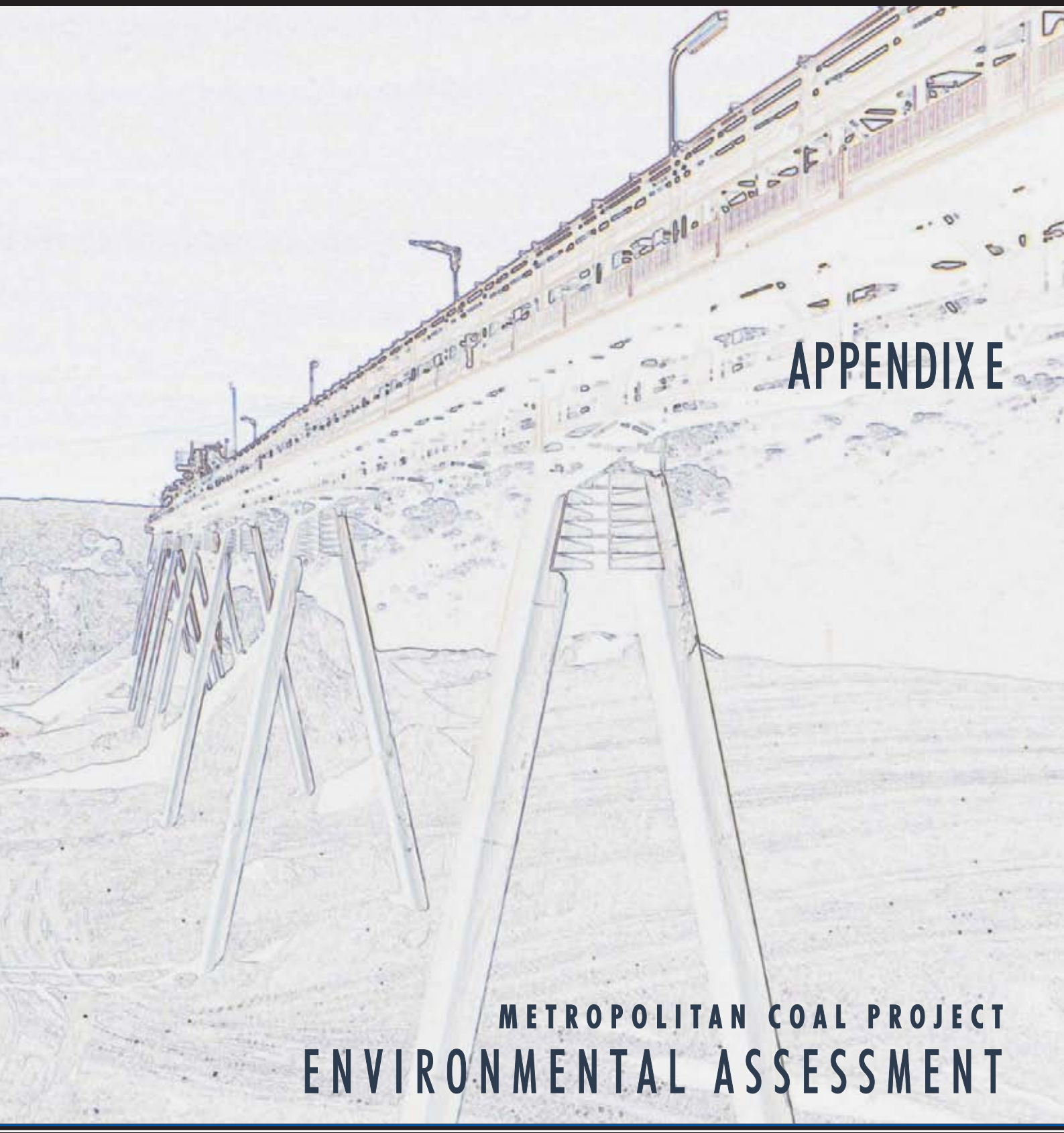

APPENDIX E

METROPOLITAN COAL PROJECT

ENVIRONMENTAL ASSESSMENT

Metropolitan Coal Project Baseline Flora Survey - Proposed Longwall Mining Area

Final Report
April 2008

Signed:

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Final Report

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EXECUTIVE SUMMARY

Metropolitan Colliery is an underground coal mining operation located approximately 30 kilometres north of Wollongong in New South Wales. The Metropolitan Colliery is owned and operated by Helensburgh Coal Pty Ltd, a wholly owned subsidiary of Peabody Pacific Pty Limited.

Bangalay Botanical Surveys were commissioned to conduct a baseline flora survey for the Metropolitan Coal Project. This report identifies and describes the floristic and structural characteristics of the vegetation located within the proposed longwall mine area.

Seasonal field surveys within the Longwalls 20-44 study area were conducted during spring 2006, summer 2006/2007, autumn 2007 and spring/summer 2007/2008. Surveys were also conducted (Bangalay Botanical Surveys 2007) for the Longwalls 18-19A study area in spring 2006, summer 2006 and autumn 2007. Field investigations involved the application of (i) general traverses throughout the site, according to the methods described in York *et al.* (1991) and the Department of Environment and Conservation (DEC) (2004) and (ii) the collection of quadrat data in accordance with methods described in DEC (2004). Specific searches for plant species of conservation significance were conducted in areas of potential or suitable habitat, according to the methods set out in Cropper (1993) and DEC (2004).

Within the study area, the vegetation has been mapped into thirteen map units (and six disturbed units) which are broadly consistent with the vegetation units described in the NPWS (2003) classification. These are: Group 1: Woodlands on Sandstone or Lateritic Soils (Map Units 1a, 1b, 1r); Group 2: Heaths and Mallee Heaths (Map Units 2a, 2b, 2c, 2r); Group 3: Upland Swamp communities (Map Units 3a, 3b, 3c, 3d); Group 4: Riparian (Map Unit 4a); Group 5: Tall Forests (Map Unit 5a); Group 6: Sandstone Gully Forests (Map Units 6a, 6r); Group 7: Woodlands on Lateritic Soils (Map Unit 1c); and Group 8: Other (Map Units 7a and 7b). Map Unit 5a is consistent with the description of the endangered ecological community '*Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion*'. Vegetation communities of conservation significance which have been mapped to the south of the study area (in the vicinity of Longwalls 18-19A) are also described.

Three threatened flora species have been recorded within the LW 20-44 study area, namely *Pultenaea aristata* (Prickly Bush-pea), *Acacia bynoeana* (Bynoe's Wattle) and *Astrotricha crassifolia* (Thick-leaf Star-hair); a fourth - *Melaleuca deanei* (Deane's Paperbark) – has been recorded within the LW18-19a study area. Furthermore, several specimens of *Leucopogon* species and *Epacris* species collected during field surveys were sent to the Herbarium at the Royal Botanic Gardens, Sydney for identification: several have been identified potentially as the threatened species *Leucopogon exolasius* and *Epacris purpurascens* var. *purpurascens*; however, fertile material required for confirmation of identification was not found during subsequent visits during spring and summer surveys, despite extensive searches.

1 INTRODUCTION

1.1 BACKGROUND

Metropolitan Colliery is an underground coal mining operation located approximately 30 kilometres (km) north of Wollongong in New South Wales (NSW) (Figure 1). The Metropolitan Colliery is owned and operated by Helensburgh Coal Pty Ltd (HCPL), a wholly owned subsidiary of Peabody Pacific Pty Limited.

The Metropolitan Coal Project would involve the continuation of underground mining operations at the Metropolitan Colliery. Significant components of the Metropolitan Coal Project include:

- Continued development of underground mining areas.
- Increased saleable coal production (from 1.5 to 2.6 Million tonnes per annum).
- Continued transport of product coal by train to the Port Kembla Coal Terminal and by truck to the Corrimal and Coalcliff Coke Works.
- Upgrade of the Coal Handling and Preparation Plant and associated surface facilities, as necessary.
- Increased rate of coal reject production. A combination of coal reject management options are proposed, including on-site and off-site disposal.
- Upgrade and extension of supporting infrastructure systems (e.g. ventilation, water management and underground mining systems), as required.

The Project would include the existing and completed mining areas, as well as the proposed underground mining area shown on Figure 2. HCPL is currently mining Longwalls 14 to 17 (Figure 2) and has sought Subsidence Management Plan (SMP) approval to mine Longwalls 18 to 19A.

1.2 SITE LOCATION AND STUDY AREA

A large proportion of the proposed underground mining area occurs within the Woronora Special Area which is part of the Sydney Metropolitan Catchment area, administered by the Sydney Catchment Authority (SCA). The areas subject to baseline flora survey (hereafter referred to as the 'study area') include the proposed underground mining area (comprising Longwalls 20-44) and the associated draw and 20mm subsidence area: the extent of these areas is illustrated in Figures 3 to 5. Where the report refers to 'adjacent areas', surveys in these areas were limited to recording the presence or absence of threatened species at spot sampling sites. References to the Longwall 18-19A area refer to the vegetation and flora species recorded within the LW18-19a study area, which is directly adjacent to and to the south of the LW20-44 study area (see reports and mapping in Bangalay Botanical Surveys 2007).

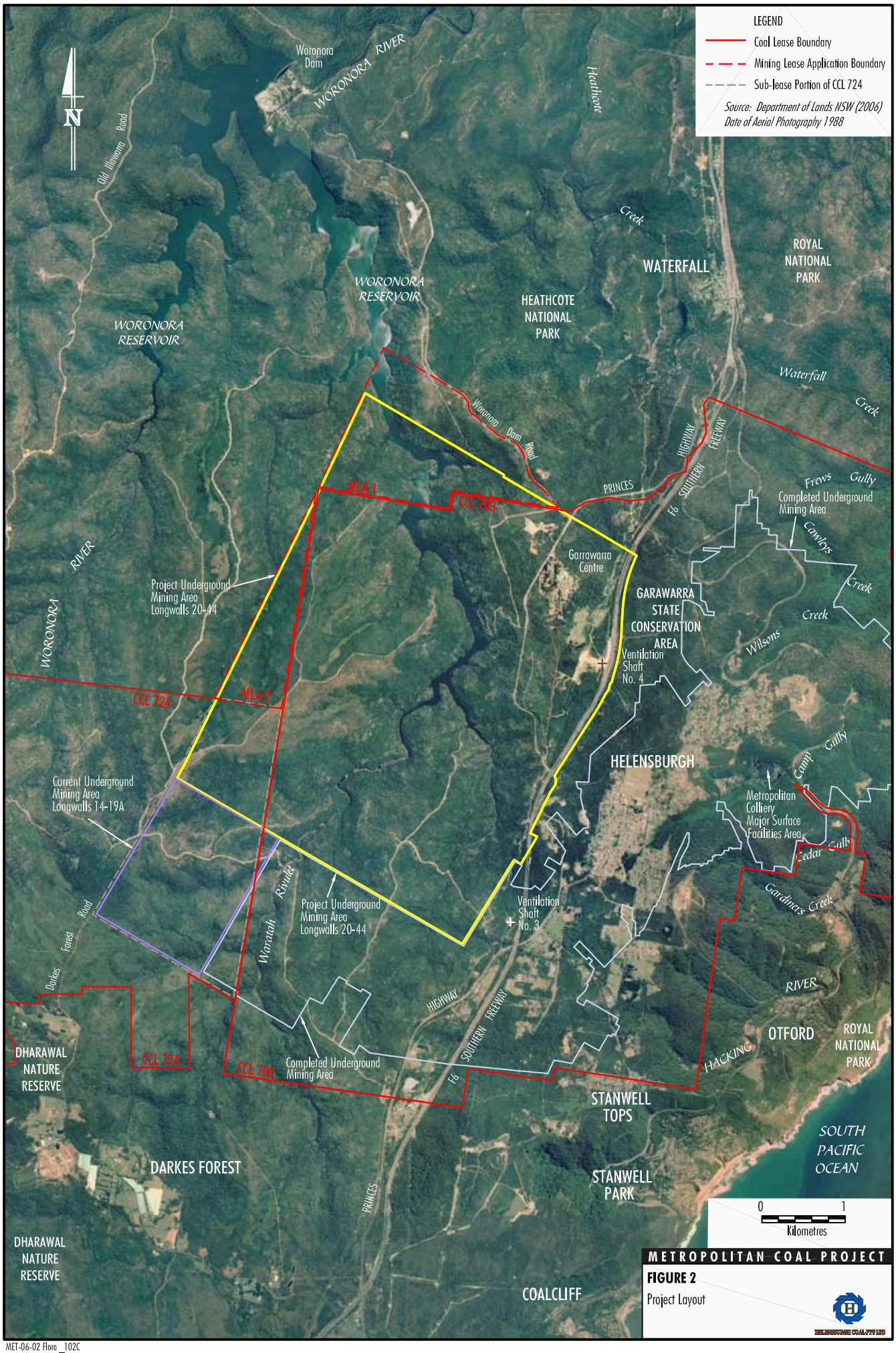
Source: Topographic Map Base - (Sydney Special, Wollongong Special) Geoscience Australia 2006, Reserve Boundaries - Department of Lands NSW 2003 and Sydney Catchment Authority Special Areas - Sydney Catchment Authority 2006

METROPOLITAN COAL PROJECT

FIGURE 1
Regional Location

HELENSBURGH COAL PTY LTD

MET-06-02 Flora_001C



MET-06-02 Flora _102C

The eastern edge of the subject site extends from the western edge of Garawarra State Conservation Area south-eastwards to the Helensburgh on-ramp to the F6 Freeway: the western boundary is roughly delineated by Fire Roads 9E and 9D, with the northen boundary broadly following Woronora Dam Road. The site's eastern boundary is approximately 1 km west of the town of Helensburgh, which is approximately 40 km south-east of Sydney. Most of the subject site area occurs within the Woronora Special Area which is part of the Sydney Metropolitan Catchment area, managed by the Sydney Catchment Authority; the remainder occurs immediately to the east of the Woronora Special Area (Figure 2) within Garrawarra State Conservation Area (under Department of Environment and Climate Change tenure). In the eastern section of the site are roads or road easements managed by the NSW Roads and Traffic Authority (RTA), service utility easements managed by various agencies (*e.g.* Energy Australia, Telstra) or private lands (*e.g.* Garrawarra Retirement Village).

1.3 AIM AND OBJECTIVES OF THIS REPORT

The aim of this flora survey report is to provide details of the flora species, vegetation communities and their habitats within the study area.

The objectives of this flora survey report are:

- to provide a summary of previous vegetation studies and vegetation mapping for the study area and surrounding areas;
- to identify, describe and map the vegetation communities present within the study area;
- to compile an inventory of native and introduced flora species which occur within the study area; and
- to identify any threatened flora species, populations, ecological communities or their habitats listed on the NSW *Threatened Species Conservation Act 1995* (TSC Act) or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), which may occur within the study area.

The investigations conducted within the study area included undertaking targeted surveys for threatened flora species known to occur in the region, or flora species or flora species habitat(s) likely to occur within the study area.

As indicated above, the aim and objectives of this report do not include the assessment of the potential impacts arising from the proposed Longwalls 20-44 on flora species and vegetation communities within the study area: rather, this report contains baseline flora information only. Assessment of potential impacts on flora species and vegetation communities (arising from the proposed Longwalls 20-44) is documented (in association with potential impacts on terrestrial fauna) in a separate flora and fauna impact assessment report.

1.4 ENVIRONMENTAL SETTING

1.4.1 Landform

The study area is located in the eastern section of the Woronora Plateau (also known as the Nepean Ramp), which extends from Robertson in the south to the upper reaches of the Georges River in the north. Keith (1994) notes that it is a dissected plateau composed largely of Traissic Hawkesbury Sandstone, with lenses of shale in its eastern section and with extensive areas of ironstone mantles remaining on broad ridges and plateaux (noted as being "extensive" in the Woronora and O'Hares Creek catchments by the National Parks and Wildlife Service [NPWS] [2003]). Topographic characteristics vary from gently sloping broad ridges and plateaux to steep-sided slopes along incised

gullies, with the majority of the study area occurring within the 280 to 350 metres (m) AHD band (excluding gullies and creeklines). These geological and topographical variations are associated with four broad vegetation community types:

- sclerophyllous woodlands;
- scrubs and heathlands on ridges and plateaux on skeletal sandstone soils or ironstone, with soils of varying depths;
- open forests on lower slopes in sheltered gullies (often with narrow bands of riparian scrub vegetation in the major creeklines);
- open forests associated with an isolated shale mantle which overlies the sandstone plateaux; and
- upland swamps in poorly-drained plateaux and creek headwaters.

The vegetation within the study area is generally undisturbed (apart from natural disturbance due to previous fires in the area), with the exception of some areas in the east of the study area (*e.g.* disturbance from powerline and road easements and on private land) which appear to have been subject to historic clearing. The study area is also traversed by several unsealed Fire Roads.

1.4.2 Planning and Bioregional Context

The study area is located within the Wollongong Local Government Area (LGA) of the Illawarra Planning Region and the Wollondilly LGA of the Sydney Surrounds Planning Region (Department of Local Governments, 2007).

The study area is also located within the Sydney Basin Bioregion (*Interim Biogeographic Regionalisation for Australia* (IBRA) (Thackway and Cresswell, 1995; Department of the Environment, Heritage, Water and the Arts (DEHWA, 2008). This IBRA Region includes the Sydney and the Central Coast regions of NSW, and extends north to the Hunter Valley, west to the Blue Mountains and south to near Nowra.

The study area also occurs within the Central Coast Botanical Subdivision of NSW, which extends north to Newcastle, south to Kiama and west to the Blue Mountains (Anderson, 1968; Harden, 2002).

At a finer scale, the study area is located within the Sydney Cataract Catchment Management Authority (CMA) Sub-region of the Sydney Metropolitan CMA Region (DECC, 2007a).

The CMA Regions and Sub-regions (Morgan, 2001) are broadly consistent with the draft sub-IBRA (version 6.1) boundaries created under the IBRA framework (DEHWA, 2008).

1.4.3 Climate

According to the modified Koeppen System of climate classification used by the NSW Bureau of Meteorology (Stern *et al.* undated), the Illawarra region experiences a temperate climate, with generally uniform rainfall, warm to hot summers and cool to cold winters. Rainfall is generally uniformly distributed throughout the year.

Almost all of the study area occurs within the 1150 to 1350 millimetres per year (mm/year) band, with the far south-eastern corner of the study area within the 1351 to 1500 mm/year rainfall band (NPWS, 2003).

An indication of mean average rainfall and temperatures can be obtained by examining figures collected by the Bureau of Meteorology for the nearest stations at Darkes Forest (located approximately 3.5 km south-east of the study area - rainfall data only) and Lucas Heights (located approximately 10 km to the north of the study area – temperature data). Mean temperatures and rainfall are shown in Table 1 below.

Table 1
Mean Temperature and Rainfall

Criteria	Data
Highest mean daily maximum temperature	26°C (February)
Lowest mean daily minimum temperature	6.6°C (July)
Highest daily maximum temperature	42°C (February)
Lowest daily minimum temperature	-0.6°C (July)
Highest mean monthly rainfall	158.7 mm (February)
Lowest mean monthly rainfall	76.9 mm (September)
Mean annual rainfall	1,419 mm

Source: NSW Bureau of Meteorology (2007). Rainfall: 1894-2007 Darkes Forest (68024), Temperature: 1958-2007 Lucas Heights (ANSTO).

Variations in temperature closely follow patterns in elevation: summers are generally warmer in the west as they are not cooled by the mitigating summer sea breezes. Temperatures are generally hottest in January and coldest in July to August. Fogs are frequent along the escarpment edge between Lake Avon and Mt. Keira and also north from Bulli. Winds are characterised by south east summer breezes and gusty south westers during the winter months (NPWS, 2003).

1.4.4 Fire History

The catchments of Woronora, O'Hares, Nepean and Avon were all extensively burnt during December 2001 and January 2002 (NPWS, 2003). Mapping of areas affected by fires in the report on the *Native Vegetation of the Woronora, O'Hares and Metropolitan Catchments* (NPWS, 2003) indicates that the study area has withstood three fires since 1970 (i.e. the vegetation has naturally regenerated following fire), although, occasional local-scale fires which may have been too small to map may have also occurred since 1970.

2 LITERATURE REVIEW

This section contains a review of literature pertaining to the study area, including:

- previous vegetation studies in the area, including review of documents published by governmental bodies (Section 2.1);
- previous vegetation mapping (Section 2.2); and
- review of threatened flora species, endangered populations, threatened ecological communities, critical flora habitat and flora of local conservation significance occurring or likely to occur within the study area, from various sources (Section 2.3).

