| **2a** | White Cypress Pine Regeneration | 0 | 233 | - |
| **2b** | White Box - White Cypress Pine Regeneration | 5 | 3 | 0.6 |
| **2c** | Derived Native Grassland | 0 | 5 | - |
| **Total** | | 46 | 382 | 8.3 |
| **3** | **White Box - White Cypress Pine Grassy Woodland** | 5 | 23 | 4.6 |
| **3a** | White Cypress Pine Regeneration | 3 | 0 | 0.0 |
| **3b** | White Box - White Cypress Pine Regeneration | 2 | 0 | 0.0 |
| **3c** | Derived Native Grassland | 3 | 193 | 64.3 |
| **Total** | | 13 | 216 | 16.6 |
| **4** | **Pilliga Box - Poplar Box - White Cypress Pine Grassy Open Woodland** | 12 | 0 | 0.0 |
| **4c** | Derived Native Grassland | 33 | 0 | 0.0 |
| **Total** | | 45 | 0 | 0.0 |
| **5** | **Bracteate Honeymyrtle Low Riparian Forest** | 15 | 27 | 1.8 |
| **Total** | | 15 | 27 | 1.8 |
| **7** | **Silver-leaved Ironbark - Narrow Leaved Ironbark - White Box Shrubby Open Forest** | 0 | 157 | - |
| **7b** | Narrow-leaved Ironbark - White Cypress Pine Regeneration | 0 | 69 | - |
| **7c** | Derived Native Grassland | 0 | 34 | - |
| **Total** | | 0 | 260 | - |
| **8** | **Yellow Box – Rough-barked Apple Grassy Woodland** | 0 | 14 | - |
| **8c** | Derived Native Grassland | 0 | 2 | - |
| **Total** | | 0 | 16 | - |
| **9** | **River Oak - River Red Gum Riparian Forest** | 0 | 77 | - |
| **9c** | Derived Native Grassland | 0 | 12 | - |
| **Total** | | 0 | 89 | - |
| **10** | **Rough-barked Apple Riparian Forb/Grass Open Forest** | 0 | 58 | - |
| **Total** | | 0 | 58 | - |
| **Total** | | **397** | **1,616** | **4.1** |

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# ATTACHMENT A

# FLORA SPECIES LISTS FOR EACH VEGETATION COMMUNITY.

| Scientific Name | Common Name | Community | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 5 | 7 | 8 | 9 | 10 | Opp |
| **CLASS FILICOPSIDA** | | | | | | | | | | |
| **Adiantaceae** | | | | | | | | | | |
| *Adiantum aethiopicum* | Common Maidenhair | | • | | | | | | | |
| *Cheilanthes distans* | Bristly Cloak Fern | • | • | | • | • | | | | |
| *Cheilanthes sieberi* subsp. *sieberi* | Poison Rock Fern | • | • | • | • | • | • | | • | |
| *Pellaea calidirupium* | | | | | | | | | | • |
| *Pellaea falcate* | Sickle Fern | | • | | • | | | | | |
| **Aspleniaceae** | | | | | | | | | | |
| *Asplenium flabellifolium* | Necklace Fern | | • | | | | | | | |
| **CLASS CYCADOPSIDA** | | | | | | | | | | |
| **Zamiaceae** | | | | | | | | | | |
| *Macrozamia stenomera* | | | • | | | | | | | |
| **CLASS CONIFEROPSIDA** | | | | | | | | | | |
| **Cupressaceae** | | | | | | | | | | |
| *Callitris glaucophylla* | White Cypress Pine | • | • | • | • | • | • | | • | |
| **CLASS MAGNOLIOPSIDA** | | | | | | | | | | |
| **SUBCLASS MAGNOLIIDAE** | | | | | | | | | | |
| **Acanthaceae** | | | | | | | | | | |
| *Brunoniella australis* | Blue Trumpet | | • | | | | | | | |
| *Rostellularia adscendens* var. *adscendens* | Pink Tongues | • | | • | | • | | | | |
| **Amaranthaceae** | | | | | | | | | | |
| *Alternanthera nana* | Hairy Joyweed | | | | • | | | | | |
| *Nyssanthes diffusa* | Barbwire Weed | | | | • | | | • | | |