2.1 PREVIOUS VEGETATION STUDIES AND PLANS

A number of vegetation studies and plans have been prepared which are relevant to the study area and wider surrounds, including:

- Native Vegetation of the Woronora, O' Hares and Metropolitan Catchments (NPWS, 2003);
- Native vegetation map report series. No. 4. Department of Infrastructure Planning and Natural Resources (Tindall et al., 2004);
- Native Vegetation of the South-east NSW: A Revised Classification and Map for the Coast and Eastern Tablelands (Tozer et al., 2006);
- Illawarra Escarpment Bioregional Assessment Study Part I: Native Vegetation of the Illawarra Escarpment and Coastal Plain (NPWS, 2002);
- Special Areas Strategic Plan of Management (SCA and DEC, 2007);
- Wollongong City Council State of the Environment Report 06/07 (Wollongong City Council [WCC] 2006/2007);
- Royal National Park, Heathcote National Park and Garawarra State Conservation Area Plan of Management (NPWS, 2000);
- various Metropolitan Colliery flora reports prepared by Gingra Ecological Surveys including Gingra Ecological Surveys (2005) Metropolitan Colliery Longwalls 14-17 Subsidence Management Plan Application: Flora Assessment; and
- Metropolitan Colliery: Longwall 18, 19 and 19A Flora Survey and Assessment (Bangalay Botanical Surveys, 2007).

A description of each previous vegetation study is provided below.

Native Vegetation of the Woronora, O' Hares and Metropolitan Catchments (NPWS, 2003)

This is an in-depth report conducted by the NPWS (now the Department of Environment and Climate Change [DECC]) on the vegetation and floristics of the major Sydney metropolitan water catchments (i.e. Woronora, O'Hares and Metropolitan catchments). The report includes detailed descriptions of a range of vegetation communities, threatened flora species and their habitats and vegetation mapping throughout all the listed catchment areas. The report and mapping are based on data collected during systematic field surveys, aerial photograph interpretation, and review of existing vegetation mapping from a range of sources.

A total of 48 vegetation communities (not including sub-communities and disturbed areas) occurring within the specified catchment areas were mapped, with descriptions including notes on threatened species recorded in those map units, and notes on the potential for each map unit to contain habitat for a range of other threatened or regionally significant flora species.

Descriptions and mapping of vegetation communities in this flora survey and assessment correlate broadly with the classification provided in NPWS (2003) (Sections 2.2 and 4.1), but refine the vegetation mapping and floristic data within the study area.

Native vegetation map report series. No. 4. Department of Infrastructure Planning and Natural Resources (Tindall et al., 2004)

This map and vegetation classification system was produced under the NSW Native Vegetation Mapping Programme (NVMP) aimed to produce a consistent coverage of vegetation maps for eastern and central NSW. This document covered the Greater Sydney-Illawarra and Southern Highlands region as far south as Batemans Bay. This document was subsequently superseded by Tozer *et al.,* (2006).

Native Vegetation of the South-east NSW: A Revised Classification and Map for the Coast and Eastern Tablelands (Tozer et al., 2006)

This document built upon the map and vegetation classification system developed by Tindall *et al.,* (2004) and data from other mapping projects to provide consistent vegetation classification coverage from Sydney to the Victorian border. The methods used to produce this map followed that of the NVMP (Tindall *et al.,* 2004).

Illawarra Escarpment Bioregional Assessment Study: Part I – Native Vegetation of the Illawarra Escarpment and Coastal Plain (NPWS, 2002)

The NPWS is the agency responsible for the completion of the Bioregional Assessment, which is one of a series of recommendations made by a Commission of Inquiry in 1999 into long-term landuse planning along the Illawarra Escarpment. The NSW State government subsequently endorsed these recommendations.

The Bioregional Assessment Study (in two volumes: Volume 1 details flora, Volume 2 refers to fauna) has collected and analysed flora and fauna data, and subsequently described and mapped vegetation communities and fauna habitats within the Wollongong LGA and parts of the northern sections of the Shellharbour LGA.

Detailed vegetation sampling and mapping within the Bioregional Assessment Study covers the area from the sandstone plateau edge to the coast. The western limit of the vegetation mapping directly abuts the eastern edge of the vegetation mapping provided in NPWS (2003); while Map Unit numbering differs between this and NPWS (2003), the descriptions and naming of the vegetation communities are generally consistent.

Special Areas Strategic Plan of Management (SCA and DEC, 2007)

The *Special Areas Strategic Plan of Management* (SASPoM) provides a strategic framework for catchment management which was developed jointly by the SCA and the DECC. The plan identifies major goals for joint managers within all Special Areas, including private lands and leases, and ensures that management will be undertaken in a manner which will contribute to the protection of water quality and ecological integrity. The SASPoM "…*seeks to ensure that land management practices throughout all Special Areas, including private lands and leases, are undertaken in a manner which will contribute to the protection of water quality and ecological integrity*." (SCA and DEC, 2007).

The NSW government established the Sydney Catchment Authority (SCA) to "…*manage and protect the water supply catchments and to ensure the provision of safe clean drinking water* [to the Sydney Metropolitan, Illawarra and Blue Mountains regions]" (SCA and DEC, 2007). Special Areas are those areas of the major water storages under the management of the SCA: these were declared in order to protect drinking water supply and quality for the Sydney Metropolitan, Illawarra and Blue Mountains areas, with the additional benefit of conserving large areas of important natural and cultural value. The SCA and NPWS are joint sponsors of the *Special Areas Strategic Plan of Management*: some

areas within the declared Special Areas have been gazetted as national parks, nature conservation areas or state conservation areas.

The SASPoM was adopted in accordance with s.49 of the *Sydney Water Catchment Management Act* 1998: both ss. 49 and 50 of the Act require the joint sponsors to prepare and give effect to a plan of management for each Special Area. The 2001 SASPoM set out objectives for joint fire management planning, integrated pest and weed species management and terrestrial flora and fauna surveys. The 2007 SASPoM builds on the 2001 document, and sets additional targets for increases in the extent and quality of native vegetation, increase in sustainable populations of a range of native fauna species, increase in the recovery of threatened species, populations and ecological communities, reduction in pest and weed species, and improvements in the condition of watercourses and wetlands. The current Plan is to have a lifespan of 10 years, and is to be reviewed every five years. Within the Special Reas, the SCA "…*regulates land use activities that may impact on water quality through the Sydney Water Catchment Management (Environmental Protection) Regulation 2001*."

Wollongong City Council State of the Environment Report 06/07 (WCC, 2006/2007)

In accordance with its responsibilities under the *Local Government Act, 1993,* WCC has prepared a State of the Environment Report for the LGA (WCC, 2006/2007). This report provides details on the condition of, and pressures upon the natural environment, and outlines possible response procedures to perceived pressures on terrestrial and aquatic ecosystems.

While the major focus of the report concentrates on issues relating to the coastal plain, information relating to the current status of factors relating to the natural environment is set out in various sections: Sections 3 (Land), 4 (Water) and 5 (Biodiversity). Section 3 (Land) describes the Illawarra Escarpment Strategic Management Plan. Section 4 (Water) gives data on water quality and water supply and management for human use within the LGA. Section 5 (Biodiversity) covers a range of subjects, including descriptions of vegetation communities, lists of threatened plant species, populations and ecological communities, locally rare or significant plant species, threats to remnant flora and vegetation and outlines strategies for the management of pest and weed species and a range of restoration and conservation projects.

Royal National Park, Heathcote National Park and Garawarra State Recreation Area[1] Plan of Management (NPWS, 2000).

This Plan of Management was prepared by NPWS under the provisions of the *National Parks and Wildlife Act, 1974* and was adopted in 2000. This document emphasises the importance of the Royal National Park (NP) and its significance in supporting a diverse range of flora, vegetation communities, fauna and habitat types. This significance is emphasised by its proximity to urban areas of Sydney.

Heathcote NP and Garawarra SCA are located along the northern and eastern borders of the Woronora Special Area, and share a similar range of vegetation communities, native plant species and habitats.

Metropolitan Colliery Longwalls 14-17 Subsidence Management Plan Application: Flora Assessment (Gingra Ecological Surveys, 2005)

This document identifies and describes the vegetation communities and flora species present within that part of the Metropolitan Colliery lease area which is the subject of the Longwall 14-17 SMP. The report also discusses the potential impacts of subsidence on vegetation associated with the mining of Longwalls 14-17, and includes assessments of the significance of impacts on three plant species listed as threatened under the TSC Act 1995.

[1] Now Garawarra State Conservation Area

Metropolitan Colliery: Longwall 18, 19 and 19A Flora Survey and Assessment (Bangalay Botanical Surveys, 2007)

This report provides the results of a flora survey and assessment for the Longwalls 18, 19 and 19A Subsidence Management Plan Application Area and assesses the potential impacts of the underground coal mining on flora. Two threatened flora species were recorded within the Application Area, namely the Prickly Bush-pea (*Pultenaea aristata*) and Deane's Paperbark (*Melaleuca deanei*). One other species was recorded during the surveys, namely Bynoe's Wattle (*Acacia bynoeana*), however, this species was recorded outside the Application Area. Twelve vegetation communities were recorded within the Application Area including two endangered ecological communities ('*O'Hares Creek Shale Forest*' and '*Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion*').

2.2 PREVIOUS VEGETATION MAPPING

Vegetation communities occurring within the study area as mapped by NPWS (2003) and/or Tozer *et al.* (2006) are listed in Table 2.

Table 2
Vegetation Previously Classified within the Study Area

Vegetation Type	NPWS (2003) Vegetation Mapping		Tozer *et al.*, (2006) Vegetation Classification	
	Map Unit	Vegetation Community	Map Unit	Vegetation Community
Sandstone Forests	25	Sandstone Gully Apple-Peppermint Forest	p140	Coastal Sandstone Gully Forest
Sandstone Woodlands	29	Exposed Sandstone Scribbly Gum Woodland	p131	Coastal Sandstone Ridgetop Woodland
	33	Silvertop Ash Ironstone Woodland		
	34	Sandstone Heath-Woodland		
Heaths and Mallees	38	Rock Pavement Heath	p117	Coastal Sandstone Plateau Heath
	39	Rock Plate Heath-Mallee	p126	Coastal Rock Plate Heath
	40	Woronora Tall Mallee-heath		
Swamps	42	Upland Swamp: Banksia Thicket	p129	Coastal Upland Swamp
	43	Upland Swamp: Tea-Tree Thicket		
	44	Upland Swamp: Sedgeland-heath Complex		
	45	Upland Swamp: Fringing Eucalypt Woodland		
Riparian Scrub	4	Sandstone Riparian Scrub	p58	Sandstone Riparian Scrub
Tall Open Forests	16	Tall Blackbutt-Apple Shale Forest	p140	Coastal Sandstone Gully Forest

Of the vegetation communities previously mapped (NPWS, 2003) within the study area, *Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion* (classified as MU16 Tall Blackbutt-Apple Shale Forest in NPWS 2003) is the only community listed as an endangered ecological community under Schedule 3 of the TSC Act 1995. Patches of the endangered ecological community *O'Hares Creek Shale Forest* occur to the south of the study area,

within the LW18-19a study area. These communities and the potential for other endangered ecological communities to occur within the study area are further discussed in Section 2.3.3.

Prior to more recent vegetation mapping by NPWS of the Illawarra Escarpment (NPWS, 2002) and the Metropolitan Catchments (NPWS, 2003), few adequate vegetation maps of the Illawarra region existed. The exception is Keith (1994), who mapped remnant vegetation of the O'Hares Creek catchment.

Keith and Myerscough (1993) also studied the floristics of upland swamp vegetation in the O'Hares Creek catchment in which four vegetation associations within the upland swamps were described, namely Banksia Thicket (equivalent to the Upland Swamp: Banksia Thicket [MU42] – Table 2), Ti-tree Thicket (equivalent to the Upland Swamp: Tea Tree Thicket [MU43] [NPWS, 2003]), Restioid Heath and Cyperoid Heath (both part of the Upland Swamp: Sedgeland-heath Complex [MU44] – Table 2).

In addition, Mills and Jakeman (1995) mapped remnant rainforest patches within the Illawarra, while Thomas (1990) has conducted a range of site-specific inventories of rainforest patches (within the Metropolitan and Woronora Catchment areas.

Other, smaller-scale vegetation mapping includes that undertaken for the Illawarra Region of Councils (IROC) remnant bushland database (although the accompanying maps are generally restricted to specific locations), and some limited vegetation mapping accompanying the Illawarra LGA State of Environment reports (i.e. Wollongong, Shellharbour and Shoalhaven councils).

2.3 THREATENED FLORA SPECIES, ENDANGERED POPULATIONS, ENDANGERED ECOLOGICAL COMMUNITES AND CRITICAL FLORA HABITAT

This section provides a review of threatened flora species (Section 2.3.1), endangered populations (Section 2.3.2), endangered ecological communities (Section 2.3.3), critical flora habitat (Section 2.3.4) and flora of local conservation significance (Section 2.3.5) which may occur within the study area.

2.3.1 Threatened Flora Species

Targeted surveys were undertaken for a number of threatened flora species for which the study area provides potential habitat. A preliminary list of candidate species was drawn from a number of databases and sources, as follows:

- DECC Atlas of NSW Wildlife for a search area covering the Wollongong and Port Hacking 1:100 000 map sheets (DECC, 2007c);
- Sydney Royal Botanic Gardens (SRBG) for a search area covering 40 x 40 kilometre (km) area surrounding the study area (SRBG, 2007a); and
- Department of Environment and Water Resources (DEWR) Protected Matters Search for a search area covering 40 km X 40 km area surrounding the study area (DEWR, 2007).

Also incorporated in the list were a number of species with populations to the north and south of the study area (beyond the search radius) for which potential suitable habitats were present (*e.g.* Jervis Bay Leek Orchid *Praosphyllum affine*). The full list of threatened flora species for which the study area provided potential habitat is provided in Appendix A.

The preliminary list of flora species was subsequently filtered to a smaller list of candidate threatened flora species for the targeted survey, based on the flora species habitat requirements and the habitats available within the study area. The list of candidate threatened flora species for the targeted survey is provided in Table 3.

Table 3
List of Candidate Threatened Flora Species for the Targeted Survey

Scientific Name	Common Name	Conservation Status	
		TSC Act [2]	EPBC Act[3]
Acacia baueri subsp. *aspera*	-	V	-
Acacia bynoeana	Bynoe's Wattle	E	V
Acacia pubescens	Downy Wattle	V	V
Astrotricha crassifolia	Thick-leaf Star-hair	V	V
Boronia deanei	Deane's Boronia	V	V
Caladenia tessellata	Tesselated Spider Orchid	E	V
Callistemon linearifolius	Netted Bottle Brush	V	-
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V
Darwinia biflora	-	V	V
Darwinia peduncularis	-	V	-
Epacris purpurascens var. *purpurascens*	-	V	-
Eucalyptus camfieldii	Camfield's Stringybark	V	V
Genoplesium baueri	Bauer's Midge Orchid	V	-
Grammitis stenophylla	Narrow-leaf Finger Fern	E	-
Grevillea parviflora subsp. *parvifora*	Small-flower Grevillea	V	V
Haloragis exalata var. *exalata*	Square Raspwort	V	V
Hibbertia puberula	-	E	-
Lasiopetalum joyceae	-	V	V
Leucopogon exolasius	Woronora Beard-heath	V	V
Melaleuca deanei	Deane's Paperbark	V	V
Persoonia hirsuta subsp. *hirsuta*	-	E	E
Persoonia mollis subsp. *maxima*	-	E	E
Prasophyllum affine	Jervis Bay Leek Orchid	E	E
Prostanthera densa	Villous Mintbush	V	V
Pterostylis saxicola	Sydney Plains Greenhood	E	E
Pultenaea aristata	Prickly Bush-pea	V	V
Tetratheca glandulosa	Black-eyed Susan	V	V
Thesium australe	Austral Toadflax	V	V

2 *Threatened Species Conservation Act 1995* (E = Endangered, V = Vulnerable)
3 *Environment Protection and Biodiversity Conservation Act 1999* (E = Endangered, V = Vulnerable)

2.3.2 Endangered Populations

A preliminary list of candidate endangered populations was drawn from the NP&WS Atlas of NSW Wildlife (10km radius search) and Environment Australia's databases (see Appendix B and Table 4), and was subsequently filtered to a smaller, interim candidate list based on habitat requirements and the site's habitats.

Table 4
List of Candidate Endangered Populations for the Targeted Survey

Botanical Name	Common Name	Habit	Conservation Status	
			NSW Status[4]	National[5]
Callitris endlicheri	'Black Cypress Pine'	Small tree	Endangered Population (E2) (Woronora Plateau)	-
Chorizema parviflorum	-	Sub-shrub	Endangered Population (E2) (Wollongong & Shellharbour LGAs)	-
Lespedeza juncea subsp. *sericea*	-	Perennial subshrub	Endangered Population (E2) (Wollongong LGA)	-

2.3.3 Endangered Ecological Communities

A preliminary list of candidate endangered ecological communities was drawn from the NP&WS Atlas of NSW Wildlife (10km radius search) and Environment Australia's databases (see Table 5), and was subsequently filtered to a smaller, interim candidate list based on habitat requirements and the site's habitats.

The list of endangered ecological communities in Appendix C was subsequently filtered to a smaller list of candidate ecological communities for the targeted surveys based on the ecological communities' habitat requirements and the habitats available within the study area.

Additionally, as stated in Section 2.2, the endangered ecological community *Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion* was detected during field surveys (unit DSF p140 of Tozer *et al.,* 2006) (DECC, 2007b). This community occurs on transitional sandstone soils, and is primarily associated with the heads and upper slopes of sandstone gullies which are downslope from residual shale or ironstone caps (*ibid.*).

A number of upland swamp vegetation types occurring in the Sydney Basin Bioregion are listed as endangered ecological communities under the TSC Act and/or EPBC Act, including '*Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps'* and '*Temperate Highland Peat Swamps on Sandstone'*. However, based on comparison of the topographical and geographic distribution, none of the vegetation occurring within upland swamps within the study area accord with these endangered ecological communities.

[4] Listed under Schedule 1 (Endangered) and Schedule 2 (Vulnerable) of the *TSC Act 1995*.

[5] Listed as Endangered or Vulnerable on the *EPBC Act 1999*.

Table 5
List of candidate Endangered Ecological Communities for the targeted survey

Endangered Ecological Community	Conservation Status	
	NSW Status[6]	National[7]
Hunter Valley Weeping Myall Woodland of the Sydney Basin Bioregion	EEC[8]	Critically Endangered
Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion	EEC	-
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps	EEC	-
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and Souith east Corner bioregions	EEC	-
Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions	EEC	-
Warkworth Sands Woodland in the Sydney Basin Bioregion	EEC	-
Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions	EEC	-
Milton Ulladulla Subtropical Rainforest in the Sydney Basin Bioregion	EEC	-
Quorrobolong Scribbly Gum Woodland in the Sydney Basin Bioregion	EEC	-
Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion	EEC	-
Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion	EEC	Endangered
Shale/Sandstone Transition Forest in the Sydney Basin Bioregion	EEC	Endangered
Sydney Coastal River-Flat Forest	EEC	-
Sydney Freshwater Wetlands in the Sydney Basin Bioregion	EEC	-
O'Hares Creek Shale Forest	EEC	-
Kurnell Dune Forest in the Sutherland Shire and City of Rockdale	EEC	-
Cumberland Plain Woodland	EEC	Endangered
Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion	EEC	-
Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion	EEC	-
Kurri Sand Swamp Woodland in the Sydney Basin Bioregion	EEC	-
Mount Gibraltar Forest in the Sydney Basin Bioregion	EEC	-
Robertson Basalt Tall Open-forest in the Sydney Basin Bioregion	EEC	-
Robertson Rainforest in the Sydney Basin Bioregion	EEC	-
Southern Highlands Shale Woodlands in the Sydney Basin Bioregion	EEC	-
Lower Hunter Spotted Gum - Ironbark Forest in the Sydney basin Bioregion	EEC	-
Sydney Freshwater Wetlands in the Sydney Basin Bioregion	EEC	-
Sydney Turpentine-Ironbark Forest	EEC	Critically Endangered
Western Sydney Dry Rainforest in the Sydney Basin Bioregion	EEC	-
Castlereagh Swamp Woodland Community	EEC	-
Elderslie Banksia Scrub Forest	EEC	-
Sutherland Shire Littoral Rainforest (now syn. with Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions)	EEC	-

[6] Listed under Schedule 1 (Endangered) and Schedule 2 (Vulnerable) of the *TSC Act 1995*.

[7] Listed as Endangered or Vulnerable on the *EPBC Act 1999*.