| **Apiaceae** | | | | | | | | | | |
| **Cyclospermum leptophyllum* | Slender Celery | | | | • | | | | | |
| *Daucus glochidiatus* Form F | Native Carrot | • | • | • | | | • | • | | |
| *Hydrocotyle laxiflora* | Stinking Pennywort | | • | • | • | • | • | | | |
| **Apocynaceae** | | | | | | | | | | |
| *Alstonia constricta* | Quinine Bush | | | | | • | | | | |
| **Gomphocarpus fruticosus* | Narrow-leaved Cotton Bush | | • | • | | | | • | • | |
| **Asteraceae** | | | | | | | | | | |
| **Aster subulatus* | Wild Aster | | | • | | | | | | |
| **Bidens pilosa* | Cobblers Pegs | | • | • | • | • | | • | | |
| **Bidens subalternans* | Greater Beggar's Ticks | • | | | • | • | • | | • | |
| *Calotis lappulacea* | Yellow Burr-daisy | • | • | • | | • | • | | | |
| **Carthamus lanatus* | Saffron Thistle | | | • | | | | | | |
| *Cassinia laevis* | Cough Bush | • | • | | • | • | • | | | |
| *Cassinia quinquefaria* | | • | • | • | | • | | | | |
| **Centaurea melitensis* | Cockspur | | | • | | | | | | |
| **Chondrilla juncea* | Skeleton Weed | | | • | | | • | • | | |
| *Chrysocephalum apiculatum* | Common Everlasting | • | • | • | | • | | | | |
| *Chrysocephalum semipapposum* | Yellow Buttons | • | | | | | | | | |
| **Cirsium vulgare* | Spear Thistle | | • | • | • | | • | | | |
| **Conyza bonariensis* | Flaxleaf Fleabane | • | • | • | • | • | • | • | • | |
| **Conyza sumatrensis* | Tall Fleabane | | • | | • | | | • | • | |
| *Cotula australis* | Carrot Weed | | • | • | | | | | | |
| *Cymbonotus* sp. | | | • | • | | • | | | | |
| *Euchiton involucratus* | Star Cudweed | | • | • | | • | | | | |
| *Euchiton sphaericus* | Cudweed | • | • | • | | • | • | | | |
| *Glossocardia bidens* | Cobbler's Tack | • | • | • | | • | • | | | |
| **Hypochaeris glabra* | Smooth Catsear | | | • | | • | | | • | |

| Scientific Name | Common Name | Community | | | | | | | | |
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| | | 1 | 2 | 3 | 5 | 7 | 8 | 9 | 10 | Opp |
| **Hypochaeris radicata* | Flatweed | | | • | | | | | | |
| *Olearia elliptica* | Sticky Daisy-bush | • | • | • | • | • | • | | • | |
| *Olearia viscidula* | Viscid Daisy Bush | • | • | | | • | | | | |
| *Picris angustifolia* subsp. *carolorum-henricorum* | | | | | | | • | | | |
| *Senecio quadridentatus* | Cotton Fireweed | | | • | | | • | • | • | |
| *Sigesbeckia australiensis* | | • | • | | | • | • | | • | • |
| **Sonchus oleraceus* | Common Sowthistle | | | | • | | | • | | |
| **Tagetes minuta* | Stinking Roger | | | | | • | | • | | |
| **Taraxacum officinale* | Dandelion | | | • | | | | | | |
| **Verbesina encelioides* subsp. *encelioides* | Crownbeard | | | | | • | | | | |
| *Vernonia cinerea var. cinerea* | A Vernonia | | | | | | • | | | |
| *Vittadinia cuneata var. cuneata* | | | | | | | • | | | |
| *Vittadinia cuneata var. hirsuta* | Fuzzweed | • | • | • | | • | | | | |
| *Vittadinia muelleri* | A Vittadinia | • | | • | | • | | | | |
| *Vittadinia* sp. | | | | • | | • | • | | | |
| **Xanthium occidentale* | Noogoora Burr | | | | | | | • | | |