[8] Endangered Ecological Community

Endangered Ecological Community	Conservation Status	
	NSW Status[6]	National[7]
Shale-gravel Transition Forest in the Sydney Basin Bioregion	EEC	-
Shale-sandstone Transition Forest	EEC	Endangered
Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	EEC	-
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	EEC	-
Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	EEC	-
Moist Shale Woodland in the Sydney Basin Bioregion	EEC	-
White Box Yellow Box Blakely's Red Gum Woodland	EEC	Critically Endangered[9]
Duffys Forest Ecological Community in the Sydney Basin Bioregion	EEC	-
Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	EEC	-
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	EEC	-
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South east Corner Bioregions	EEC	-
Hygrocybeae Community of Lane Cove Bushland Park	EEC	-
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	EEC	-
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney basin and South East Corner bioregions	EEC	-
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	EEC	-
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	EEC	-
Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions	EEC	-

Note that the Determination to list *Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion* as an Endangered Ecological Community had not been finalised at the time that the list of candidate EECs was drawn up; the Final Determination for this EEC was made in late 2007.

2.3.4 Critical Flora Habitat

No critical flora habitat has been declared under the TSC Act or the EPBC Act in the region of the study area.

[9] slightly different to state listing.

3 METHODS

3.1 SURVEY TIMING AND SUMMARY OF FIELD EFFORT

Seasonal field surveys were conducted within the study area (including the associated draw and subsidence areas), in conjunction with threatened species searches in adjacent areas. The field surveys were conducted during spring 2006, summer 2006/2007 and spring/summer 2007/2008. Additional field surveys were conducted in adjacent areas (*i.e.* beyond the study area) in order to ascertain the extent of those threatened flora species recorded within the study area; survey dates were during late winter (29 and 30 August 2007) and spring 2007 (between 13 and 17 September 2007). Surveys have also been undertaken by Bangalay Botanical Surveys (2007) immediately to the south for Longwalls 18-19A in spring 2006, summer 2006 and autumn 2007.

Field investigations involved the application of general traverses throughout the site, according to the methods described in York *et al.* (1991). Specific searches for plant species of conservation significance known from the locality were conducted in areas of potential or suitable habitat, according to the methods set out in Cropper (1993).

The design of all stages of the surveys (including the preliminary assessments, data and background information collection, general and threatened species field surveys and sampling techniques) accord with the requirements set out in the Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft (Department of Environment and Conservation [DEC] 2004). A summary of field hours undertaken for the study area is provided in Table 6 below.

Table 6
Summary of Field Effort

Survey Type	Targetting	Duration	
		Dates	Person Hours
Random Meander/ Targetted Searches Spring surveys	All threatened flora, endangered populations and endangered ecological communities conducive to spring surveys. Approximately 30% dedicated to mapping vegetation boundaries.	14th, 15th, 17th, 22nd, 23rd, 24th, 27th, 29th, 30th November and the 1st and 4th December, 2006.	176
Random Meander/ Targetted Searches Summer surveys	All threatened flora, endangered populations and endangered ecological communities conducive to summer surveys. Approximately 10% dedicated to mapping vegetation boundaries.	12th, 15th, 16th, 17th and 18th January, 2007.	80
Random Meander/ Targetted Searches - Draw Area	All threatened flora, endangered populations and endangered ecological communities conducive to spring and summer surveys. Approximately 10% dedicated to mapping vegetation boundaries.	10th, 21st, 22nd and 30th November, 2007 and the 8th, 17th, 24th, May, 2007.	112
Targetted Species Searches – Adjacent areas	All threatened flora, endangered populations and endangered ecological communities conducive to spring and summer surveys. Approximately 10% dedicated to mapping vegetation boundaries.	18th and 29th June, 1st, 2nd, 16th and 21st September, 20th December, 2007 and the 29th, January, 2008.	128

		Duration	
Quadrat – LW 20-44 area	-	21st, 22nd, 24th, 25, 28th and 29th May, 2007.	96
Quadrat – draw area	-	16th, 28th, and 29th November, 10th, 19th and 21st December, 2007 and the 9th January 2008.	112

3.2 TARGETED SURVEYS FOR THREATENED PLANT SPECIES AND MAPPING OF ENDANGERED ECOLOGICAL COMMUNITIES

Targeted surveys were undertaken in areas of potential habitat for threatened flora species known to occur in the region (Section 2.3).

The habitat searches were undertaken by stratifying existing (NPWS, 2003) mapping (and air photo interpretation [API]) into units containing potentially suitable habitat and prioritising searches in those areas which contained highest habitat potential.

Targeted searches were undertaken according to the methods set out in Cropper (1993) and DEC (2004). Within the longwall and associated draw and subsidence areas, occurrences of any threatened species recorded are represented in the accompanying graphics by a single point location; densities at these points range from individual plants up to 30 plants in a 2m x 2m ($4m^2$) sample area. Occasionally, extensive stands are also represented by a single point location; these locations correspond to records in an accompanying database (refer to footnote 14). Records in adjacent area searches also consist of records of individuals or densities of plants up to 5 plants in a $1m^2$ area.

Native vegetation was surveyed and assessed according to the structural classifications detailed in Specht and Specht (1999), with all vascular plant species recorded. Plant species identifications conform to recent nomenclature in Harden (1990, 1992, 1993, 2002), Harden and Murray (2000), and to recent name changes listed in *Cunninghamia* and *Telopea*.

Extensive searches were conducted across the study area both in areas that were easily accessible (*e.g.* along fire trails) as well as remnant vegetation areas that were not as easily accessed. Existing fire trails were often used as the starting point from which searches commenced as the fire trails generally occur along ridgetops which are potential habitat for many of the threatened flora species targeted by the surveys.

3.3 SPOT SAMPLING

Spot sampling sites are shown on Figure 3. These sites were scanned for threatened species. The location of spot samples was recorded with a hand held GPS unit. In circumstances where threatened species were detected, the co-ordinates were also logged under the appropriate threatened species.

3.4 QUADRAT SAMPLING

Quadrat-based sampling was undertaken in accordance with *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft* (DEC, 2004). Information recoded at each quadrat included species present, Braun Blanquet cover-abundance scores, vegetation structure, landform details and photographic records. Quadrat sampling locations are

shown on Figure 3. Fourteen plots (Plots 1 to 13 and Plot 48 - shown on Figure 3) were reported in the survey and assessment report prepared by Bangalay Botanical Surveys (2007) for the *Metropolitan Colliery Longwalls 18-19A Subsidence Management Plan*. An additional 49 quadrats were ascribed on the basis of the area occupied by each stratified unit in the study area as indicated in Table 7 below.

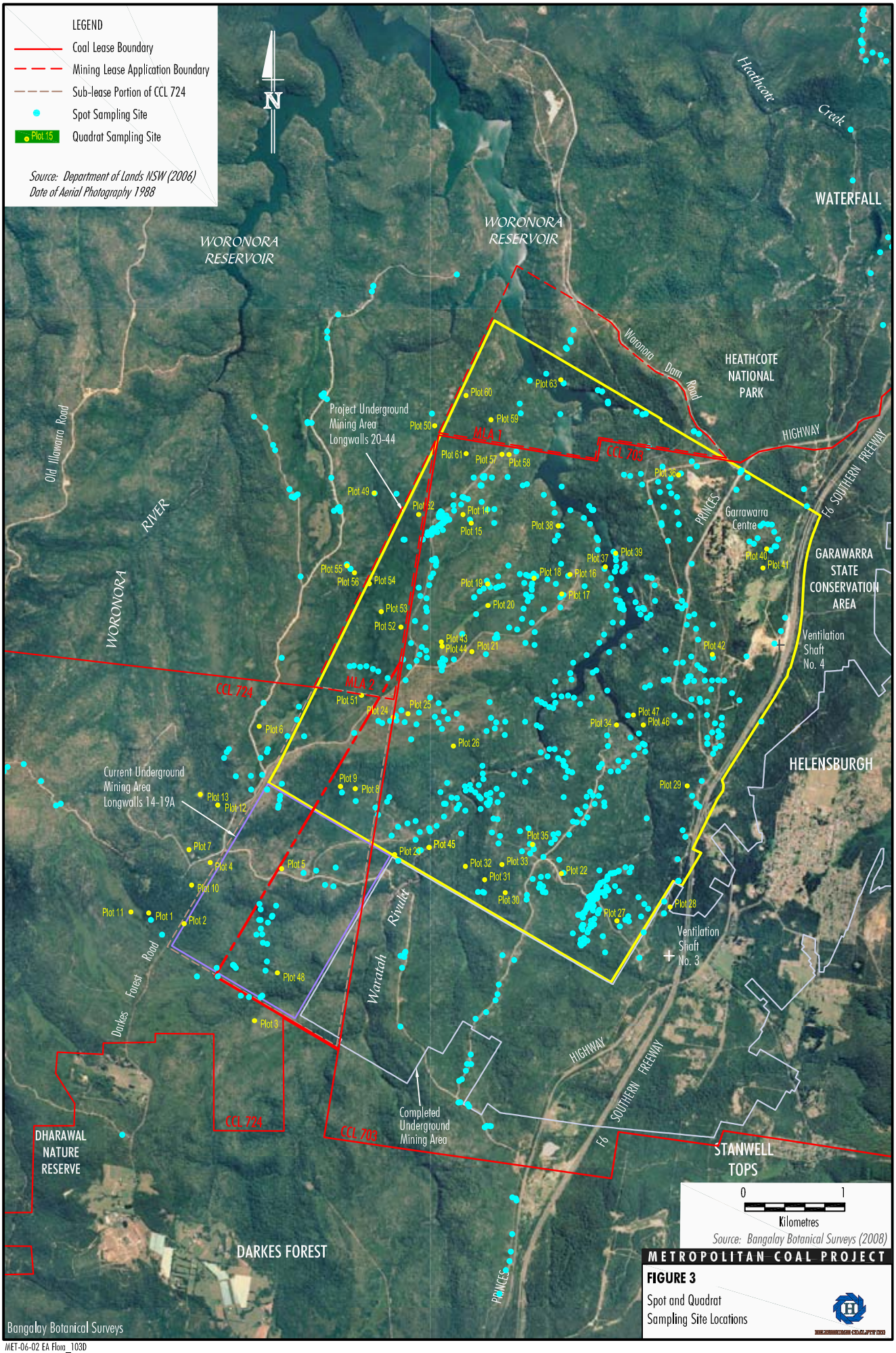


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FIGURE 3

Spot and Quadrat Sampling Site Locations

MET-06-02 EA Flora_103D

Table 7
Quadrats per Stratified Vegetation Unit

Stratified Unit	Vegetation Unit	Map Unit (this report)	SCA Map Unit (NPWS 2003)	Stratified Vegetation Group (habitat type)	Quadrats reported in BBS (2007)	Additional Quadrats (this study)
1	Tall Blackbutt-Apple Shale Forest	5a	16	Shale and Tansitional communities	1; 2 and 10	40; 41
	O'Hares Creek Shale Forest	5b	17			
2	Exposed Sandstone Scribbly Gum Woodland	1a	29	Ridge Woodland communities on Sandstone	3; 4; 6; 7; 8	21; 27; 29; 30; 33; 35; 43; 46; 51; 52; 55; 58; 60; 62
2	Sandstone Heath-Woodland	1b	33	Ridge Woodland communities on Sandstone		
3	Rock Pavement Heath	2a	38	Sandstone Mallees, Heaths and Scrubs	5	14; 16; 19; 22; 50; 57
3	Rock Plate Heath-Mallee	2b	39	Sandstone Mallees, Heaths and Scrubs		
3	Woronora Tall Mallee-heath	2c	40	Sandstone Mallees, Heaths and Scrubs		
4	Upland Swamp: Banksia Thicket	3a	42	Upland Swamps	11; 13	15; 20; 24; 25; 44; 53; 54; 55
4	Upland Swamp: Tea Tree Thicket	3b	43	Upland Swamps		
4	Upland Swamp: Sedgeland-heath Complex	3c	44	Upland Swamps		
4	Upland Swamp: Fringing Eucalypt Woodland	3d	45	Upland Swamps		
5	Sandstone Riparian Scrub	4a	4	Riparian		32; 45; 47; 49
6	SS Gully Apple-Peppermint Forest	6a	25	Sandstone Gully Woodland/ Open Forest	9; 12; 48	18; 23; 26; 28; 31; 34; 38; 39; 56; 59; 61; 63
7	Silvertop Ash Ironstone Woodland	1c	33	Ironstone Woodland		17; 36; 42
8	Modified (Acacia Scrubland)	7a	50/51	Other		37
8	Introduced	7b	50/51	Other		

3.5 VEGETATION MAPPING

Habitats were delineated during preliminary stages by means of previous mapping (Section 2.2) and aerial photography interpretation; the extent of each vegetation community identified was subsequently ground truthed and mapped (Section 2.2). Sampling was undertaken by means of a general survey (York *et al.,* 1991) and detailed, targetted searches by means of Random Meander surveys (Cropper, 1993). Plot-based surveys (*i.e.* quadrats) were undertaken in autumn 2007, spring 2007 and summer 2008 (Table 6).

The following information was recorded for each vegetation community type:

- vascular plant species characterising each stratum;
- typical range in the height of each stratum;
- typical range in the projective foliage cover of the upper strata;
- location, indicative distribution and abundance of any threatened flora species, endangered populations and endangered ecological communities where detected;
- location of spot sampling points where no threatened flora species, endangered populations and endangered ecological communities where detected; and
- general condition of the community including evidence of fire, disturbance, presence and abundance of weeds.

3.6 VEGETATION CONDITION ASSESSMENT

Condition classes were ascribed to each map unit in the following categories (deLacey and Chamberlain, unpublished, 2000):

- ***Low Disturbance (or disturbance absent)*** - Basal, understorey and upper canopy species of all age classes represented. No apparent disturbance or if present very localised. Very high level of resilience. Tree dieback limited to infrequent occurrences of mature individuals (concomitant with surrounding natural areas) or post-fire epicormic/lignotuberous growth evident.
- ***Moderate Disturbance -*** Basal, understorey and upper canopy species of all age classes represented. Moderate levels of localised disturbance apparent (*i.e.* although not grazed or slashed, some negative influence from adjacent areas may affect integrity). Good connectivity and habitat provision. Good level of resilience. Tree dieback limited to infrequent occurrences of mature individuals (greater levels than in surrounding natural areas) or post-fire epicormic/lignotuberous growth evident.
- ***High Disturbance -*** Tree cover or understorey species only with some overstorey and/or understorey integrity (*e.g.* grazed, slashed or physically disturbed). Basal species not well represented, apparent disturbance high (*i.e.* possibly grazed, slashed, or physically disturbed with negative influence from adjacent areas affecting integrity evident). Introduced vine thickets occasionally smothering canopy. Moderate habitat provision and level of resilience. Fragmented connectivity and influenced negatively by activities in adjacent areas. Possibility of tree dieback but recruitment present.
- ***Very High Disturbance -*** Tree cover or understorey species only with little overstorey and/or understorey integrity. Basal species not well represented, apparent disturbance very high (*e.g.* grazed, slashed, run-on area or terrain physically disturbed [*i.e.* modified]) with negative influence from adjacent areas affecting integrity evident). Introduced vine thickets occasionally smothering canopy. Low to very low habitat provision and level of resilience. Low connectivity

and severely influenced negatively by activities in adjacent areas. Tree dieback apparent with no recruitment. No post-fire epicormic/lignotuberous growth evident.

4 RESULTS AND DISCUSSION

4.1 VEGETATION COMMUNITIES

For the purposes of this report, the vegetation communities within the study area have been classified into thirteen vegetation map units and six corresponding disturbed units, which are broadly consistent with the classification described in NPWS (2003). These are described below in Table 8, with their distribution mapped in Figure 4. Vegetation community mapping of the Longwalls 18-19A area and surrounds is also shown on Figure 4 and described in Bangalay Botanical Surveys (2007). Community descriptions provided below are based on the information collected using the methods described in Section 3 (above) within the study area.

Table 8
Vegetation Communities Identified within the Study Area

Vegetation Communities Identified within the Study Area		NPWS (2003) Vegetation Mapping		Tozer *et al.*, (2006) Vegetation Mapping	
Map Unit	**Vegetation Community**	**Map Unit**	**Vegetation Community**	**Map Unit**	**Vegetation Community**
Woodlands on Sandstone or Lateritic Soils					
1a	Exposed Sandstone Scribbly Gum Woodland	29	Exposed Sandstone Scribbly Gum Woodland	p131	Coastal Sandstone Ridgetop Woodland
1b	Sandstone Heath-Woodland	34	Sandstone Heath-Woodland		
1c	Silvertop Ash Ironstone Woodland	33	Silvertop Ash Ironstone Woodland		
1r	Disturbed and/or Regenerating Sandstone or Lateritic Communities	-	-		
Heaths and Mallee Heaths					
2a	Rock Pavement Heath	38	Rock Pavement Heath	p117	Coastal Sandstone Plateau Heath
2b	Rock Plate Heath-Mallee	39	Rock Plate Heath-Mallee		
2c	Woronora Tall Mallee-heath	40	Woronora Tall Mallee-heath	p126	Coastal Rock Plate Heath
2r	Regenerating Mallee-heath	-	-		
Upland Swamps					
3a	Upland Swamp: Banksia Thicket	42	Upland Swamp: Banksia Thicket	p129	Coastal Upland Swamp
3b	Upland Swamp: Tea Tree Thicket	43	Upland Swamp: Tea Tree Thicket		
3c	Upland Swamp: Sedgeland-heath Complex	44	Upland Swamp: Sedgeland-heath Complex		
3d	Upland Swamp: Fringing Eucalypt Woodland	45	Upland Swamp: Fringing Eucalypt Woodland		

Vegetation Communities Identified within the Study Area		NPWS (2003) Vegetation Mapping		Tozer *et al.*, (2006) Vegetation Mapping	
Map Unit	**Vegetation Community**	**Map Unit**	**Vegetation Community**	**Map Unit**	**Vegetation Community**
Riparian Scrub					
4a	Sandstone Riparian Scrub	4	Sandstone Riparian Scrub	p58	Sandstone Riparian Scrub
Tall Open Forests					
5a	*Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion*	16	Tall Blackbutt-Apple Shale Forest	p140	Coastal Sandstone Gully Forest
5b	O'Hares Creek Shale Forest	17	O'Hares Creek Shale Forest	p143	Sydney Shale-Ironstone Cap Forest
5r	Regenerating O'Hares Creek Shale Forest	50	Regenerating Vegetation		
Sandstone Forests					
6a	Sandstone Gully Apple-Peppermint Forest	25	Sandstone Gully Apple-Peppermint Forest	p140	Coastal Sandstone Gully Forest
6r	Disturbed and/or Regenerating Sandstone Gully Apple-Peppermint Forest	-	-	-	-
Disturbed Land					
7a	*Acacia* Regeneration	49A	-	NV	-
7b	Introduced – Weeds and Exotics	50	Weeds and Exotics	NV	+/- native vegetation cover

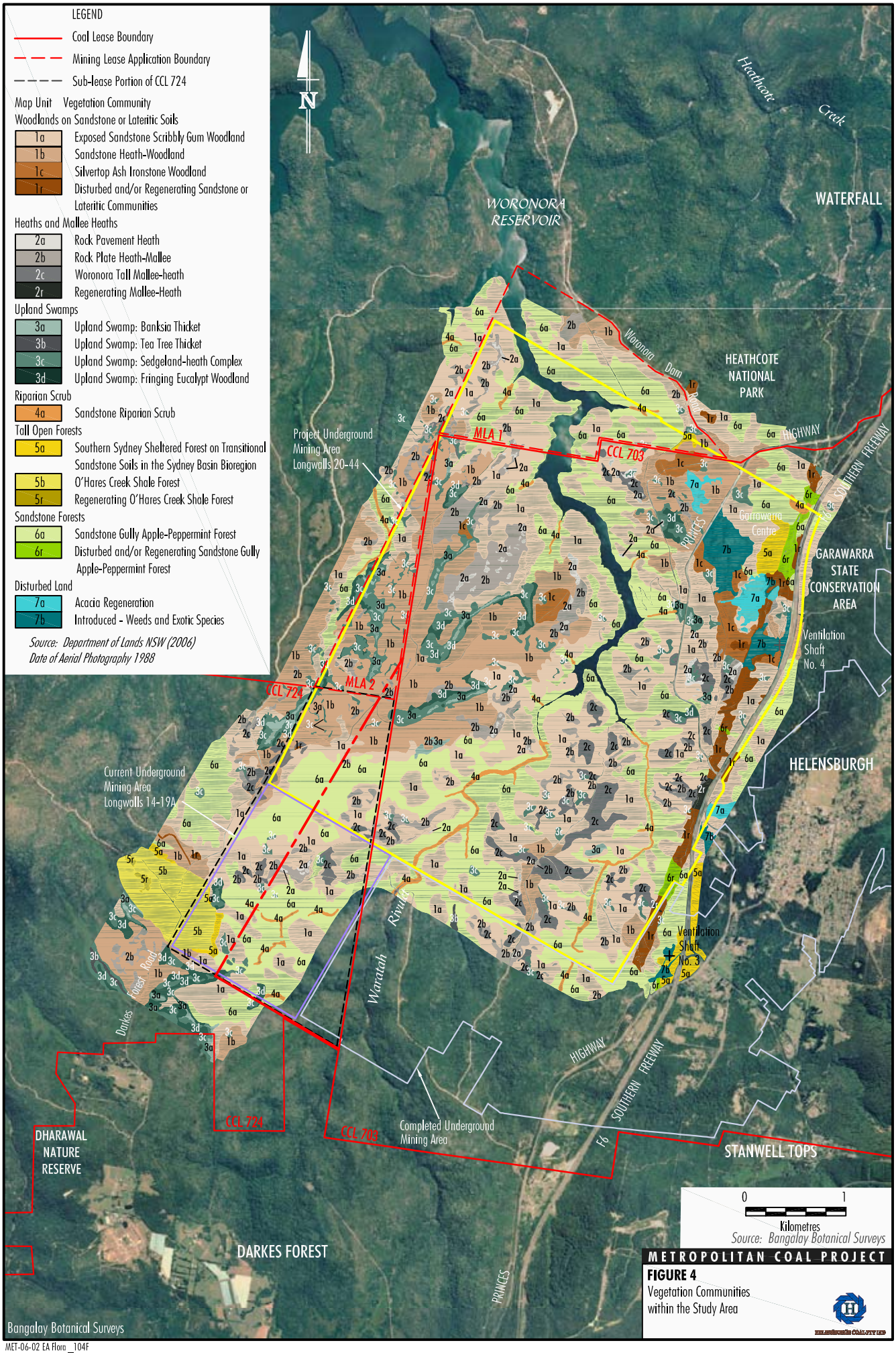

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FIGURE 4
Vegetation Communities within the Study Area

MET-06-02 EA Flora _104F

4.1.1 Woodlands on Sandstone or Lateritic Soils

Sandstone Woodlands within the study area include Exposed Sandstone Scribbly Gum Woodland, Sandstone Heath-Woodland, Silvertop Ash Ironstone Woodland and Disturbed and/or Regenerating Sandstone or Lateritic Communities; these are described below and mapped on Figure 4.