| **Bignoniaceae** | | | | | | | | | | |
| *Pandorea pandorana* | Wonga Wonga Vine | • | • | | • | • | • | | | |
| **Boraginaceae** | | | | | | | | | | |
| **Echium plantagineum* | Paterson's Curse | | | | • | | | | | |
| **Brassicaceae** | | | | | | | | | | |
| **Lepidium africanum* | A Peppercress | | • | • | | | • | • | | |
| **Cactaceae** | | | | | | | | | | |
| **Opuntia stricta* | Common Prickly Pear | • | • | • | • | • | | • | | |
| **Campanulaceae** | | | | | | | | | | |
| *Wahlenbergia communis* | Tufted Bluebell | | • | | | | | | | |
| *Wahlenbergia gracilis* | Sprawling Bluebell | • | • | | • | | • | | | |
| *Wahlenbergia planiflora* subsp. *longipila* | | | • | | | • | | | | |
| **Caryophyllaceae** | | | | | | | | | | |
| *Gypsophila tubulosa* | Annual Chalkwort | • | | | | | | | | |
| **Petrorhagia nanteuilii* | Proliferous Pink | • | • | • | | | • | | • | |
| **Stellaria media* | Common Chickweed | | | | | • | | • | | |
| **Casuarinaceae** | | | | | | | | | | |
| *Casuarina cunninghamiana* | River Oak | | | | | | | • | | |
| **Chenopodiaceae** | | | | | | | | | | |
| *Atriplex spinibractea* | Spiny-fruit Saltbush | | | • | | | | | | |
| **Chenopodium ambrosioides* | Mexican Tea | | | | | | | • | | |
| *Chenopodium melanocarpum* | Black Crumbweed | • | | | | | | | | |
| *Einadia nutans* subsp. *linifolia* | Climbing Saltbush | | • | | | | • | | | |
| *Maireana microphylla* | Small-leaf Bluebush | | | • | | | | • | | |
| *Sclerolaena birchii* | Galvanized Burr | | | • | | | | | | |
| **Clusiaceae** | | | | | | | | | | |
| *Hypericum gramineum* | Small St. John's Wort | • | • | • | | • | • | | • | |
| **Convolvulaceae** | | | | | | | | | | |
| *Convolvulus graminetinus* | | | | • | | | | | | |
| *Dichondra repens* | Kidney Weed | • | • | • | • | • | • | • | | |
| *Evolvulus alsinoides* var. *decumbens* | | • | | | | • | | | | |
| **Dilleniaceae** | | | | | | | | | | |
| *Hibbertia obtusifolia* | Hoary Guinea Flower | • | • | | • | • | • | | | |
| **Ericaceae - Styphelioideae** | | | | | | | | | | |
| *Melichrus urceolatus* | Urn-heath | • | • | | • | • | • | | | |

| Scientific Name | Common Name | Community | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 5 | 7 | 8 | 9 | 10 | Opp |
| **Euphorbiaceae** | | | | | | | | | | |
| *Beyeria viscose* | Pinkwood | • | • | | • | • | | | | |
| *Chamaesyce drummondii* | Caustic Weed | | | • | | • | | | | |
| **Fabaceae: Faboideae** | | | | | | | | | | |
| *Desmodium brachypodum* | Large Tick-trefoil | • | • | | • | • | • | | • | |
| *Desmodium varians* | Slender Tick-trefoil | • | • | | | • | • | | | |
| *Glycine clandestine* | Love Creeper | | • | • | • | | • | | | |
| *Glycine* sp. | | • | | | | | | | | |
| *Glycine tabacina* | A Glycine | • | • | | • | • | • | • | | |
| *Hardenbergia violacea* | Purple Coral Pea | | • | | | | | | | • |
| *Hovea apiculata* | | | • | | | • | | | • | |
| *Hovea lanceolata* | | | • | | | | | | | • |
| *Indigofera adesmiifolia* | Tick Indigo | • | • | | | • | | | | |
| **Medicago polymorpha* | Burr Medic | | | • | | | | | | |
| *Swainsona galegifolia* | Smooth Darling-pea | • | • | • | • | • | | | • | |
| **Trifolium angustifolium* | Narrow-leaved Clover | | | • | | | | | | |
| **Trifolium arvense* | Haresfoot Clover | • | • | | | | | | | |
| **Trifolium campestre* | Hop Clover | | | • | | | | • | | |
| **Trifolium repens* | White Clover | | | • | | | | • | | |
| **Fabaceae: Mimosoideae** | | | | | | | | | | |
| *Acacia burrowii* | Burrow's Wattle | | | | | | | | | • |
| *Acacia cheelii* | Motherumbah | | • | | | | | | | |
| *Acacia decora* | Western Silver Wattle | • | • | • | • | • | | | | |
| *Acacia implexa* | Hickory Wattle | | • | | | | | | | |
| *Acacia paradoxa* | Kangaroo Thorn | | | | | | | | | • |
| *Acacia salicina* | Cooba | | • | • | | • | | • | • | |
| **Gentianaceae** | | | | | | | | | | |
| **Centaurium erythraea* | Common Centaury | • | • | • | | | • | • | • | |
| *Schenkia spicata* | Spike Centaury | • | • | • | | • | | | | |
| **Geraniaceae** | | | | | | | | | | |
| *Geranium solanderi subsp. solanderi* | Native Geranium | | • | • | • | • | | • | • | |
| *Geranium* sp. | | • | • | | • | | • | | | |
| *Pelargonium inodorum* | | | | • | | | | | | |
| **Goodeniaceae** | | | | | | | | | | |
| *Goodenia cycloptera* | | | | • | | | | | | |
| *Goodenia hederacea* | Forest Goodenia | • | | | | • | | | | • |
| *Goodenia* sp. | | | • | • | | | | | | |
| **Lamiaceae** | | | | | | | | | | |
| *Ajuga australis* | Austral Bugle | • | • | | • | | • | | | |
| *Mentha satureioides* | Creeping Mint | • | • | • | • | | • | | | |
| *Oncinocalyx betchei* | | • | • | • | | • | • | | | |
| *Scutellaria humilis* | Dwarf Skullcap | • | | | | | | | | |
| **Stachys arvensis* | Stagger Weed | | | • | | | | | | |
| **Lobeliaceae** | | | | | | | | | | |
| *Pratia purpurascens* | Whiteroot | | | | • | | | | | |
| **Loranthaceae** | | | | | | | | | | |
| *Amyema cambagei* | | | | | | | | • | | |
| *Amyema miquelii* | Stalked Mistletoe | | • | | | | | | | |
| *Amyema miraculosum* subsp. *boormanii* | | | | | | | | | | • |
| *Amyema pendulum* | | | | | | • | | | | |
| *Dendrophthoe glabrescens* | | | | | | • | | | | |

| Scientific Name | Common Name | Community | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 5 | 7 | 8 | 9 | 10 | Opp |
| *Lysiana exocarpi* subsp. *tenuis* | | | | | | • | | | | |
| **Malaceae** | | | | | | | | | | |
| **Cotoneaster pannosus* | | | | • | | | | | | |
| **Malvaceae** | | | | | | | | | | |
| *Abutilon oxycarpum* | Straggly Lantern-bush | | | | • | | | | | |
| *Sida corrugata* | Corrugated Sida | • | | | | | • | | | |
| *Sida cunninghamii* | Ridged Sida | • | | | | • | | | | |
| *Sida spinosa* | A Sida | | | • | | | | | | |
| **Moraceae** | | | | | | | | | | |
| *Ficus rubiginosa* | Port Jackson Fig | | | | | | | | | • |
| **Myrsinaceae** | | | | | | | | | | |
| **Anagallis arvensis* | Scarlet Pimpernel | • | • | • | • | | | • | | |
| **Myrtaceae** | | | | | | | | | | |
| *Angophora floribunda* | Rough-barked Apple | | • | | • | | • | • | • | |
| *Ecualyptus albens* | White Box | • | • | • | • | • | | | • | |