Map Unit 1a: Exposed Sandstone Scribbly Gum Woodland

Distribution

This community typically occurs on shallow sandy soils on ridges and upper slopes, and typically features sandstone benches, outcrops and ridges; sandstone outcropping and boulders are common, although deeper soils occur above and below sandstone benches, with localised occurrences of mallee species from adjacent heaths and mallee-heaths (Map Units 2b and 2c). This vegetation type constitutes a common component of native vegetation in the study area; much of this community has been subject to bushfire in the last 5 years, with regeneration of all strata evident.

Where past disturbance has occurred and evidence of regeneration exists (*e.g.* along powerline easements and track edges), this community has been mapped as Map Unit 1r: Disturbed and/or Regenerating Sandstone or Lateritic Woodland Communities.

Floristics and Structure

The upper canopy species form a woodland structure typically to 6-12m high, with an FPC of (10)-15-20%. Upper canopy species include Broad-leaved Scribbly Gum *Eucalyptus haemastoma,* Scribbly Gum *Eucalyptus racemosa,* Narrow-leaved Stringybark *Eucalyptus oblonga,* Red Bloodwood *Corymbia gummifera* and Silver-top Ash *Eucalyptus sieberi*; occasional mallee species are Yellow-top Ash *Eucalyptus luehmanniana* and *Eucalyptus apiculata* where this community adjoins Map Units 2a, 2b and 2c, or tree species such as Smooth-barked Apple *Angophora costata* and Sydney Peppermint *Eucalyptus piperita* where it adjoins Map Unit 6a.

Where a secondary canopy occurs, species include a range of regenerating forms of upper canopy species, along with tall shrubs such as Old Man Banksia *Banksia serrata,* Geebungs *Persoonia lanceolata, Persoonia pinifolia* and *Persoonia levis* and Flaky-barked Teatree *Leptospermum trinervium*; height range is typically 3-6m with an FPC of 10-25%.

The shrub stratum structure varies from low and patchy (for example, where exposed rocks or rock platforms are common) to very dense, typically ranging from 0.5-2m high. Species include taxa from the Proteaceae including *Hakea laevipes, Hakea sericea, Personia linearis, Banksia ericifolia* subsp. *ericifolia, Hakea dactyloides*, *Banksia spinulosa, Lambertia formosa*, *Lomatia silaifolia* and *Grevillea sericea,* Fabaceae such as *Pultenaea tuberculata, Pultenaea linophylla, Pultenaea stipularis, Daviesia corymbosa, Dillwynia retorta, Bossiaea heterophylla,* various wattles including *Acacia suaveolens, Acacia linifolia, Acacia terminalis, Acacia ulicifolia* and *Acacia myrtifolia,* with other species such as *Acrotriche divaricata*, *Epacris microphylla, Leucopogon microphyllus, Eriostemon australasius*, *Philotheca scabra, Pimelea linifolia* subsp. *linifolia, Platysace lanceolata* and *Kunzea ambigua.*

The groundcover layer ranges from low and sparse (especially where exposed rock or small rock platforms occur) to occasionally moderately dense and diverse, with a typical height range of 0.2-1m. Species include sedges and rushes such as *Lomandra filiformis* subsp. *filiformis, Lomandra obliqua, Lomandra glauca, Lepidosperma laterale, Cyathochaeta diandra, Caustis flexuosa,* subshrubs such as *Platysace linearifolia, Bossiaea scolopendria*, *Actinotus helianthi* and *Platysace ericoides,* herbs *Dampiera stricta, Xanthosia tridentata* and *Laxmannia gracilis,* occasional ferns including *Pteridium esculentum* and *Lindsaea linearis,* and grasses and groundcover species including *Patersonia*

sericea, Dianella caerulea var. *producta, Entolasia stricta, Austrostipa pubescens,* and *Aristida ramosa* var. *ramosa.*

Climbers and twiners are limited in diversity: species include *Billardiera scandens, Hardenbergia violacea* and *Cassytha glabella.*

Introduced species were not recorded in this map unit, although low abundance of widespread species such as Cats Ears *Hypochaeris radicata* occur along track edges.

Flora of Conservation Significance

This community is known to provide habitat in the Woronora, O'Hares and Metropolitan Catchments for *Epacris purpurascens* var. *purpurascens* (V), *Leucopogon exolasius* (V), *Pultenaea aristata* (V), *Darwinia grandiflora* (2RCi), *Eucalyptus apiculata* (3RC-), *E. luehmanniana* (2RCa), *Grevillea longifolia* (2RC-) and *Hibbertia nitida* (2RC-) (NPWS, 2003). *Pultenaea aristata* was recorded within this vegetation community, as were *Eucalyptus luehmanniana* and *Darwinia grandiflora*. Potential (unconfirmed) occurrences of *Epacris purpurascens* var. *purpurascens* and *Leucopogon exolasius* were also recorded (Figure 5).

Map Unit 1b: Sandstone Heath-Woodland

Distribution

This community typically occurs on plateaux, broad ridges and upper slopes on sandy soils; soils appear generally deeper than those where Map Unit 1a (MU29 of NPWS 2003) occurs, often with evidence of a gravelly ironstone layer in some locations, especially near the ecotone with Map Unit 1c (Silver-top Ash Ironstone Woodland). Much of this community has been subject to bushfire in the last 5 years, with regeneration of all strata evident.

Where past disturbance has occurred and evidence of regeneration exists (*e.g.* along powerline easements), this community has been mapped as Map Unit 1r: Disturbed and/or Regenerating Sandstone or Lateritic Woodland Communities.

Floristics and Structure

This community is generally a woodland or open woodland to 8-12m high, with an FPC of 10-25%. Common upper canopy species include Narrow-leaved Scribbly Gum *Eucalyptus racemosa,* Broad-leaved Scribbly Gum *Eucalyptus haemastoma,* Narrow-leaved Stringybark *Eucalyptus oblonga,* Red Bloodwood *Corymbia gummifera* and Silver-top Ash *Eucalyptus sieberi,* with occasional mallees Yellow-top Ash *Eucalyptus luehmanniana,* Narrow-leaved Mallee-ash *Eucalyptus stricta* and *Eucalyptus apiculata* where this community adjoins Map Units 2b and 2c. The hybrid *Angophora dichromophloia* occurs sporadically.

The mid-canopy stratum varies, depending on location, from absent up 25% FPC. Typical species are Old Man Banksia *Banksia serrata,* Heath-leaved Banksia *Banksia ericifolia,* Broad-leaved Geebung *Persoonia levis* and Flaky-barked Teatree *Leptospermum trinervium,* typically to a height of 2-3m.

The shrub stratum is generally 0.5-2m height, with an FPC of 20-35%. Characteristic species include Banksias such as *Banksia oblongifolia, Banksia ericifolia* subsp. *ericifolia, Banksia spinulosa* and *Banksia marginata,* various Wattles including *Acacia suaveolens, Acacia obtusifolia, Acacia ulicifolia, Acacia myrtifolia, Acacia terminalis* and *Acacia linifolia,* members of the Fabaceae (including *Pultenaea linophylla*, *Pultenaea stipularis, Pultenaea tuberculata, Pultenaea aristata, Dillwynia retorta, Dillwynia phylicoides, Bossiaea heterophylla* and *Phyllota phylicoides*), Proteaceae (including *Hakea laevipes, Personia linearis, Persoonia lanceolata, Petrophile pulchella, Hakea sericea, Lambertia*

formosa and *Grevillea buxifolia*), Rutaceae (including *Philotheca scabra, Phebalium squamulosum* subsp. *squamulosum,* and *Eriostemon australasius*), Epacridaceae (*Epacris microphylla* var. *microphylla*, *Epacris pulchella, Leucopogon esquamatus* and *Leucopogon ericoides*) and *Pimelea linifolia* subsp. *linifolia.*

The groundcover stratum varies from low and patchy to moderately dense and diverse, attaining 0.5-1m height and a FPC of up to 40%. Typical species include Mat Rushes *Lomandra obliqua, Lomandra glauca* and *Lomandra filiformis* subsp. *filiformis,* subshrubs such as *Platysace linearifolia, Platysace ericoides, Hibbertia riparia* and *Bossiaea scolopendria,* Flannel Flowers *Actinotus helianthi* and *Actinotus minor,* various monocotyledons including *Lepidosperma laterale, Caustis flexuosa, Cyathochaeta diandra, Laxmannia gracilis, Dianella caerulea* var. *producta,* Purple Flags *Patersonia sericea* and *Patersonia fragilis* and *Lepyrodia scariosa, Dampiera stricta, Xanthosia tridentata,* Bracken *Pteridium esculentum,* and grasses including *Eragrostis brownei, Entolasia stricta, Austrostipa pubescens* and *Aristida ramosa* var. *ramosa.*

Climbers and twiners are limited in diversity: species include Apple Berry *Billardiera scandens* and Devil's Twine *Cassytha glabella.*

Introduced species were not recorded in this map unit, although some widespread species such as Cats Ears *Hypochaeris radicata* occur in low numbers along track edges.

Flora of Conservation Significance

This community is known to provide habitat in the Woronora, O'Hares and Metropolitan Catchments for *Eucalyptus luehmanniana* (2RCa) (NPWS, 2003). Within the study area, the threatened species *Pultenaea aristata* (V) and *Acacia bynoeana* (E) were recorded within this vegetation community (Figure 5); *Melaleuca deanei* (V) has also been recorded in this vegetation community within the LW18-19a area (Bangalay Botanical Surveys 2007). Potential (unconfirmed) occurrences of *Epacris purpurascens* var. *purpurascens* and *Leucopogon exolasius* were also recorded (Figure 5).

Map Unit 1c: Silvertop Ash Ironstone Woodland

Distribution

This community generally occurs on lateritic soils on broad ridges, most commonly in the northern parts of the study area. Much of this community has been subject to bushfire in the last 5 years, with regeneration of all strata evident.

Where past disturbance has occurred and evidence of regeneration exists (*e.g.* along powerline easements, with more extensive disturbance to the south and east of the Garrawarra retirement village where areas have been previously cleared for pine plantations), this community has been mapped Map Unit 1r: Disturbed and/or Regenerating Sandstone or Lateritic Woodland Communities.

Floristics and Structure

The upper canopy species form a woodland structure to 8-15m high, with an FPC of 15-20%. This community is characterised by Silver-top Ash *Eucalyptus sieberi,* with Red Bloodwood *Corymbia gummifera*, Narrow-leaved Stringybark *Eucalyptus oblonga,* Narrow-leaved Scribbly Gum *Eucalyptus racemosa* and Broad-leaved Scribbly Gum *Eucalyptus haemastoma;* the latter species is more common where the community forms a transition with elements of Exposed Sandstone Scribbly Gum Woodland (Map Unit 1a).

Typical secondary canopy species include Old Man Banksia *Banksia serrata, Persoonia levis* and Flaky-barked Teatree *Leptospermum trinervium,* typically to 3-4m high and with an FPC of less than 20%.

The shrub stratum encompasses a range of species to 0.8-2m high, with an FPC of up to 35%. Species include Sweet-scented Wattle *Acacia suaveolens,* Sunshine Wattle *Acacia terminalis,* Flax-leaf Wattle *Acacia linifolia* and Red-stemmed Wattle *Acacia myrtifolia,* Finger Hakea *Hakea laevipes, Hovea linearis,* Peach Heath *Lissanthe strigosa,* Narrow-leaved Geebung *Personia linearis,* Dwarf Wedge Pea *Gompholobium minus, Banksia marginata,* Clustered Bitter Pea *Daviesia corymbosa,* Finger Hakea *Hakea laevipes*, Rice Flower *Pimelea linifolia* subsp. *linifolia,* Silky Hakea *Hakea sericea, Dillwynia teretifolia, Eriostemon scaber,* Variable Bossiaea *Bossiaea heterophylla,* Broad-leaved Geebung *Persoonia levis,* Hairpin Banksia *Banksia spinulosa,* Wax Flower *Eriostemon australasius*, Mountain Devil *Lambertia formosa*, Crinkle Bush *Lomatia silaifolia,* Conesticks *Petrophile pulchella,* Gymea Lily *Doryanthes excelsa,* Grey Spider Flower *Grevillea buxifolia,* Pink Spider Flower *Grevillea sericea* and *Grevillea diffusa* subsp*. diffusa.*

The groundcover layer is generally moderately dense and diverse, attaining 0.5-1m maximum height and a FPC of 15-35%. Species include Small-flowered Mat-rush *Lomandra micrantha subsp. tuberculata, Lomandra filiformis* subsp. *filiformis,* Carrot Tops *Platysace linearifolia,* Blue Flax Lily *Dianella caerulea* var. *producta,* Flannel Flower *Actinotus minor,* Dwarf Wedge Pea *Gompholobium minus,* Sword Sedge *Lepidosperma laterale, Dampiera stricta,* Curly Wigs *Caustis flexuosa, Cyathochaeta diandra, Fimbristylis dichotoma,* Purple Flags *Patersonia sericea* and *Patersonia glabrata,* Three-awn Speargrass *Aristida ramosa,* Love Grass *Eragrostis brownei,* Kangaroo Grass *Themeda australis,* Wiry Panic *Entolasia stricta* and Spear Grass *Austrostipa pubescens.*

Climbers and twiners are limited in diversity to occaional specimens of False Sarsaparilla *Hardenbergia violacea* and Devil's Twine *Cassytha glabella.*

Introduced species were not recorded in this map unit, although some widespread species such as Cats Ears *Hypochaeris radicata* occur in low numbers along track edges.

Flora of Conservation Significance

This community is known to provide habitat in the Woronora, O'Hares and Metropolitan Catchments for *Pultenaea aristata* (V), *Darwinia grandiflora* (2RCi) and *Hibbertia nitida* (2RC-) (NPWS 2003). Within the study area, *Darwinia grandiflora* was recorded and potential (unconfirmed) occurrences of *Epacris purpurascens* var. *purpurascens* (Figure 5).

Map Unit 1r: Disturbed and/or Regenerating Sandstone or Lateritic Communities

To the west of the Princes Highway, most occurrences of Map Units 1a, 1b and 1c within the study area have been ascribed 'Low Disturbance', although localised minor disturbances may occur (such as the creation and maintenance of unsealed fire trails and small infrastructure sites). Some larger areas of ridgetop woodlands have been subject to prior and current disturbances associated with the major north-south powerline easements, and within and adjacent to major highways (including the Princes Highway and F6 Freeway); other disturbances include cleared land (*e.g.* within the Garrawarra retirement village, and the rifle range near Garrawarra).

Most of these areas are mapped as Map Unit 1r: Regenerating Sandstone Woodland (Figure 4).

Floristics and Structure

The native species present comprise a range of species described in Map Units 1a, 1b and 1c; introduced species occur sporadically, and often in isolation in previously disturbed areas. Introduced species include grasses such as Quaking Grass *Briza maxima,* Rhodes Grass *Chloris gayana* and Panic Veldt Grass *Ehrharta erecta,* and herbs such as Cats Ears *Hypochaeris radicata* and Fleabeanes *Conyza* spp. The threatened species *Pultenaea aristata* (V), was recorded within this vegetation community (Figure 5), with *Acacia bynoeana* (E) recorded in this community within the LW18-19a study area (Bangalay Botanical Surveys 2007).

4.1.2 Heaths and Mallee Heaths

Heaths and Mallee Heaths within the proposed longwall mining area include Rock Pavement Heath, Rock Plate Heath-Mallee, Woronora Tall Mallee-heath and Regenerating Mallee-heath as described below and mapped on Figure 4.

Map Unit 2a: Rock Pavement Heath

This community generally occurs on large, exposed sandstone rock outcrops (NPWS 2003) on ridges and upper slopes; this community can also occur as small patches too small to accurately map within more widespread communities (such as Map Unit 1a (MU29 NPWS 2003) and Map Unit 2c (MU40 NPWS 2003)). Much of this community has been subject to bushfire in the last 5 years, with regeneration evident.

Where past disturbance has occurred and evidence of regeneration exists, this community has been mapped as Map Unit 2r: Disturbed and/or Regenerating Mallee-heath.

Floristics and Structure

In most locations, this community comprises an occasional, patchy shrub stratum to 1.5-3m tall, along with smaller shrubs and groundcover species (to a height of 0.2-0.5m) in pockets of soil between rock outcrops or on very thin soils which have accumulated on sandstone platforms: tree species are characteristically absent, although sporadic individuals and small stands of tree and mallee species may occur in deeper soils between exposed rock platforms. Both shrub and groundcover strata are typically sparse, although denser patches of groundcover species and low shrubs occur in depressions on rock platforms or between rock benches where soil accumulates.

Shrub species include *Acacia suaveolens, Aotus ericoides, Grevillea sericea*, *Monotoca scoparia, Acacia myrtifolia, Petrophile pulchella, Epacris microphylla* var. *microphylla*, *Leucopogon microphyllus, Dillwynia retorta, Phyllota phylicoides, Pultenaea elliptica, Hakea teretifolia, Calytrix tetragona, Styphelia tubiflora, Woollsia pungens, Banksia ericifolia* subsp. *ericifolia, Grevillea buxifolia, Pimelea linifolia* subsp. *linifolia, Kunzea ambigua* and *Darwinia fascicularis* subsp. *fascicularis.* The RoTAP species *Monotoca ledifolia* (3RC-) occurs in some sites.

Typical groundcover species include small shrubs such as *Mirbelia rubiifolia* and *Platysace ericoides,* various sedge and rush species including *Lepidosperma laterale*, *Lomandra obliqua, Haemodorum corymbosum, Patersonia sericea, Lepyrodia scariosa*, *Cyathochaeta diandra, Saropsis fastigiata,* and herbs including *Actinotus minor, Xanthosia pilosa forma* A and *Drosera spatulata.*

No introduced species were recorded in this map unit.

Flora of Conservation Significance

This community is known to provide habitat in the Woronora, O'Hares and Metropolitan Catchments for *Monotoca ledifolia* (3RC-) (NPWS, 2003). Within the study area, one threatened species, *Pultenaea aristata* (V), was recorded within this vegetation community.

Map Unit 2b: Rock Plate Heath-Mallee

Distribution

This community occurs on sometimes extensive sandstone outcrops and rock plates (NPWS 2003) on ridges and plateaux, often surrounding or intermingled with patches of Rock Pavement Heath (Map Unit 2a), and usually adjacent to other sandstone ridgetop communities (Woronora Tall Mallee-heath (Map Unit 2c) or Exposed Sandstone Scribbly Gum Woodland (Map Unit 1a)). Much of this community has been subject to bushfire in the last 5 years, with regeneration of all strata evident.