| *Eucalyptus blakelyi* | Blakely's Red Gum | | | | | | | | • | |
| *Eucalyptus camaldulensis* | River Red Gum | | | | | | | • | | |
| *Eucalyptus crebra* | Narrow-leaved Ironbark | • | • | | • | • | • | | | |
| *Eucalyptus dealbata* | Tumbledown Red Gum | • | • | | | • | | | | |
| *Eucalyptus melanophloia* | Silver-leaved Ironbark | | | | • | • | | | | |
| *Eucalyptus melliodora* | Yellow Box | | | | | | • | | | |
| *Melaleuca bracteata* | Black Tea-tree | | | | • | | | • | | |
| **Nyctaginaceae** | | | | | | | | | | |
| *Boerhavia dominii* | Tarvine | • | | | | | | | | |
| **Oleaceae** | | | | | | | | | | |
| *Jasminum suavissimum* | | • | | | | • | | • | • | |
| *Notelaea microcarpa* var. *microcarpa* | Velvet Mock Olive | • | • | | • | • | • | • | • | |
| **Oxalidaceae** | | | | | | | | | | |
| *Oxalis exilis* | | • | • | | | | | | | |
| *Oxalis radicosa* | An Oxalis | • | | | | | | | | |
| *Oxalis* sp. | | | • | • | | | | | | |
| **Plantaginaceae** | | | | | | | | | | |
| *Plantago cunninghamii* | | | • | • | | | | | | |
| *Plantago debilis* | Slender Plantain | • | • | • | | | | | | |
| **Plantago lanceolata* | Lamb's Tongues | | | • | | | | • | | |
| **Polygonaceae** | | | | | | | | | | |
| *Rumex brownii* | Swamp Dock | • | | • | | | | | | |
| **Ranunculaceae** | | | | | | | | | | |
| *Clematis aristata* | Old Man's Beard | | • | | | | | | | |
| *Clematis glycinoides* | Headache Vine | | | | • | | | • | | |
| *Clematis microphylla* | Small-leaved Clematis | | | • | | | | | | |
| *Ranunculus pumilio* | Ferny Buttercup | | | • | | | | | | |
| **Rhamnaceae** | | | | | | | | | | |
| *Alphitonia excelsa* | Red Ash | | | | | • | | | | |
| **Rosaceae** | | | | | | | | | | |
| *Acaena agnipila* | | • | • | • | • | • | | | • | |
| **Rosa rubginosa* | Sweet Briar | | | • | • | | | • | • | |
| *Rubus parvifolius* | Native Raspberry | | | | • | | | | | |
| **Rubiaceae** | | | | | | | | | | |
| *Asperula conferta* | Common Woodruff | | • | • | | • | | | | |
| *Galium gaudichaudii* | Rough Bedstraw | • | • | | | • | | | | |
| *Galium leptogonium* | | • | • | | • | | | | | |

| Scientific Name | Common Name | Community | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 5 | 7 | 8 | 9 | 10 | Opp |
| *Galium propinquum* | Maori Bedstraw | | • | | | • | | | | |
| *Psydrax odorata* | Shiny-leaved Canthium | | | | | • | | | | |
| **Rutaceae** | | | | | | | | | | |
| *Geijera parviflora* | Wilga | | | | | | | • | | |
| **Santalaceae** | | | | | | | | | | |
| *Santalum lanceolatum* | Northern Sandalwood | | | | | • | | | | • |
| **Sapindaceae** | | | | | | | | | | |
| *Dodonaea sinuolata* subsp. *sinuolata* | | • | | | | | | | | • |
| *Dodonaea viscosa* subsp. *angustifolia* | Sticky Hop Bush | • | • | • | • | • | | • | • | |
| **Scrophulariaceae** | | | | | | | | | | |
| **Misopates orontium* | Lesser Snapdragon | • | | | | | | | | |
| *Veronica plebeian* | Trailing Speedwell | • | | • | • | | | | | |
| **Solanaceae** | | | | | | | | | | |
| **Solanum nigrum* | Black-berry Nightshade | | | | • | | | | | |
| *Solanum parvifolium* | | | | | • | | | | | |
| **Sterculiaceae** | | | | | | | | | | |
| *Brachychiton populneus* | Kurrajong | • | • | | • | • | • | | • | |
| **Thymelaeaceae** | | | | | | | | | | |
| *Pimelea curviflora* var. *divergens* | | • | • | • | • | | | | | |
| *Pimelea neo-anglica* | Poison Pimelea | • | • | • | • | • | • | • | • | |
| **Urticaceae** | | | | | | | | | | |
| *Urtica incise* | Stinging Nettle | | • | | • | • | | • | | |
| **Verbenaceae** | | | | | | | | | | |
| **Verbena caracasana* | | | | • | • | | | • | | |
| **Violaceae** | | | | | | | | | | |
| *Melicytus dentatus* | Tree Violet | | • | | • | | | • | | |
| **Viola odorata* | Sweet Violet | | | | | | | • | | |
| **SUBCLASS LILIIDAE** | | | | | | | | | | |
| **Anthericaceae** | | | | | | | | | | |
| *Arthropodium milleflorum* | Pale Vanilla-lily | | • | | | | | | | |
| **Cyperaceae** | | | | | | | | | | |
| *Carex incomitata* | | • | • | | • | | | • | | |
| *Cyperus gracilis* | Slender Flat-sedge | • | • | • | | | • | | | |
| *Cyperus vaginatus* | Stiff Flat-sedge | | • | | • | | | • | • | |
| *Eleocharis pallens* | Pale Spike-sedge | | | | • | | | | | |
| *Fimbristylis dichotoma* | Common Fringe-sedge | • | | | | | | | | |
| *Scleria mackaviensis* | | • | • | | | • | • | | | |
| **Juncaceae** | | | | | | | | | | |
| *Juncus remotiflorus* | | • | | | | | | | | |
| **Lomandraceae** | | | | | | | | | | |
| *Lomandra filiformis* subsp. *coriacea* | | • | • | | | | | | | |
| *Lomandra filiformis* subsp. *filiformis* | Wattle Mat-rush | • | • | • | • | • | • | | | |
| *Lomandra longifolia* | Spiny-headed Mat-rush | | • | | • | • | | • | | |
| *Lomandra multiflora* | Many-flowered Mat-rush | • | • | | • | • | • | | • | |
| *Luzula meridionalis* | | | • | | | | | | | |
| **Luzuriagaceae** | | | | | | | | | | |
| *Eustrephus latifolius* | Wombat Berry | | • | | • | | | | | |
| **Orchidaceae** | | | | | | | | | | |
| *Cymbidium canaliculatum* | Tiger Orchid | | | | • | | | | • | |
| *Eriochilus cucullatus* | | | • | | | | | | | |
| *Microtis* sp. | | • | | • | | | | | | |
| *Pterostylis revolute* | | • | • | | | | | | | • |

| Scientific Name | Common Name | Community | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 5 | 7 | 8 | 9 | 10 | Opp |
| *Pterostylis* sp. | | • | • | • | | • | | | | |
| **Phormiaceae** | | | | | | | | | | |
| *Dianella longifolia* | Blueberry Lily | • | • | | • | • | • | | • | |
| *Dianella revoluta* | Spreading Flax-lily | • | • | | • | • | | | | |
| **Poaceae** | | | | | | | | | | |
| *Aristida leichhardtiana* | | | • | | | | | | | |
| *Aristida personata* | Purple Wire-grass | • | • | • | • | • | • | • | • | |
| *Aristida vagans* | Threeawn Speargrass | • | | | | | | | | |
| *Austrodanthonia bipartita* | Wallaby Grass | | | • | | | | | | |
| *Austrodanthonia fulva* | Wallaby Grass | • | | | | | | | | |
| *Austrodanthonia racemosa* var. *obtusata* | Wallaby Grass | • | • | | • | • | • | | | |
| *Austrostipa rudis* | | | • | | | | | | | |
| *Austrostipa scabra* subsp. *scabra* | Speargrass | • | • | • | • | • | • | | | |