Where past disturbance has occurred and evidence of regeneration exists, this community has been mapped as Map Unit 2r: Disturbed and/or Regenerating Mallee-heath (Figure 4).

Floristics and Structure

Tree species occur in discrete if occasionally dense stands or as isolated patches, typically either as true mallee species or tree species exhibiting a mallee habit, to 3-6m high; these often occur in deeper pockets of soil between rock outcrops and platforms, or occasionally as large, dense stands in some sites. The understorey is generally continuous and occasionally dense, and features a range of heathy shrubs typically 0.5-2m high; the groundcover stratum is generally patchily distributed, to 0.2-0.5m high, with an FPC of 25-35%.

Common mallee species are Mallee Ash *Eucalyptus stricta, Eucalyptus apiculata,* Yellow-top Ash *Eucalyptus luehmanniana* and occasional Whipstick Mallee Ash *Eucalyptus multicaulis.* Mallee forms of tree species include Red Bloodwood *Corymbia gummifera*, Broad-leaved Scribbly Gum *Eucalyptus haemastoma,* Narrow-leaved Stringybark *Eucalyptus oblonga* and Silver-top Ash *Eucalyptus sieberi.*

Occasional taller shrub species include Flaky-barked Teatree *Leptospermum trinervium,* Broad-leaved Geebung *Persoonia levis,* Dwarf Apple *Angophora hispida* and Old Man Banksia *Banksia serrata*.

Common species in a diverse shrub layer are taxa from the Proteaceae such as *Banksia oblongifolia, Hakea laevipes, Isopogon anemonifolius, Persoonia lanceolata, Banksia spinulosa, Petrophile pulchella, Lambertia formosa*, *Hakea sericea* and *Grevillea sericea,* wattles including *Acacia suaveolens, Acacia myrtifolia* and *Acacia linifolia,* Fabaceae taxa such as *Pultenaea tuberculata, Dillwynia retorta, Bossiaea heterophylla, Bossiaea scolopendria* and *Phyllota phylicoides,* she-oaks *Allocasuarina distyla* and *Allocasuarina nana,* heaths including *Epacris microphylla* var. *microphylla* and *Leucopogon esquamatus,* and *Kunzea capitata, Pimelea linifolia* subsp. *linifolia, Platysace lanceolata, Philotheca scabra* and *Leptospermum squarrosum.*

Common groundcover species include Mat Rushes such as *Lomandra obliqua, Lomandra glauca* and *Lomandra filiformis* subsp. *filiformis,* herbs such as *Actinotus minor, Dampiera stricta* and *Xanthosia pilosa forma* A., *Cyathochaeta diandra,* Purple Flags *Patersonia glabrata* and *Patersonia sericea, Lepyrodia scariosa, Lindsaea linearis,* and grasses including *Entolasia stricta, Austrostipa pubescens* and *Anisopogon avenaceus.*

Climbers and twiners are limited in diversity: species include Apple Berry *Billardiera scandens* and Devil's Twine *Cassytha glabella.*

No introduced species were recorded in this map unit.

Flora of Conservation Significance

This community is known to provide habitat in the Woronora, O'Hares and Metropolitan Catchments for *Eucalyptus apiculata* (3RC-) and *Eucalyptus luehmanniana* (2RCa) (NPWS, 2003). Within the study area, the threatened species *Pultenaea aristata* (V) was recorded within this vegetation community.

Map Unit 2c: Woronora Tall Mallee-heath

Distribution

This community typically occurs on sandstone rock benches or more extensive rock outcropping and rock platforms on ridges and upper slopes, generally adjacent to (and often intermingled with) ridgetop woodlands (Map Units 1a and 1b (Map Units 29 and 34; NPWS 2003)), often covering extensive areas. As with the preceding two Map Units, more extensive stands of this community can contain smaller patches of both Map Units 2a and 2b, forming a mosaic of tall mallee species intermingled with patches of shorter shrubby heath or exposed rock platforms too small to map accurately. Much of this community has been subject to bushfire in the last 5 years, with regeneration of all strata evident.

Where past disturbance has occurred and evidence of regeneration exists, this community has been mapped as Map Unit 2r: Disturbed and/or Regenerating Mallee-heath (Figure 4).

Floristics and Structure

Although described as a mallee vegetation type, upper canopy species can occasionally form a low woodland to open woodland structure; more typically, tree species (either true mallees or tree species exhibiting a mallee habit) occur as (often dense) discrete stands or patches, generally to 5-8m high, with an FPC of 10-25%, interspersed with exposed rock platforms or areas of dense, shrubby heath. Taller shrub species also occur where tree cover is less dense, to a height of 2-4m, while the shrub layer varies from sparse around exposed rock outcrops or below dense tree cover to dense in areas where soil accumulates, from 0.5-2m high.

Common upper canopy species include mallee forms of Red Bloodwood *Corymbia gummifera*, Broad-leaved Scribbly Gum *Eucalyptus haemastoma,* Narrow-leaved Stringybark *Eucalyptus oblonga* and Silver-top Ash *Eucalyptus sieberi*, with occasionally dense stands of Yellow-top Ash *Eucalyptus luehmanniana, Eucalyptus apiculata* and Whipstick Mallee Ash *Eucalyptus multicaulis.*

Taller shrub species include Old Man Banksia *Banksia serrata,* Heath-leaved Banksia *Banksia ericifolia* subsp. *ericifolia,* Dwarf Apple *Angophora hispida* and Flaky-barked Teatree *Leptospermum trinervium*.

A diverse shrub stratum includes Proteaceous taxa such as *Grevillea buxifolia, Banksia oblongifolia, Grevillea oleoides, Banksia ericifolia* subsp. *ericifolia, Hakea laevipes, Isopogon anemonifolius, Hakea teretifolia, Petrophile pulchella*, *Banksia spinulosa, Lambertia formosa*, *Persoonia lanceolata* and *Petrophile sessilis;* Epacridaceae species including *Monotoca scoparia, Epacris microphylla* var. *microphylla*, *Leucopogon esquamatus* and *Leucopogon microphyllus var. microphyllus;* Myrtaceous shrubs such as *Leptospermum squarrosum, Angophora hispida, Leptospermum trinervium, Leptospermum polygalifolium* subsp. *polygalifolium, Leptospermum arachnoides* and *Kunzea capitata*; wattles such as *Acacia suaveolens, Acacia ulicifolia* and *Acacia myrtifolia;* Fabaceous taxa including *Pultenaea tuberculata, Pultenaea aristata, Bossiaea scolopendria, Dillwynia retorta* and *Bossiaea heterophylla;* and *Pimelea linifolia* subsp. *linifolia, Platysace linearifolia, Philotheca scabra* and *Eriostemon australasius.*

Groundcover species include Mat Rushes *Lomandra filiformis* subsp. *filiformis* and *Lomandra obliqua,* subshrubs such as *Hibbertia riparia, Actinotus minor, Gonocarpus teucrioides* and *Tetratheca ericifolia, Dampiera stricta,* species from Cyperaceae and Iridaceae *Cyathochaeta diandra, Lepidosperma laterale, Ptilothrix deusta, Lepyrodia scariosa, Patersonia glabrata* and Curly Wigs *Caustis flexuosa, Laxmannia gracilis,* grasses *Anisopogon avenaceus,* Wiry Panic *Entolasia stricta* and Spear Grass *Austrostipa pubescens,* and Ivy-leaved Goodenia *Goodenia hederacea* var. *hederacea, Xanthosia tridentata,* Screw Fern *Lindsaea linearis, Xanthorrhoea resinifera* and Slender Yellow-eye *Xyris gracilis* subsp. *gracilis.*

Introduced species were not recorded in this map unit.

Flora of Conservation Significance

This community is known to provide habitat in the Woronora, O'Hares and Metropolitan Catchments for *Eucalyptus luehmanniana* (2RCa) (NPWS, 2003). Within the study area, the threatened species *Pultenaea aristata* (V) and *Astrotricha crassifolia* (V) were recorded within this vegetation community. Potential (unconfirmed) occurrences of *Epacris purpurascens* var. *purpurascens* (Vulnerable under the NSW *Threatened Species Conservation Act 1995*) and *Leucopogon exolasius* (V) (Vulnerable under the NSW *Threatened Species Conservation Act 1995* and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*) were also recorded (Figure 5).

Map Unit 2r: Regenerating Mallee-heath

Distribution

To the west of the Princes Highway, most occurrences of Map Units 2a, 2b and 2c within the study area have been ascribed 'Low Disturbance', although localised minor disturbances may occur (such as the creation and maintenance of unsealed fire trails and small infrastructure sites). To the east of the Princes Highway and along the western edge of the F6 Freeway, some areas of heath and mallee-heath are subject to prior and current disturbances, including those associated with the major north-south powerline easements and major highways (including the Princes Highway and F6 Freeway).

These areas are mapped as Map Unit 2r: Disturbed and/or Regenerating Mallee-heath (Figure 4).

Floristics and Structure

The native species present comprise a range of species described in Map Units 2a, 2b and 2c, although introduced species occur sporadically, and often in isolation in previously disturbed areas. Introduced species include Sow Thistle *Sonchus oleraceus*, Common Chickweed *Stellaria media,* Whiskey Grass *Andropogon virginicus,* Rhodes Grass *Chloris gayana,* Summer Grass *Digitaria sanguinalis* and herbs such as Cats Ears *Hypochaeris radicata* and Fleabeanes *Conyza* spp. The threatened species *Pultenaea aristata* was recorded within this vegetation community (Figure 5).

4.1.3 Upland Swamps

Upland swamps within the proposed longwall mining area include Upland Swamp: Banksia Thicket, Upland Swamp: Tea Tree Thicket, Upland Swamp: Sedgeland-heath Complex and Upland Swamp: Fringing Eucalypt Woodland as described below and mapped on Figure 4.

Most of the occurrences of upland swamp vegetation communities exhibit little disturbance, although, in common with much of the rest of the study area, these have been subject to bushfire in recent times. Prior and current disturbances are generally restricted to the creation and maintenance of

access/maintenance tracks, most of which are located beyond the boundaries of most upland swamps.

Map Unit 3a: Upland Swamp: Banksia Thicket

Distribution

This community generally occurs in drainage lines within broader upland swamp communities occurring on elevated, broad sandstone ridgetops (NPWS 2003). While often occurring as a distinct band in some sites, this community is found in close association with Map Unit 3b (MU43 NPWS 2003), sharing many common species; note that it is not always possible at the scale of current vegetation mapping to accurately delineate smaller occurrences of this Map Unit or Map Unit 3b in many upland swamp drainage lines. Much of this community has been subject to bushfire in the last 5 years, with regeneration of all strata evident.

Floristics and Structure

Taller tree species are generally absent in most locations, although some low tree cover (such as Scribbly Gums *Eucalyptus haemastoma* and *Eucalyptus racemosa*) may occur where this community closely abuts adjacent woodland (*e.g.* Map Unit 3d: Fringing Eucalypt Woodland).

A dense shrub layer shrub to a height of 3m or occasionally more is one of the characteristic features of this vegetation community, often with an FPC of up to 60% or greater. The groundcover layer is also characteristically dense, to 0.5-1.5m tall, with an FPC of up to 70%; in some locations, Coral Fern *Gleichenia dicarpa* can form dense thickets with taller sedge species (such as Saw Sedges *Gahnia* spp.) to 2m tall.

Characteristic tall shrub species include Swamp Banksia *Banksia robur* and occasionally dense stands of Heath-leaved Banksia *Banksia ericifolia* subsp. *ericifolia*; a variety of other species can also occur including (depending on location) Sydney Golden Wattle *Acacia longifolia,* Prickly Teatree *Leptospermum continentale,* Golden Spray *Viminaria juncea,* Swamp Wattle *Acacia elongata* and Dagger Hakea *Hakea teretifolia*. Shrub species in the lower strata include the abovementioned species with *Sprengelia incarnata, Banksia paludosa, Epacris obtusifolia, Leptospermum squarrosum*, *Allocasuarina paludosa, Almaleea paludosa, Aotus ericoides* and *Banksia oblongifolia.*

Typical groundcover species include dense patches of Coral Fern *Gleichenia dicarpa,* often up to 2m high, with a diverse range of sedge and rush species such as *Lepidosperma urophorum, Lepidosperma forsythii, Lepidosperma limicola, Lepidosperma viscidum, Leptocarpus tenax, Schoenus brevifolius, Eleocharis acuta, Empodisma minus, Baumea teretifolia, Baumea rubiginosa, Chorizandra cymbaria* and, in some wetter locations, Button Grass *Gymnoschoenus sphaerocephalus.* Various small shrubs also occur, including *Leucopogon esquamatus, Bauera microphylla, Boronia parviflora, Symphionema paludosum* and Guinea Flowers such as *Hibbertia cistoidea, Hibbertia riparia* and *Hibbertia rufa,* with herb, fern and grass species such as Screw Fern *Lindsaea linearis, Gonocarpus micranthus subsp. micranthus, Comesperma defoliatum, Tetrarrhena juncea, Histiopteris incisa, Utricularia gibba*, *Pteridium esculentum, Actinotus minor, Mitrasacme polymorpha, Centella asiatica,* and Sundews *Drosera binata* and *Drosera spatulata.*

Introduced species were not recorded in this map unit.

Flora of Conservation Significance

This community is known to provide habitat in the Woronora, O'Hares and Metropolitan Catchments for *Pultenaea aristata* (V) (NPWS, 2003). No threatened species were recorded within this vegetation community within the study area.

Map Unit 3b: Upland Swamp: Tea Tree Thicket

Distribution

As with the preceding community (Map Unit 3a), this community generally occurs in the central channels of upland swamps and moist drainage lines which form the headwater of secondary creeklines (NPWS 2003). Much of this community has been subject to bushfire in the last 5 years, with regeneration of all strata evident.

This community is similar in structure and floristics to Map Unit 3a (Banksia Thicket), and characteristic species of both communities are often found within a particular swamp.

Floristics and Structure

As described for Map Unit 3a, taller tree species are generally absent in most locations, although some low tree cover (such as Scribbly Gums *Eucalyptus haemastoma* and *Eucalyptus racemosa*) may occur where this community closely abuts adjacent woodland. Taller shrub species (to 4-7m tall) occur in some locations, but are more commonly limited to woodland margins: species include Sydney Golden Wattle *Acacia longifolia,* Broad-leaved Geebung *Persoonia levis* and Prickly Teatree *Leptospermum juniperinum*.

The shrub stratum is characteristically very dense, often to 3m high with an FPC of 60% or more. Species include *Sprengelia incarnata,* Swamp Banksia *Banksia robur, Banksia paludosa* subsp. *paludosa,* Prickly Teatree *Leptospermum juniperinum, Melaleuca squarrosa,* Yellow Teatree *Leptospermum polygalifolium subsp. polygalifolium*, Heath-leaved Banksia *Banksia ericifolia* subsp. *ericifolia, Allocasuarina paludosa,* Sweet-scented Wattle *Acacia suaveolens,* Sunshine Wattle *Acacia terminalis,* Dagger Hakea *Hakea teretifolia*, Lemon-scented Bottlebrush *Callistemon citrinus,* Golden Spray *Viminaria juncea, Leucopogon esquamatus* and *Leptospermum continentale.*

The groundcover stratum is typically dense, up to 0.5-1.5m high, occasionally taller where tall sedge species or dense patches of Coral Fern *Gleichenia dicarpa* occur. Species include Coral Ferns *Gleichenia microphylla* and *Gleichenia dicarpa,* sedge and rush species including *Schoenus pachylepis, Gahnia sieberiana,* Button Grass *Gymnoschoenus sphaerocephalus,* Heron Bristle Rush *Chorizandra cymbaria, Leptocarpus tenax, Empodisma minus, Eurychorda complanata,* Bog Rush *Schoenus brevifolius, Baumea rubiginosa, Lepidosperma urophorum, Lepidosperma forsythii* and *Lepidosperma limicola,* subshrubs including Mitre Plant *Mitrasacme polymorpha, Baeckea imbricata, Leucopogon esquamatus, Micrantheum ericoides, Hibbertia linearis, Bauera microphylla, Almaleea paludosa,* Lesser Flannel Flower *Actinotus minor,* Poverty Raspwort *Gonocarpus tetragynus*, *Hibbertia cistoidea, Sphaerolobium vimineum,* and Swamp Boronia *Boronia parviflora*; and Yellow-eyes *Xyris operculata* and *Xyris gracilis* subsp. *gracilis, Selaginella uliginosa*, Stinking Pennywort *Hydrocotyle peduncularis,* Screw Fern *Lindsaea linearis,* Sundew *Drosera spatulata,* Forked Sundew *Drosera binata.*

Introduced species were not recorded in this map unit.

Flora of Conservation Significance

This community is not known to provide habitat in the Woronora, O'Hares and Metropolitan Catchments for rare or threatened plant species (NPWS, 2003) and none were recorded within the study area during current surveys.

Map Unit 3c: Upland Swamp: Sedgeland-heath Complex

Distribution

This community typically occurs in the drier parts of upland swamps and moist drainage lines, often surrounding Map Units 3a (Banksia Thicket) and 3b (Teatree Thicket) (MU42 and MU43; NPWS 2003), or occasionally in minor depressions on sandstone platforms. The floristic composition of this community varies widely, depending on soil characteristics, drainage patterns and topography, although some elements are common to all occurrences of this vegetation community. Note that the sub-units of this community (described as Map Unit 44(a): Sedgeland, (b): Restioid Heath and (c): Cyperoid Heath in NPWS (2003)) are merged into one unit in this report and for the purposes of mapping: in most cases, the differences between the sub-units described in NPWS (2003) are generally not readily discernible in most of the sites surveyed, although some sites not visited during field surveys may exhibit the characteristics so described.

Much of this community has been subject to bushfire in the last 5 years, with regeneration of all strata evident.

Floristics and Structure

Upper and secondary canopy species are largely absent in most sites, although some small or isolated patches of low trees (such as Scribbly Gums *Eucalyptus haemastoma* and *Eucalyptus racemosa*) along with regenerating specimens can occur. Similarly, occasional tall shrub species (including Broad-leaved Geebung *Persoonia levis* and Flaky-barked Teatree *Leptospermum trinervium*) occur in low numbers in some locations.

The shrub stratum varies from sparse and low (where sedge and rush species predominate) to moderately dense, attaining a typical height of 0.5-1.5m and an FPC of 40-60%. Floristic composition is typically diverse, including Epacridaceae species *Epacris microphylla, Epacris pulchella, Epacris obtusifolia, Sprengelia incarnata, Leucopogon esquamatus, Woollsia pungens* and *Leucopogon microphyllus var. microphyllus,* Fabaceae species including *Viminaria juncea, Pultenaea tuberculata, Pultenaea aristata, Dillwynia floribunda, Phyllota phylicoides* and *Aotus ericoides,* the Wattles *Acacia suaveolens, Acacia myrtifolia* and *Acacia longifolia,* and Proteaceae species such as *Petrophile pulchella* and *Petrophile sessilis, Isopogon anemonifolius, Hakea dactyloides, Hakea teretifolia, Grevillea sericea, Grevillea diffusa* subsp. *diffusa, Banksia oblongifolia, Banksia paludosa, Banksia spinulosa* and *Banksia ericifolia* subsp. *ericifolia* (which can form dense, almost monotypic stands in some locations). Species from other families include *Pimelea linfolia* subsp. *linifolia*, *Leptospermum polygalifolium, Leptospermum squarrosum* and *Melaleuca thymifolia.*

The groundcover stratum is characteristically dense and diverse, consisting of a range of herb, sedge, rush and forb species, typically 0.2-1.5m tall and an FPC of up to 60-70%. Species composition at each location depends on a range of factors, but typically includes ferns such as *Gleichenia dicarpa, Schizaea bifida* and *Lindsaea linearis,* subshrubs including *Mitrasacme polymorpha* and *M. pilosa, Leucopogon esquamatus, Baeckea imbricata, Bauera microphylla, Epacris obtusifolia*, *Gompholobium minus,* Guinea Flowers *Hibbertia cistoidea, Hibbertia riparia, Hibbertia diffusa, Hibbertia rufa, Actinotus minor, Sphaerolobium vimineum* and *Platysace lanceolata, Dampiera stricta, Hypericum gramineum, Stackhousia nuda,* Restionaceae sedges such as *Leptocarpus tenax, Empodisma minus, Lepyrodia*

scariosa and *Saropsis fastigiata,* Cyperaceae taxa including *Cyathochaeta diandra, Ptilothrix deusta, Schoenus brevifolius* and *Chorizandra cymbaria,* and various other monocotyledonous species including Christmas Bells *Blandfordia nobilis, Xanthorrhoea resinosa, Xanthorrhoea concava, Haemodorum corymbosum, Sowerbaea juncea,* Yellow-eyes *Xyris operculata* and *X. gracilis* subsp. *gracilis,* Sundews *Drosera spatulata* and *Drosera peltata,* grasses such as *Entolasia stricta* and *Tetrarrhena turfosa,* and *Selaginella uliginosa.*

No introduced species were recorded in this map unit.