| *Austrostipa setacea* | Corkscrew Grass | • | | | | | | | | |
| *Austrostipa verticillata* | Slender Bamboo Grass | • | • | • | • | • | • | • | • | |
| *Bothriochloa decipiens* | Red Grass | | • | | | | | | • | |
| **Bromus molliformis* | Soft Brome | | | • | | | | | | |
| *Chloris truncata* | Windmill Grass | | | • | • | | | | | |
| *Chloris ventricosa* | Plump Windmill Grass | • | • | • | • | • | | • | • | |
| *Cymbopogon refractus* | Barbwire Grass | • | • | • | • | • | • | | | |
| *Cynodon dactylon* | Couch | | | | | | | • | | |
| *Dichanthium sericeum* | Queensland Bluegrass | • | • | • | | • | • | | | |
| *Dichelachne micrantha* | Shorthair Plumegrass | • | • | • | | • | | | | |
| *Digitaria brownii* | Cotton Panic Grass | • | | | | | | | | |
| *Echinopogon intermedius* | Erect Hedgehog Grass | | | | • | | | • | | |
| *Echinopogon ovatus* | Forest Hedgehog Grass | | | | | | | | • | |
| *Elymus scaber* | | • | • | • | | | | | | |
| *Enneapogon gracilis* | Slender Bottle-washers | • | | | | • | | | | |
| *Eragrostis alveiformis* | | | | • | | | | | | |
| *Eragrostis brownii* | Brown's Lovegrass | • | • | | | | | | | |
| *Eragrostis elongata* | Clustered Lovegrass | • | | | | | | | | |
| *Eragrostis leptostachya* | Paddock Lovegrass | • | • | • | | • | • | | • | |
| *Eragrostis parviflora* | Weeping Lovegrass | | | | | • | | | • | |
| **Hyparrhenia hirta* | Coolatai Grass | | • | • | • | | | | • | |
| *Imperata cylindrica* | Blady Grass | | | | • | | | | | • |
| **Lolium* sp. | | | | • | | | | | | |
| *Microlaena stipoides* | Weeping Grass | | | | • | • | • | • | | |
| *Notodanthonia longifolia* | Long-leaved Wallaby Grass | • | • | | | • | | | | |
| *Oplismenus imbecillis* | Creeping Beard Grass | | | | • | | | | | |
| *Panicum simile* | Two Coloured Panic | • | • | • | | • | • | | | |
| *Paspalidium constrictum* | Knottybutt Grass | • | | | | | | | | |
| **Paspalum dilatatum* | Paspalum | | | • | | | | | | |
| **Paspalum urvillei* | Vasey Grass | | | • | • | | | | | |
| *Poa labillardierei* | Tussock Grass | • | • | | • | | | • | | |
| *Poa sieberiana* var. *sieberiana* | Snowgrass | • | • | | | | | | | |
| *Sporobolus creber* | Slender Rat's Tail Grass | • | • | • | | • | | | • | |
| *Themeda australis* | Kangaroo Grass | • | • | | • | • | | | | |
| **Urochloa panicoides* | Urochloa Grass | | | • | | | | | | |
| **Vulpia* sp. | | | | • | | | | | | |
| **Xanthorrhoeaceae** | | | | | | | | | | |
| *Xanthorrhoea johnsonii* | Johnson's Grass Tree | | | | | • | | | | |
| | | | | | | | | | | |

| Scientific Name | Common Name | Community | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 5 | 7 | 8 | 9 | 10 | Opp |
| **TOTAL NATIVE SPECIES** | **193** | **99** | **111** | **68** | **67** | **86** | **51** | **31** | **32** | |
| | | | | | | | | | | |
| **TOTAL INTRODUCED SPECIES** | **46** | **8** | **12** | **32** | **15** | **8** | **7** | **20** | **9** | |
| | | | | | | | | | | |
| **GRAND TOTAL SPECIES** | **239** | **107** | **123** | **100** | **82** | **94** | **58** | **51** | **41** | |