Flora of Conservation Significance

This community is known to provide habitat in the Woronora, O'Hares and Metropolitan Catchments for *Acacia baueri* subsp. *aspera* (V), *Pultenaea aristata* (V) and *Monotoca ledifolia* (3RC-) (NPWS, 2003). Within the study area, the threatened species *Pultenaea aristata* (V) was recorded within this vegetation community (Figure 5).

Map Unit 3d: Upland Swamp: Fringing Eucalypt Woodland

Distribution

This is an ecotone community occurring between Upland Swamp communities and the surrounding Sandstone Woodlands (NPWS 2003): while the upper canopy structure and species composition appears identical to adjacent sandstone woodlands, much of the groundcover stratum differs in the inclusion of sedge, forb and herb species more typically found in swampy sites. Much of this community has been subject to bushfire in the last 5 years, with regeneration of all strata evident.

Floristics and Structure

Upper canopy species occur to 10-12m high, mainly in drier sites along swamp margins, with an FPC of 15-25%. Common upper canopy species include Scribbly Gums *Eucalyptus haemastoma* and *Eucalyptus racemosa,* with Red Bloodwood *Corymbia gummifera* and occasional species such as Silvertop Ash *Eucalyptus sieberi* and Narrow-leaved Stringybark *Eucalyptus oblonga.*

Occasional isolated or sporadic taller shrubs occur in most locations to a height of 3-4m, with an FPC of less than 10%; species include Heath-leaved Banksia *Banksia ericifolia,* Broad-leaved Geebung *Persoonia levis,* Black She-oak *Allocasuarina littoralis* and Flaky-barked Teatree *Leptospermum trinervium.*

The shrub stratum (to 2-3m in height, and an FPC of 30% or up to 60% where upper canopy species are absent) is typically diverse, with species including occasionally dense patches of *Banksia ericifolia* subsp. *ericifolia* along with *Banksia oblongifolia, Lambertia formosa, Grevillea oleoides, Leptospermum polygalifolium* subsp. *polygalifolium, Epacris longiflora, Acacia suaveolens, Sprengelia incarnata, Grevillea sericea, Hakea teretifolia, Hakea dactyloides, Platysace lanceolata, Leptospermum squarrosum* and *Persoonia pinifolia.*

Depending on location, the groundcover stratum varies from low and patchy to very dense and diverse, attaining 0.5-1m maximum height and an FPC of up to 60%. Species include ferns such as *Pteridium esculentum, Schizaea bifida* and *Lindsaea linearis,* subshrubs including *Micrantheum ericoides, Hibbertia riparia, Sphaerolobium vimineum, Actinotus minor, Mitrasacme polymorpha, Epacris obtusifolia* and *Platysace linearifolia,* the sedge and rush species *Empodisma minus*, *Leptocarpus tenax* and *Lepyrodia scariosa,* herb and forb species including *Xanthosia pilosa forma* A, *Centella asiatica* and *Wahlenbergia gracilis,* a range of monocotyledons such as *Caesia parviflora var. vittata* and *Dichopogon fimbriatus, Selaginella uliginosa,* Sundews *Drosera spatulata* and *Drosera peltata* and grasses including *Entolasia stricta.*

Climbers and twiners species are limited to sporadic occurrences of Slender Devil's Twine *Cassytha glabella,* Devil's Twine *Cassytha pubescens* and Apple Berry *Billardiera scandens.*

Introduced species were not recorded in this map unit.

Flora of Conservation Significance

This community is known to provide habitat in the Woronora, O'Hares and Metropolitan Catchments for *Epacris purpurascens* var. *purpurascens* (V), *Pultenaea aristata* (V), *Darwinia grandiflora* (2RC-), *Eucalyptus apiculata* (3RC-) (NPWS, 2003). Within the study area, the threatened species *Pultenaea aristata* (V) was recorded within this vegetation community.

4.1.4 Riparian Scrub

Within the study area, prior and current disturbances in this vegetation community are generally minor and localised, although most occurrences of this vegetation group are regenerating after extensive fire. Condition class ascribed is 'Low disturbance' with some localised disturbance limited to those locations where roads cross creeklines; some minor levels of weed infestation (especially Crofton Weed *Agerantina adenophora* and Mist Flower *Ageratina riparia*) along Waratah Rivulet downstream of the Fire Road 9H crossing. Sanstone Riparian Scrub community is described below and mapped on Figure 4.

Map Unit 4a: Sandstone Riparian Scrub

Distribution

Sandstone Riparian Scrub occurs along most creeklines as fringing vegetation type along broader channels within the southern and central parts of the study area. Most occurrences of this community have been subject to bushfire in the last 5 years, with regeneration of all strata evident.

Floristics and Structure

Upper canopy species occur either within this community, or are trees within adjacent open forest communities (Map Unit 6a) that overhang this vegetation community; they form an open forest structure to 18-25m high, with an FPC of up to 35%. Common species include Smooth-barked Apple *Angophora costata* and Sydney Peppermint *Eucalyptus piperita* with occasional Silver-top Ash *Eucalyptus sieberi,* Narrow-leaved Scribbly Gum *Eucalyptus racemosa* and Red Bloodwood *Corymbia gummifera.*

In most locations, taller shrub species are a mixture of mesic and sclerophyllous taxa, forming a continuous stratum to a maximum height of 4-6m, with an FPC of up to 50%; in broader gullies, tall shrubs can occur as isolated stands or individuals. Characteristic species include Kanuka *Tristaniopsis laurina,* Water Gum *Tristania neriifolia, Leptospermum morrisonii,* Black She-oak *Allocasuarina littoralis,* River Lomatia *Lomatia myricoides,* Woolly Teatree *Leptospermum grandifolium,* Black Wattle *Callicoma serratifolia,* NSW Christmas Bush *Ceratopetalum gummiferum,* Orangebark *Maytenus silvestris* and Willow-leaved Hakea *Hakea salicifolia,* with mesic species such as Lilly Pilly *Acmena smithii* and Coachwood *Ceratopetalum apetalum* in more sheltered locations. Smaller shub species include *Callistemon citrinus, Pultenaea daphnoides, Baeckea linifolia, Dodonaea triquetra, Melaleuca squarrosa, Persoonia pinifolia, Pseudanthus pimelioides, Leionema dentatum, Lissanthe sapida, Phebalium squamulosum* subsp*. squamulosum* and *Logania albiflora.*

The groundcover layer structure and species composition varies depending on location; it is occasionally moderately dense and diverse, to a maximum height of 1m and an FPC of 10-15%,

although taller sedges occur in some locations to a height of 2m. Species include sedges and rushes such as *Schoennus brevifolius*, *Isolepis inundatus, Lepidosperma laterale, Lepidosperma limicola, Chorizandra cymbaria,* Saw Sedges *Gahnia sieberiana* and *G. clarkei, Centrolepis strigosa, Guringalia dimorpha, Lepyrodia anarthria,* Black Bog Rush *Schoenus melanostachys,* Mat Rushes *Lomandra longifolia* and *Lomandra fluviatilis,* a variety of ferns including *Sticherus flabellatus, Gleichenia dicarpa* and *Gleichenia microphylla, Pteridium esculentum, Calochlaena dubia, Todea Barbara, Blechnum cartilagineum* and *Blechnum wattsii,* grasses and other monocotyledons such as *Stylidium productum, Dianella caerulea* var. *producta, Entolasia marginata, Tetrarrhena juncea* and Yellow-eyes *Xyris gracilis* subsp. *gracilis* and *Xyris operculata,* and herbs and subshrubs including *Hibbertia riparia,* Hairy Stinkweed *Opercularia hispida, Dampiera stricta* and *Mitrasacme polymorpha.*

Climbers and twiners include Apple Berry *Billardiera scandens,* Pearl Vine *Stephania japonica* var. *discolor,* Old Man's Beard *Clematis glycinoides,* Native Sarsaparilla *Smilax glyciphylla,* False Sarsaparilla *Hardenbergia violacea* and Devil's Twine *Cassytha glabella.*

Few introduced species were recorded in this map unit, including occasional patches of Crofton Weed *Ageratina adenophora* and Mist Flower *Ageratina riparia* occur in sporadic locations downstream of fire trail crossings.

Flora of Conservation Significance

This community is known to provide habitat in the Woronora, O'Hares and Metropolitan Catchments for *Astrotricha crassifolia* (V), *Grevillea longifolia* (2RC-) and *Lomandra fluviatilis* (3RCa) (NPWS, 2003). Within the study area, the threatened species *Pultenaea aristata* (V) and *Astrotricha crassifolia* (V) were recorded within this vegetation community, with RoTAP species *Grevillea longifolia* and *Lomandra fluviatilis*. Potential (unconfirmed) occurrences of *Epacris purpurascens* var. *purpurascens* were also recorded (Figure 5).

4.1.5 Tall Open Forests

Tall Open Forests within the study area include *Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion*; O'Hares Creek Shale Forest and Regenerating O'Hares Creek Shale Forest occur to the south in the vicinity of Longwalls 18 to 19A. These communities are described below, with *Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion* mapped on Figure 4.

Map Unit 5a: Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion

Distribution

This community "…*is typically associated with sheltered heads and upper slopes of gullies on transitional zones where sandstone outcrops may exist, but where soils are influenced by lateral movement of moisture, nutrients and sediment from more fertile substrates, such as shale/ironstone caps or dolerite dykes, in adjacent areas.*" (DECC, 2007b). This community is restricted in distribution to areas on lower to mid-slopes in the eastern parts of the study area, with further occurrences within Garrawarra SCA and on private lands in the south-east of the study area and beyond (Figure 4). This community has also been identified in the Longwalls 18 to 19A area to the south. This community is listed as an Endangered Ecological Community on Schedule 1 of the TSC Act.[10]

This community has been recorded from the local government areas of Campbelltown, Hurstville, Kogarah, Sutherland, Wollondilly and Wollongong within the Sydney Basin Bioregion and may occur

[10] http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10569

elsewhere in the Bioregion. This community is found within an estimated total extent of occurrence of less than 45,000 ha, bounded approximately by Hurstville, Carss Park, Bundeena, Otford, Stanwell Tops, Darkes Forest, Punchbowl Creek and Menai. Within this range, the community is currently estimated to occupy an area of approximately 400 - 4,000 ha. These estimates indicate that the geographic distribution of this community on transitional sandstone soils is highly restricted.

Floristics and Structure

The description below is for the occurrences of this community in the east of the study area. A description of this community in the Longwalls 18-19A study area is provided in Bangalay Botanical Surveys (2007).

The upper canopy structure is generally continuous, with the exception of areas intersected by powerline easements, roads and road easements or along fire trails. A typical canopy height of up to 25m high, though occasionally to 28-35m, with an FPC of 35-50%. This community is an open forest characterised by eucalypts with scattered subcanopy trees, a diverse shrub layer and well-developed groundcover of ferns, forbs, grasses and graminoids. Upper canopy species include Blackbutt *Eucalyptus pilularis,* Smooth-barked Apple *Angophora costata,* Sydney Peppermint *Eucalyptus piperita,* Narrow-leaved Scribbly Gum *Eucalyptus racemosa,* Red Bloodwood *Corymbia gummifera* and Silvertop Ash *Eucalyptus sieberi.*

Typical upper understorey species are Hickory *Acacia implexa,* Mock Olive *Notolaea longifolia,* Orangebark *Maytenus silvestris*, Sweet Pittosporum *Pittosporum undulatum,* Blueberry Ash *Elaeocarpus reticulatus,* Cherry Ballart *Exocarpos cupressiformis,* Black She-oak *Allocasuarina littoralis,* Two-veined Hickory *Acacia binervata* and Muttonwood *Rapanea variabilis.* Areas regenerating after disturbance may also have a dense stratum of wattles including Green Wattle *Acacia irrorata,* Two-veined Hickory *Acacia binervata* and Sydney Golden Wattle *Acacia longifolia.*

The shrub stratum varies from low and patchy to very dense, attaining 0.5-2m height and an FPC of up to 45%. Typical native shrub layer species include Sydney Golden Wattle *Acacia longifolia,* White Dogwood *Ozothamnus diosmifolius,* Long-leaf Wattle *Acacia longissima,* Star-hairs *Astrotricha latifolia,* Lance Bearded Heath *Leucopogon lanceolatus* var. *lanceolatus*, Native Currant *Leptomeria acida*, Narrow-leaved Geebung *Persoonia linearis*, Graceful Bush Pea *Pultenaea daphnoides,* Coffee Bush *Breynia oblongifolia, Leucopogon juniperinus* and Broom Heath *Monotoca scoparia*. Species such as Old man Banksia *Banksia serrata,* Hairpin Banksia *Banksia spinulosa,* Sunshine Wattle *Acacia terminalis* and Sweet-scented Wattle *Acacia suaveolens* may also occur where this community occurs on more exposed topography or where rock outcrops occur.

The regenerating groundcover stratum varies from moderately dense to very dense along minor drainage lines, to 0.5-1.5m tall. Species include Flax Lily *Dianella longifolia* var. *longifolia,* Rough Guinea Flower *Hibbertia aspera,* Gymea Lily *Doryanthes excelsa,* Sword Sedge *Lepidosperma laterale,* Bracken *Pteridium esculentum,* Crinkle Bush *Lomatia silaifolia,* Variable Tick Trefoil *Desmodium varians,* Bat's Wing Fern *Histiopteris incisa,* Shield Fern *Polystichum australiense,* Pastel Flower *Pseuderanthemum variabile, Xanthosia pilosa forma* A, Mulga Fern *Cheilanthes sieberi,* Lacy Wedge Fern *Lindsaea microphylla,* Bordered Panic *Entolasia marginata, Poa labillardieri,* Basket Grass *Oplismenus imbecillis,* Kangaroo Grass *Themeda australis,* Hedgehog Grass *Echinopogon caespitosus,* Mat Rush *Lomandra longifolia* and Hill Fireweed *Senecio hispidulus* var. *hispidulus.* Swampy or wetter sites may also have fern and tall sedge species to 2m, including Gristle Fern *Blechnum cartilagineum,* Rasp Fern *Doodia aspera* and Black Bog Rush *Schoenus melanostachys.*

Climbing and trailing species include False Sarsaparilla *Hardenbergia violacea,* Common Milk Vine *Marsdenia rostrata,* Bearded Tylophora *Tylophora barbata,* Common Silkpod *Parsonsia straminea,* Golden Guinea Flower *Hibbertia scandens,* Love Creepers *Glycine clandestina* and *Glycine tabacina,* and Pearl Vine *Stephania japonica* var. *discolor.*

Introduced species occur along track and road edges; occasional species include Paddys Lucerne and *Sida rhombifolia* Cat's Ears *Hypochaeris radicata.*

Flora of Conservation Significance

This community is not known to provide habitat for any threatened plant species in the Woronora, O'Hares and Metropolitan Catchments (NPWS, 2003). No threatened species were recorded within this vegetation community within the study area.

Map Unit 5b: O'Hares Creek Shale Forest

Distribution

This community occurs on remnant shale caps on broad ridges and upper slopes, generally overlying sandstone geologies. This community occurs to the south in the Longwalls 18-19A study area (as shown on Figure 4), but does not occur within the LW20-44 study area. Note that this Map Unit (equiv. MU 17 (NPWS 2003); MU 21 (NPWS 2002)) is listed as an Endangered Ecological Community on the Schedules to the TSC Act.[11] A description of the community from Bangalay Botanical Surveys (2007) is provided below.

Keith (1994) notes that O'Hares Creek Shale Forest was once likely to be more extensive across much of the Darkes Forest and Helensburgh Areas extending north to Heathcote. Consequently the Catchments of Woronora, O'Hares and Cataract conserve the majority of the remaining examples.

Floristics and Structure

The upper canopy structure is generally continuous, with a typical canopy height of up to 25m high, though occasionally to 28-35m, with an FPC of 30-40% throughout. Characteristic upper canopy species are Smooth-barked Apple *Angophora costata,* Sydney Peppermint *Eucalyptus piperita* and White Stringybark *Eucalyptus globoidea,* with occasional specimens of Red Bloodwood *Corymbia gummifera* and Silvertop Ash *Eucalyptus sieberi.*

The upper understorey (to 8m) is variable, occasionally dense although often sparse or patchy. Typical species are Two-veined Hickory *Acacia binervata* and Sydney Golden Wattle *Acacia longifolia,* with occasional Sweet Pittosporum *Pittosporum undulatum,* Green Wattle *Acacia irrorata,* Blueberry Ash *Elaeocarpus reticulatus,* Cherry Ballart *Exocarpos cupressiformis* and Black She-oak *Allocasuarina littoralis.*

Snow-in-Summer *Melaleuca linariifolia* occurs sporadically throughout minor drainage lines in low-lying parts of this community.

The shrub stratum varies from low and patchy to moderately dense, attaining 0.5-3m height and an FPC of up to 45%. Typical species include wattles such as *Acacia longifolia, Acacia linifolia* and *Acacia suaveolens,* with *Ozothamnus diosmifolius, Leucopogon lanceolatus* var. *lanceolatus*, *Leptomeria acida*, *Persoonia linearis*, *Pultenaea daphnoides, Breynia oblongifolia, Leucopogon juniperinus* and *Monotoca scoparia*. Species such as *Banksia serrata, Banksia spinulosa, Acacia terminalis* and *Acacia myrtifolia* occur more commonly at the ecotone where this community merges with open forests and woodlands on sandstone.

The groundcover stratum varies from low and moderately sparse below dense patches of understorey species, to moderately dense along minor drainage lines, to 0.2-1.5m tall. Species include ferns such as *Pteridium esculentum, Lindsaea microphylla, Calochlaena dubia* and *Cheilanthes sieberi,* grasses

[11] http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10569

such as *Echinopogon caespitosus, Entolasia marginata, Poa labillardieri, Oplismenus imbecillis, Themeda australis* and *Entolasia stricta,* various monocotyledons including *Dianella longifolia* var. *longifolia, Doryanthes excelsa, Lepidosperma laterale, Lomandra longifolia* and *Lomandra multiflora,* low shrubs such as *Hibbertia aspera, Lomatia silaifolia, Xanthosia pilosa forma* A, and herbs including *Desmodium varians, Pseuderanthemum variabile, Senecio hispidulus* var. *hispidulus.* Damper sites may also have ferns including *Blechnum cartilagineum, Histiopteris incisa* and *Doodia aspera* and tall sedge species up to 2m tall such as *Gahnia sieberiana* and *Schoenus melanostachys.*

Climbing and trailing species include *Hardenbergia violacea, Marsdenia suaveolens, Tylophora barbata, Parsonsia straminea, Stephania japonica* var. *discolor,* Guinea Flowers *Hibbertia scandens* and *Hibbertia dentata,* and Love Creepers *Glycine clandestina* and *Glycine tabacina.*

Exotic species are restricted to track and road edges, generally in low numbers; species include Fleabanes *Conyza* spp., Paddy's Lucerne *Sida rhombifolia* and Cat's Ears *Hypochaeris radicata.*

Flora of Conservation Significance

This community is not known to provide habitat in the Woronora, O'Hares and Metropolitan Catchments for rare or threatened plant species, and none was recorded by Bangalay Botanical Surveys (2007); however, it may provide potential habitat for species such as *Epacris purpurascens* var. *purpurascens* (V), *Thesium australe* (V) and *Acacia pubescens* (V).

Map Unit 5r: Regenerating O'Hares Creek Shale Forest

Distribution

Small areas of previously disturbed O'Hares Creek Shale Forest occur to the south, along the south-western margins of the major stand of this vegetation community within the Longwalls 18-19A study area (Figure 4). A description of this community from Bangalay Botanical Surveys (2007) is provided below.

Floristics and Structure

Regenerating upper canopy and mid-canopy species occur to 8-15m tall, with an FPC of 35-50% (depending on location and the nature of previous disturbance), with occasionally dense and continuous stands of mid-canopy and shrub layer species to 1.5-3m tall, along with a range of groundcover species to 0.5-1m tall.

Common regenerating upper canopy species are Smooth-barked Apple *Angophora costata,* White Stringybark *Eucalyptus globoidea* and Sydney Peppermint *Eucalyptus piperita,* with occasional specimens of Red Bloodwood *Corymbia gummifera* and Narrow-leaved Scribbly Gum *Eucalyptus racemosa* where this community intergrades with adjacent sandstone woodland communities. Common understorey species are wattles such as *Acacia binervata, Acacia longifolia, Acacia linifolia, Acacia suaveolens* and *Acacia myrtifolia,* with *Daviesia ulicifolia, Bursaria spinosa, Banksia ericifolia, Banksia spinulosa, Petrophile pulchella, Pultenaea retusa, Pultenaea daphnoides, Ozothamnus diosmifolius* and *Persoonia linearis.* The groundcover stratum typically includes dense stands of species such as Bracken *Pteridium esculentum,* and a range of grasses such as Blady Grass *Imperata cylindrica* var. *major,* Hedgehog Grass *Echinopogon caespitosus,* Kangaroo Grass *Themeda australis* and Bordered Panic *Entolasia marginata,* with herbs including *Pomax umbellata, Helichrysum elatum, Brunoniella australis* and *Senecio hispidulus* var. *hispidulus* and rush and sedge species including *Lomandra longifolia, Lomandra multiflora, Dianella caerulea* var. *producta* and *Lepidosperma laterale.*

4.1.6 Sandstone Forests

Sandstone Forests within the study area include Sandstone Gully Apple-Peppermint Forest and Disturbed and/or Regenerating Sandstone Gully Apple-Peppermint Forest as described below and mapped on Figure 4.

Map Unit 6a: Sandstone Gully Apple-Peppermint Forest

Distribution

This vegetation community occurs on sheltered slopes and gullies on Hawkesbury Sandstone derived soils throughout the study area (NPWS, 2003). At least part of this community has been subject to bushfire in the last 5 years, with regeneration of all strata evident.

Floristics and Structure

At higher elevations on mid-slopes and upper slopes, this community occurs as a woodland or open forest community, with an FPC of 25-30% and a typical canopy height of 15-18m; on lower slopes and in more sheltered sites, this is an open forest community, with an FPC of 30-35%, to 16-20m high, occasionally to 25m where mature trees remain in sheltered gullies. Common upper canopy species are Smooth-barked Apple *Angophora costata,* Sydney Peppermint *Eucalyptus piperita,* Red Bloodwood *Corymbia gummifera* and Narrow-leaved Scribbly Gum *Eucalyptus racemosa,* with occasional Blue-leaved Stringybark *Eucalyptus agglomerata* in deeper gullies, and Silver-top Ash *Eucalyptus sieberi* in more exposed locations.

The secondary canopy, to a height of 4-8m with an FPC of less than 15-25%, is patchily distributed, but is often denser in sheltered gullies where this community adjoins Map Unit 4a (Riparian Scrub) in deep, sheltered gullies alongside creeklines. Typical species include Black She-oak *Allocasuarina littoralis,* NSW Christmas Bush *Ceratopetalum gummiferum,* Old Man Banksia *Banksia serrata*, Flaky-barked Teatree *Leptospermum trinervium* and Narrow-leaved Geebung *Persoonia linearis.*

The shrub stratum is typically dense and diverse, attaining 0.5-2m height and an FPC of up to 50%. Floristic composition includes species from Fabaceae such as *Pultenaea daphnoides*, *Pultenaea stipularis, Dillwynia retorta, Dillwynia elegans, Aotus ericoides, Bossiaea heterophylla,* Wedge Peas *Gompholobium virgatum* and *Gompholobium grandiflorum* and *Daviesia mimosoides.* Wattles including *Acacia suaveolens, Acacia obtusifolia, Acacia terminalis, Acacia myrtifolia, Acacia ulicifolia* and *Acacia linifolia,* Proteaceae taxa including Hakeas *Hakea laevipes, Hakea gibbosa* and *Hakea sericea,* Geebungs *Personia linearis, Persoonia levis* and *Persoonia pinifolia,* Banksias including *Banksia ericifolia* subsp. *ericifolia, Banksia serrata* and *Banksia spinulosa,* Grevilleas such as *Grevillea sericea* and *Grevillea oleoides, Petrophile pulchella, Lambertia formosa* and *Lomatia silaifolia,* Myrtaceae species such as Teatrees *Leptospermum grandifolium, Leptospermum trinervium* and *Leptospermum polygalifolium subsp. polygalifolium, Kunzea ambigua,* and *Eriostemon australasius*, *Philotheca scabra, Polyscias sambucifolia* and *Acrotriche divaricata.*

The groundcover layer is moderately dense and diverse, up to 0.8-1.5m tall, although taller sedge and rush species occur in damper gullies. Species include herbs and subshrubs such as *Opercularia hispida, Gonocarpus teucrioides, Gonocarpus tetragynus, Stylidium productum, Centella asiatica, Hybanthus monopetalus, Tetratheca ericifolia, Hydrocotyle peduncularis* and *Hibbertia riparia,* Grass Trees such as *Xanthorrhoea arborea,* grasses including *Entolasia stricta, Austrostipa pubescens, Anisopogon avenaceus, Tetrarrhena juncea* and *Entolasia marginata,* the sedge and rush species *Lomandra filiformis* subsp. *filiformis, Lepidosperma laterale, Lepyrodia anarthria, Schoenus melanostachys* and *Lomandra longifolia,* and monocotyledons such as *Dianella caerulea* var. *producta* and *Xyris gracilis* subsp. *gracilis.*

Climbers and twiners include *Stephania japonica* var. *discolor, Hibbertia dentata, Cassytha glabella, Clematis glycinoides, Smilax glyciphylla, Hardenbergia violacea* and *Billardiera scandens.*

Introduced species are restricted to the edges of tracks and roads and within the powerline easements in the eastern section of the study area, and as isolated specimens at stream crossings. Common species include Fleabanes *Conzya* spp., Whiskey Grass *Andropogon virginicus* and Paddys Lucerne *Sida rhombifolia.*

Flora of Conservation Significance

This community is known to provide habitat in the Woronora, O'Hares and Metropolitan Catchments for *Leucopogon exolasius* (V), *Grevillea longifolia* (2RC-) and *Lomandra fluviatilis* (3RCa) (NPWS, 2003); potential habitat also exists for *Epacris purpurascens* var. *purpurascens* (V). Within the study area, the threatened species *Pultenaea aristata* (V) and *Astrotricha crassifolia* (V) were recorded within this vegetation community. Potential (unconfirmed) occurrences of *Epacris purpurascens* var. *purpurascens* (V) and *Leucopogon exulasius* (V) were also recorded (Figure 5).

Map Unit 6r: Disturbed and/or Regenerating Sandstone Gully Apple-Peppermint Forest

Distribution

To the west of the Princes Highway, most occurrences of Map Unit 6a within the study area have been ascribed 'Low Disturbance', although localised minor disturbances may occur, such as the creation and maintenance of unsealed fire trails (throughout the study area) and small infrastructure sites (such as water quality monitoring and pumping stations). To the east of the Princes Highway, some larger areas of sandstone gully forests have been subject to some prior and current disturbances associated with the major north-south powerline easements and major highways (including the Princes Highway and F6 Freeway).

Localised patches of 'Moderate disturbance' are mapped as Map Unit 6r: Regenerating Sandstone Gully Forest (Figure 4).

Floristics and Structure

The native species present comprise species described for Map Unit 6a. Introduced species include Cats Ears *Hypochaeris radicata,* Fleabanes *Conyza* spp., Slender Celery *Ciclospermum leptophyllum,* Kurnell Curse *Hydrocotyle bonariensis,* Crofton Weed *Ageratina adenophora*, Spear Thistle *Cirsium vulgare,* Panic Veldt Grass *Ehrharta erecta* and Summer Grass *Digitaria sanguinalis*.

4.1.7 Disturbed Land

In general, disturbed landscapes are more widespread in the eastern sections of the study area, particularly near major roads, powerline easements and residential areas. Prior and current disturbances include within the major north-south powerline easements, within and adjacent to major highways (including the Princes Highway and F6 Freeway) and previously cleared land.

Prior disturbance events have also led to areas of dense *Acacia* scrub, which mostly occurs in areas adjacent to cleared land and within powerline easements: patches too small to map may also occur in other locations, especially adjacent to disturbed sites in the east of the study area.

Map Unit 7a: Acacia Regeneration

Distribution

This community is generally most common in the eastern parts of the site, generally adjacent to previously disturbed landscapes.

Floristics and Structure

This community is generally a scrub to closed scrub, to 2-3m high, formed of a number of *Acacia* species, but with *Acacia longifolia* particularly common. These species commonly occur with a range of weed species, such as Lantana *Lantana camara,* Fleabanes *Conyza* spp., members of the Solanaceae (*e.g. Solanum mauritianum, Solanum nigrum*) and grasses including Whiskey Grass *Andropogon virginicus* and African Love Grass *Eragrostis curvula*. In addition, native canopy and shrub species may also occur, including Sydney Peppermint *Eucalyptus piperita,* Silver-top Ash *Eucalyptus sieberi* and Smooth-barked Apple *Angophora costata,* as well as shrub species such as Heath-leaved Banksia *Banksia ericifolia.*

Map Unit 7b: Introduced – Weeds and Exotic Species

Distribution

This community is generally most common in the eastern parts of the site, generally adjacent to previously disturbed landscapes (e.g. near the disused quarry, Garrawarra Retirement village, powerline and road easements).

Floristics and Structure

Remnant vegetation may be restricted to occasional native tree cover above exotic shrub and groundcover species, while some areas (for example the Garrawarra Retirement village) may feature solely exotic species. The threatened species *Pultenaea aristata* (V) was recorded within this vegetation community (Figure 5).

4.2 VEGETATION CONDITION

One of the key factors in assessing the value of remnant urban bushland is the 'resilience' of the patch or remnant to disturbance. McDonald (1996) postulates that "…*Arguably, the ecosystem property of most interest to restoration is that of 'resilience' - that is, the capacity of a community or species to 'bounce back' after disturbance... This is because it is likely that the autecological limits and disturbance adaptations of individual species which largely govern resilience after natural disturbance will largely govern recovery after anthropogenic disturbance or other anthropogenic impacts…*".

With respect to the remnant vegetation within the study area, a number of factors were noted during the fieldwork, including:

- current or prior disturbance of native vegetation;
- distribution and abundance of weeds;
- the occurrence of imported soil and fill;
- roads and tracks;
- alterations to site drainage characteristics and indication of fire regimes; and
- the adequacy of linkages between vegetation within the study area and that in adjacent areas.

Condition classes for native vegetation communities are provided in Table 9 below.

Table 9
Native Vegetation Condition Classes

Map Unit	Type	Condition Class	Condition and Indicative Matrix
1a	Exposed Sandstone Scribbly Gum Woodland	Low disturbance (or disturbance absent)	Natural vegetation cover reflecting little, if any, disturbance. Minimal disturbance: all habitat components still present, still retains high integrity. Vegetation present has good resilience and removing the causes of any disturbance type could show immediate beneficial effects. Minor disturbance along track or road edges.
1b	Sandstone Heath-Woodland	Low disturbance (or disturbance absent)	Natural vegetation cover reflecting little, if any, disturbance. Minimal disturbance: all habitat components still present, still retains high integrity. Vegetation present has good resilience and removing the causes of any disturbance type could show immediate beneficial effects. Minor disturbance along track or road edges.
1c	Silvertop Ash Ironstone Woodland	Low disturbance (or disturbance absent)	Natural vegetation cover reflecting little, if any, disturbance. Minimal disturbance: all habitat components still present, still retains high integrity. Vegetation present has good resilience and removing the causes of any disturbance type could show immediate beneficial effects. Minor disturbance along track or road edges.
1r	Disturbed and/or Regenerating Sandstone or Lateritic Communities	Low to moderate localised disturbance.	Local disturbance evident (appears to have been subject to historic clearing). Natural vegetation cover reflecting moderate disturbance with most habitat components still present, although upper stratum may be absent or modified or regenerating. Vegetation present has good resilience and removing the causes of any disturbance type could show immediate beneficial effects.
2a	Rock Pavement Heath	Low disturbance (or disturbance absent)	Natural vegetation cover reflecting little, if any, disturbance. Minimal disturbance: all habitat components still present, still retains high integrity. Vegetation present has good resilience and removing the causes of any disturbance type could show immediate beneficial effects. Minor disturbance along track or road edges.
2b	Rock Plate Heath-Mallee	Low disturbance (or disturbance absent)	Natural vegetation cover reflecting little, if any, disturbance. Minimal disturbance: all habitat components still present, still retains high integrity. Vegetation present has good resilience and removing the causes of any disturbance type could show immediate beneficial effects. Minor disturbance along track or road edges.
2c	Woronora Tall Mallee-heath	Low disturbance (or disturbance absent)	Natural vegetation cover reflecting little, if any, disturbance. Minimal disturbance: all habitat components still present, still retains high integrity. Vegetation present has good resilience and removing the causes of any disturbance type could show immediate beneficial effects. Minor disturbance along track or road edges.
2r	Disturbed and/or Regenerating Mallee-Heath	Low to moderate localised disturbance.	Local disturbance evident (appears to have been subject to historic clearing). Natural vegetation cover reflecting moderate disturbance with most habitat components still present, although upper stratum may be absent or modified or regenerating. Vegetation present has good

Map Unit	Type	Condition Class	Condition and Indicative Matrix
			resilience and removing the causes of any disturbance type could show immediate beneficial effects.
3a	Upland Swamp: Banksia Thicket	Low disturbance (or disturbance absent)	Natural vegetation cover reflecting little, if any, disturbance. Minimal disturbance: all habitat components still present, still retains high integrity. Vegetation present has good resilience and removing the causes of any disturbance type could show immediate beneficial effects. Minor disturbance along track or road edges.
3b	Upland Swamp: Tea Tree Thicket	Low disturbance (or disturbance absent)	Natural vegetation cover reflecting little, if any, disturbance. Minimal disturbance: all habitat components still present, still retains high integrity. Vegetation present has good resilience and removing the causes of any disturbance type could show immediate beneficial effects. Minor disturbance along track or road edges.
3c	Upland Swamp: Sedgeland-heath Complex	Low disturbance (or disturbance absent)	Natural vegetation cover reflecting little, if any, disturbance. Minimal disturbance: all habitat components still present, still retains high integrity. Vegetation present has good resilience and removing the causes of any disturbance type could show immediate beneficial effects. Minor disturbance along track or road edges.
3d	Upland Swamp: Fringing Eucalypt Woodland	Low disturbance (or disturbance absent)	Natural vegetation cover reflecting little, if any, disturbance. Minimal disturbance: all habitat components still present, still retains high integrity. Vegetation present has good resilience and removing the causes of any disturbance type could show immediate beneficial effects. Minor disturbance along track or road edges.
4a	Sandstone Riparian Scrub	Low disturbance (or disturbance absent)	Natural vegetation cover reflecting little, if any, disturbance. Minimal disturbance: all habitat components still present, still retains high integrity. Vegetation present has good resilience and removing the causes of any disturbance type could show immediate beneficial effects. Minor disturbance along track or road edges.
5a	Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion	(i) Low disturbance; (ii) Moderate disturbance	(i) Natural vegetation cover reflecting little, if any, disturbance. Minimal disturbance: all habitat components still present, still retains high integrity. Vegetation present has good resilience and removing the causes of any disturbance type could show immediate beneficial effects. (ii) Moderate disturbance - local disturbance evident. Natural vegetation cover – generally in moderate condition. Moderate disturbance: most habitat components still present, although upper stratum may be absent or modified or regenerating. Vegetation present has good resilience and removing the causes of any disturbance type could show immediate beneficial effects.
5b	O'Hares Creek Shale Forest	Low disturbance (or disturbance absent)	Natural vegetation cover reflecting little, if any, disturbance. Minimal disturbance: all habitat components still present, still retains high integrity. Vegetation present has good resilience and removing any causes of any disturbance type could show immediate beneficial effects. Minor disturbance along track or road edges.
5r	Regenerating O'Hares Creek	Moderate disturbance	Local disturbance evident, appears to have been subject to historic clearing. Natural vegetation cover reflecteing

Map Unit	Type	Condition Class	Condition and Indicative Matrix
	Shale Forest		moderate disturbance with most habitat components present, although upper stratum may be absent or modified or regenerating. Vegetation present has good resilience and removing the causes of any disturbance type could show immediate beneficial effects.
6a	Sandstone Gully Apple-Peppermint Forest	Low disturbance (or disturbance absent)	Natural vegetation cover reflecting little, if any, disturbance. Minimal disturbance: all habitat components still present, still retains high integrity. Vegetation present has good resilience and removing the causes of any disturbance type could show immediate beneficial effects. Minor disturbance along track or road edges.
6r	Disturbed and/or Regenerating Sandstone Gully Apple-Peppermint Forest	Low to moderate localised disturbance.	Local disturbance evident. Natural vegetation cover – generally in moderate condition. Moderate disturbance: most habitat components still present, although upper stratum may be absent or modified or regenerating. Vegetation present has good resilience and removing the causes of any disturbance type could show immediate beneficial effects.
7a	Acacia Regeneration	Moderate to high disturbance	Degraded as a consequence of continued disturbance and degradation which has affected the long-term sustainability of the vegetation. Understorey species partly lost but regeneration apparent; ground cover often dominated by weeds and introduced grasses.
7b	Introduced – Weeds and Exotics	Moderate to high disturbance	Degraded as a consequence of continued disturbance and degradation which has affected the long-term sustainability of the vegetation. Understorey species mostly lost but regeneration apparent, if sporadic; ground cover and shrub stratum often dominated by weeds and introduced grasses.

4.3 INDIGENOUS PLANT SPECIES

The results of both the current surveys and previous surveys (NPWS, 2003; NPWS, 2002; Keith, 1994) indicate that the great majority of plant species occurring within the Woronora Special Area and the study area are native species. All species recorded during current surveys within the study area are listed in the species list (Appendix D). Where relevant, the conservation significance of these plant species is discussed below (Sections 4.5 to 4.8).

4.4 INTRODUCED AND NOXIOUS WEED SPECIES

In general, introduced plant species are limited to areas which have been subject to prior and/or current disturbance (i.e. Map Units marked “r” and track margins). Exotic species occur infrequently along fire roads within the study area, and generally include widespread and common species in low densities. However, exotic species diversity and abundance increases within vegetation along major roads (the F6 freeway and the Old Princes Highway), albeit in narrow bands on either side of these major roads. Larger areas of disturbed landscapes also occur in the north-eastern and eastern sections of the study area: a range of exotic species occur within and surrounding the Garrawarra hospital site, paddocks to the south and east of the Garrawarra retirement village (now abandoned and overgrown), an apparently abandoned pine plantation to the south of the Garrawarra retirement village and in and around rural residential land in the south-eastern section of the study area. A number of these species are listed as noxious under the Noxious Weeds Act 1993, or are considered as ‘Environmental Weed’ species by Blood (2001).

Some species recorded during the survey, while native, occur beyond their natural range; these species appear to have been introduced into the study area from nearby areas. Coastal Tea Tree *Leptospermum laevigatum* forms dense stands in previously disturbed areas of Map Unit 1a and Coastal Banksia *Banksia integrifolia* occurs sporadically in disturbed portions of Map Unit 6.

Noxious Weed Species

Of the invasive exotic species recorded during recent surveys within the study area, several are listed as Noxious Weeds[12] under the Noxious Weeds Act 1993 (Order No. 20, 2006) for the Wollongong City Council LGA (see Table 10 below).

Table 10
Noxious Weed Species Recorded on the Subject Site for Wollongong City Council LGA (included under the Illawarra District Weeds Authority)

Botanical Name	Common Name	Category Code
Cortaderia selloana	Pampas Grass	W2
Eragrostis curvula	African Love Grass	W2
Lantana camara	Lantana	W4, W5
Lycium ferocissimum	African Boxthorn	W4
Myrsiphyllum asparagoides	Bridal Veil Creeper	W5
Opuntia stricta	Prickly Pear	W4
Oxalis spp. (all spp. except natives)	Oxalis	W5
Romulea rosea	Onion Grass	W5
Rubus fruticosus sp. aggregate	Blackberry	W2

Environmental Weed Species

In addition to the Noxious Weed species present on the site, a number of Environmental Weed Species listed by Blood (2001) were detected on the subject site during this survey, as listed in Table 11.

Table 11
Environmental Weed Species Recorded on the Subject Site (Blood, 2001)

Botanical Name	Common Name
Acetosa sagittata	Turkey Rhubarb
Anagallis arvensis	Scarlet Pimpernel
Andropogon virginicus	Whiskey Grass
Anredera cordifolia	Madeira Vine
Araujia sericiflora	Moth Vine
Bidens pilosa	Cobbler's Pegs
Briza maxima	Quaking Grass
Briza minor	Trembling Grass
Bromus catharticus	Prairie Grass
Centaurium spp.	Centaury
Chloris gayana	Rhodes Grass

[12] Noxious weeds are declared by order of the Minister for Agriculture under the Noxious Weeds Act 1993.

Botanical Name	Common Name
Cirsium vulgare	Spear Thistle
Conyza spp.	Fleabanes
Crocosmia x *crocosmiiflora*	Montbretia
Ehrharta erecta	Panic Veldt Grass
Eragrostis curvula	African Love Grass
Hypochaeris radicata	Cats Ears
Ipomoea indica	Common Morning Glory
Lantana camara	Lantana
Ligustrum sinense	Small-leaved Privet
Lonicera japonica	Japanese Honeysuckle
Medicago polymorpha	Burr Medic
Nephrolepis cordifolia	Fishbone Fern
Ochna serrulata	Ochna
Olea europaea subsp. *africana* (syn. *O. africana*)	African Olive
Oxalis corniculata	Creeping Oxalis
Oxalis pes-caprae	Soursob
Oxalis purpurea	Purple Oxalis
Paspalum dilatatum	Paspalum
Paspalum urvillei	Vasey Grass
Pennisetum clandestinum	Kikuyu
Phytolacca octandra	Inkweed
Plantago lanceolata	Plantain
Protasparagus aethiopicus	Asparagus Fern
Ranunculus repens	Creeping Buttercup
Romulea rosea	Onion Grass
Senecio madagascariensis	Fireweed
Setaria spp.	Pigeon Grasses
Sida rhombifolia	Paddy's Lucerne
Solanum mauritianum	Wild Tobacco
Solanum nigrum	Black Berry Nightshade
Sporobolus indicus var. *capensis*	Slender Rat's Tail Grass
Stenotaphrum secundatum	Buffalo Grass
Tradescantia fluminense (syn. *T. albiflora*)	Wandering Jew
Trifolium repens	White Clover
Verbena bonariensis	Veined Verbena

Nationally Significant Weed Species

Several of the Noxious and Environmental weed species listed above are listed as Weed Species of National Significance (see Table 10, below) as part of the National Weeds Strategy (ARMCANZ, ANZECC and Forestry Ministers 1999[13]).

[13] Agriculture and Resource Management Council of Australia and New Zealand, Australian and New Zealand Environment and Conservation Council and Forestry Ministers

Table 12
Weed Species of National Significance

Botanical Name	Common Name
Rubus fruticosus aggregate	Blackberry
Asparagus asparagoides	Bridal Veil Creeper
Lantana camara	Lantana

4.5 ENDANGERED ECOLOGICAL COMMUNITIES

The '*Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion*' endangered ecological community "…*is typically associated with sheltered heads and upper slopes of gullies on transitional zones where sandstone outcrops may exist, but where soils are influenced by lateral movement of moisture, nutrients and sediment from more fertile substrates, such as shale/ironstone caps or dolerite dykes, in adjacent areas.*" (DECC 2007b). Within the study area, this community occupies the transitional zones between shale soils and adjacent sandstone gullies (Map Unit 5a on Figure 4). A description of this community within the study area is provided in Section 4.1.5.

The '*O'Hares Creek Shale Forest* endangered ecological community was recorded in the south-west of the Longwalls 18 to 19A study area (Map Unit 5b on Figure 4). In the region, O'Hares Creek Shale Forest is found between the watersheds of the O'Hares and Woronora Catchments, with smaller isolated patches also found along Appin Road and in the Cataract Catchment on Fire Trails 7A (NPWS, 2003). A description of this community is provided in Section 4.1.5 (above).

Note that neither of these endangered ecological communities is listed as 'Threatened' under the provisions of the EPBC Act 1999. Given the geology and topography of the study area, it is unlikely that any other threatened ecological communities listed under the TSC Act 1995 and/or EPBC Act 1999 occur within the study area.

While not listed under the provisions of the TSC Act or the EPBC Act, a number of the vegetation communities present within the study area are of regional or local conservation significance. The conservation significance of those vegetation units occurring within the study area are provided below in Table 13.

Table 13 Conservation Status of Vegetation Communities recorded within the study area.

Map Unit	Vegetation Community	Regional Conservation Status - Sydney Basin Bioregion (NP&WS 2003)	
		Woronora, O' Hare's Creek and Metroplitan Catchments (NP&WS 2003)	**Illawarra Escarpment Bioregional Assessment Study (NP&WS 2002)**
1a	Exposed Sandstone Scribbly Gum Woodland (MU29 (NPWS 2003))	Extensive across the Woronora Plateau south from Royal NP. Less than 10% of its extent within the Sydney Basin Bioregion occurs within NPWS estate.	Described as MU30 (NPWS 2002). Probably adequately conserved in either NPWS estate or catchment lands in the Illawarra.
1b	Sandstone Heath-Woodland (MU34 (NPWS 2003)).	Localised community found between Royal NP and O' Hare's Creek catchment. Extent within Sydney Basin Bioregion unknown, but probably adequately conserved within NPWS estate.	This Map Unit is probably included in MU30 of NPWS 2002.
1c	Silvertop Ash Ironstone Woodland (MU33 (NPWS 2003))	Localised community found between Royal NP and O' Hare's Creek catchment. Approximately 2/3rd of its extent within the Sydney Basin Bioregion in NPWS estate (NPWS 2003).	Approximately 25% within conservation reserves, catchment lands or LGA reserves.
2a	Rock Pavement Heath (MU38 (NPWS 2003))	Poorly mapped and described community. Likely to be widespread across sandstone environments of the Bioregion, although few are likely to include *Callitris* spp. as found in the Catchments. Poorly conserved (~5%) within NPWS estate in the Sydney Basin Bioregion.	Described as MU48 (NPWS 2002). Only occurs within catchment lands in this study.
2b	Rock Plate Heath-Mallee (MU39 (NPWS 2003))	Widespread though restricted to small areas of suitable habitat between Morton and Wollemi NPs. Extent within Sydney Basin Bioregion unknown, but probably adequately conserved within NPWS estate.	Described as MU49 (NPWS 2002). Only occurs within catchment lands in this study.
2c	Woronora Tall Mallee-heath (Equiv. MU40 (NPWS 2003))	From O' Hare's Creek to Brisbane Waters NP. Poorly conserved (~5%) within NPWS estate in the Sydney Basin Bioregion.	This Map Unit is probably included in MU49 of NPWS 2002.
3a	Upland Swamp: Banksia Thicket (Equiv. MU42 (NPWS 2003))	Widespread across sandstone plateaux of the Bioregion although most extensive on the Morton and Woronora Plateaux. Generally described as Sandstone Wet Heath Complexes. Between Wollemi and Morton NPs. Adequately conserved within NPWS estate in the Sydney Basin Bioregion.	Described as MU41 – Banksia Thicket. Less than 30% conserved in NPWS estate, catchment lands, State Forest or LGA reserves in the Illawarra region.
3b	Upland Swamp: Tea Tree Thicket (Equiv. MU43 (NPWS 2003))	Widespread across sandstone plateaux of the Bioregion although most extensive on the Morton and Woronora Plateaux. Generally described as Sandstone Wet Heath Complexes. Between Wollemi and Morton NPs. Adequately conserved within NPWS estate in the Sydney Basin Bioregion.	Described as MU40 – Teatree Thicket. Inadequately reserved in the Illawarra – approximately 25% conserved in NPWS estate, catchment lands, State Forest or LGA reserves in the Illawarra region.
3c	Upland Swamp: Sedgeland-heath Complex (Equiv. MU44 (NPWS 2003))	Widespread across sandstone plateaux of the Bioregion although most extensive on the Morton and Woronora Plateaux. Generally described as Sandstone Wet Heath Complexes. Between Wollemi and Morton NPs.	Described as MU42. Less than 40% occurring in NPWS estate, catchment lands, State Forest or LGA reserves in the Illawarra region.

Map Unit	Vegetation Community	Regional Conservation Status - Sydney Basin Bioregion (NP&WS 2003)	
3d	Upland Swamp: Fringing Eucalypt Woodland (Equiv. MU45 (NPWS 2003))	Widespread across sandstone plateaux of the Bioregion although most extensive on the Morton and Woronora Plateaux. Generally described as Sandstone Wet Heath Complexes. Between Wollemi and Morton NPs. Adequately conserved within NPWS estate in the Sydney Basin Bioregion.	Described as MU43. Inadequately reserved in the Illawarra region – less than 15% conserved in NPWS estate, catchment lands, State Forests or LGA reserves.
4a	Sandstone Riparian Scrub (Equiv. MU4 (NPWS 2003))	Widely distributed along narrow sandstone gullies and gorges of the Bioregion. Not well mapped as the community often forms only a narrow riparian ribbon. Approximately 2/3rd of its extent within the Sydney Basin Bioregion in NPWS estate (NPWS 2003).	No equivalent in NPWS 2002.
5a	Tall Blackbutt-Apple Shale Forest (Equiv. MU16 (NPWS 2003); MU20 (NP&WS 2002))	Localised community occurring between Bulli Tops and Royal NP. Not described elsewhere. Adequately conserved within NPWS estate in the Sydney Basin Bioregion. "… *currently estimated to occupy an area of approximately 400 - 4 000 ha* … [indicating] *that the geographic distribution of Southern Sydney sheltered forest on transitional sandstone soils is highly restricted*." (DEC 2006) Listed as an EEC under the Schedules to the TSC Act (as *Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion*).	Described as Map Unit 20 (NP&WS, 2002); "...*appears to extend north into the Royal National Park along the deeper gullies of the Hacking River*..." Less than 15% within conservation reserves (NPWS estate, catchment lands) in the Illawarra. Given its restricted distribution, probably not well conserved.
6a	Sandstone Gully Apple-Peppermint Forest (Equiv. MU25 (NPWS 2003))	South from Georges R to Bulli Tops on the Woronora Plateau. Adequately conserved within NPWS estate in the Sydney Basin Bioregion.	Described as MU28. Approximately 15% occurring within conservation reserves (NPWS estate, catchment lands and LGA reserves), probably inadequately conserved in the Illawarra region.
7a	Introduced (Equiv. MU49A (NPWS 2003))	N/A	N/A
7b	Regenerating Acacia Scrub (Equiv. MU50 (NPWS 2003))	N/A	N/A

4.6 THREATENED PLANT SPECIES

Three threatened flora species were recorded within the proposed longwall mining area during current field surveys; these are Bynoe's Wattle (*Acacia bynoeana*), Thick-leaf Star-hair (*Astrotricha crassifolia*), Prickly Bush-pea (*Pultenaea aristata*). Deane's Paperbark (*Melaleuca deanei*), Prickly Bush-pea (*Pultenaea aristata*) and Bynoe's Wattle (*Acacia bynoeana*) were also recorded within the LW18-19a study area (Bangalay Botanical Surveys 2007) (see Table 14 and Figure 5). It should be noted that each point location mapped in Figure 5 (below) can represent a range of measures of abundance of the threatened species detected[14].

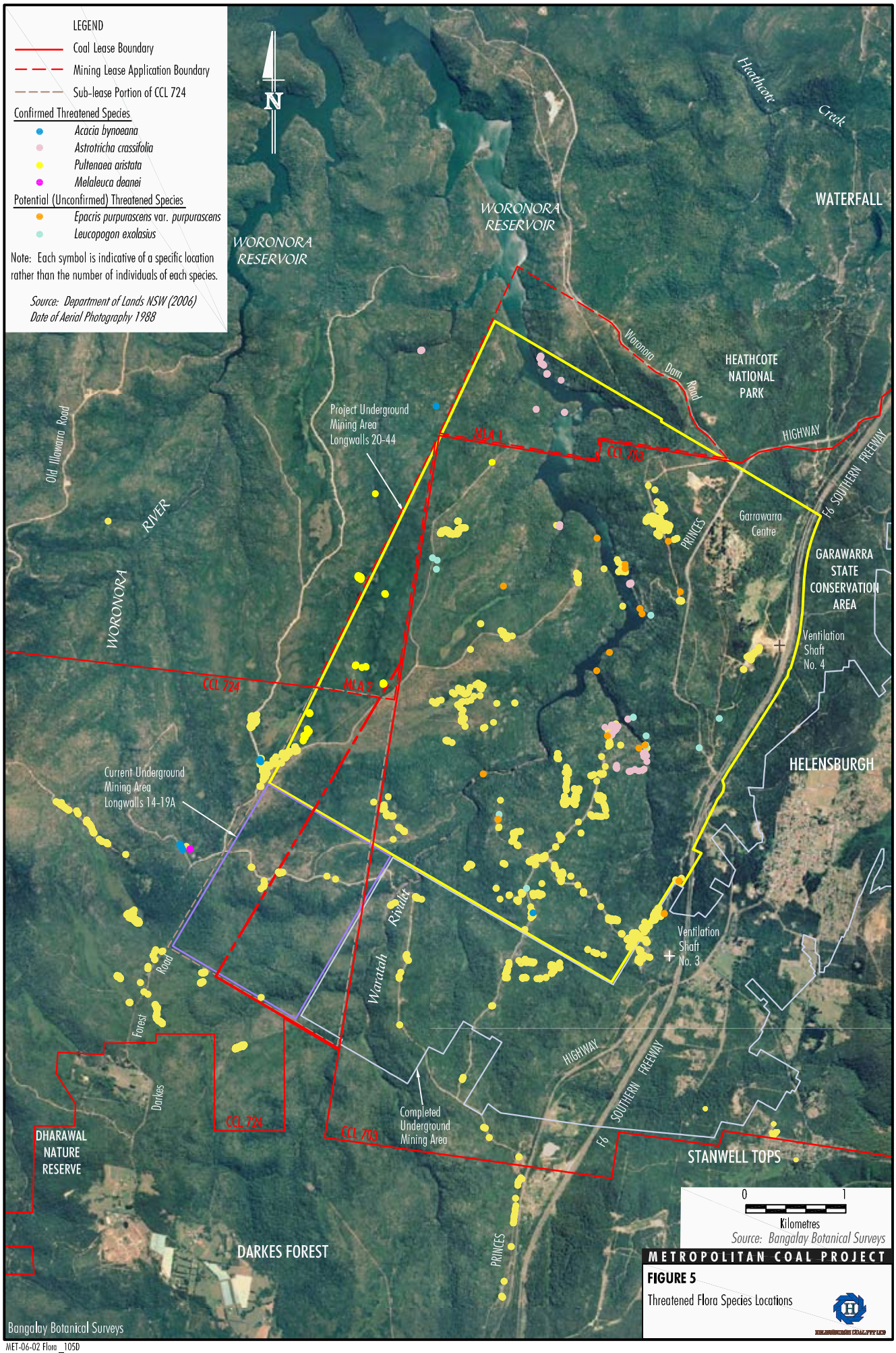
Possible occurrences of a further two threatened species, namely *Leucopogon exolasius* and *Epacris purpurascens var. purpurascens* were recorded, although the identification of these species could not be confirmed (see Appendix E) at the time of writing this report, due to the lack of fertile fruiting or flowering parts required for positive identifications.

Although suitable habitat exists within the study area for a number of other threatened flora species, no other threatened flora species were detected within the study area or adjacent areas during the surveys.

Table 14
Threatened Flora Species Recorded Within the Proposed Longwall Mining Area and during adjacent area searches

Scientific Name	Common Name	Conservation Status		Location Recorded
		TSC Act[15]	EPBC Act[16]	
Confirmed Identifications				
Acacia bynoeana	Bynoe's Wattle	E	V	LW 20-44 20mm draw area; also LW18-19a study area
Astrotricha crassifolia	Thick-leaf Star-hair	V	V	LW 20-44 and associated draw and subsidence area
Pultenaea aristata	Prickly Bush-pea	V	V	LW 20-44 and associated draw and subsidence area; also in LW18-19a study area (recorded as densities/ individual specimens and occasionally as extensive stands), and detected during adjacent areas searches.
Melaleuca deanei	Deane's Paperbark	V	V	LW 18-19a
Potential Identifications - Unconfirmed				
Leucopogon exolasius	-	V	V	LW 20-44
Epacris purpurascens var. purpurascens	-	V	-	LW 20-44

[14] These measures are detailed in a threatened species database available from HCPL on request.
[15] Threatened Species Conservation Act 1995 (E = Endangered, V = Vulnerable)
[16] Environment Protection and Biodiversity Conservation Act 1999 (E = Endangered, V = Vulnerable)



MET-06-02 Flora _105D

Thick-leaf Star-hair

Within the proposed longwall mining area, *Astrotricha crassifolia* (Thick-leaf Star-hair) occurs on benches and slopes in deeper gullies, occasionally extending further upslope where conditions are favourable (Figure 4). Within the proposed longwall mining area, this species occurs within Map Units 1a, 2c, 4a and 6a (Figure 5). Within the longwall and associated draw and subsidence areas, occurrences of this species are represented in the graphics (see Figure 5 above) by a single point location; densities at these points range from individual plants to small clusters; these locations correspond to records in an accompanying database (refer to footnote 14).

Bynoe's Wattle

Within the proposed longwall mining area, *Acacia bynoeana* (Bynoe's Wattle) occurs on broad ridges and plateaux (Figure 4). This species was recorded at within Map Unit 1b; this species also occurs in Map Unit 1r within the LW18-19a study area (Figure 5).

Within the longwall and associated draw and subsidence areas, occurrences of this species are represented in the graphics (see Figure 5 above) by a single point location; records at these points are of individual plants and the locations correspond to records in an accompanying database (refer to footnote 14).

Prickly Bush-pea

Within the study area, *Pultenaea aristata* (Prickly Bush-pea) was recorded at multiple locations, as individuals or within small groups, in the following vegetation communities (Figures 4 and 5):

- Exposed Sandstone Scribbly Gum Woodland (Map Unit 1a);
- Sandstone Heath-Woodland (Map Unit 1b);
- Disturbed and/or Regnerating Sandstone or Lateritic Communities (Map Unit 1r);
- Rock Pavement Heath (Map Unit 2a);
- Rock Plate Heath-Mallee (Map Unit 2b);
- Woronora Tall Mallee Heath (Map Unit 2c);
- Disturbed and/or Regenerating Heath or Mallee Heath (Map Unit 2r);
- Upland Swamp: Sedgeland-heath Complex (Map Unit 3c);
- Upland Swamp: Fringing Eucalypt Woodland (Map Unit 3d);
- Riparian Scrub (Map Unit 4a);
- Sandstone Gully Apple-Peppermint Forest (Map Unit 6a);
- Disturbed and/or Regenerating Sandstone Gully Forest (Map Unit 6r); and
- Disturbed Landscapes (Map Unit 7b).

While this species occurs in a range of vegetation communities, within the study area it is more commonly found in damp sites in heath, and along the fringes of upland swamps. Within the longwall and associated draw and subsidence areas, occurrences of this species are represented in the graphics (see Figure 5 above) by a single point location; densities at these points range from individual plants up to 30 plants in a 2m x 2m ($4m^2$) sample area. Extensive stands are occasionally also represented by a single point location; these locations correspond to records in an accompanying database (refer to footnote 14), (*e.g.* as 'Edge [of distribution] not recorded - extends into adjacent areas of heathland and along woodland margins'). Records in adjacent areas also consist of records of individuals or densities of plants up to 5 plants in a $1m^2$ area.

Deane's Paperbark

Melaleuca deanei (Deane's Paperbark) was recorded at one location within the LW18-19a study area, within Sandstone Heath-Woodland (Map Unit 1b) (Figure 5).

Table 15 lists those threatened flora species which, while targeted during the field surveys (based on the occurrence of potential habitat) were not detected. A description of each species' habitats and known distribution is also provided.

Within the longwall and associated draw and subsidence areas, occurrences of this species are represented in the graphics (see Figure 5 above) by a single point location; records at these points are of individual plants and the locations correspond to records in an accompanying database (refer to footnote 14).

Table 15
Threatened Flora Species Targeted During the Survey (Not Recorded)

Species	Conservation Status		Habitat and Known Distribution
	TSC Act[17]	EPBC Act[18]	
Acacia baueri subsp. *aspera*	V	-	This species inhabits coastal heath and on sandstone plateaus in exposed rocky damp areas. It is known to occur sporadically on the Woronora Plateau (Harden, 1991; DECC, 2007d).
Downy Wattle (*Acacia pubescens*)	V	V	This species is usually found in dry sclerophyll forest and woodland in clay soils (SRBG, 2007b) or on alluviums, shales at the intergrade between shales and sandstone. It is distributed from Bilpin to the Georges River and the Oakdale area, NSW (SRBG, 2007b.).
Deane's Boronia (*Boronia deanei*)	V	V	This species inhabits areas of wet heath, particularly in the margins between open forest and swamps and streams (DECC, 2007d). Scattered populations can be found between the far south-east of NSW and the Blue Mountains (DECC, 2007d).
Caladenia tessellata	E	V	This species mostly inhabits grassy sclerophyll woodland on clay loam or sandy soils (DECC, 2007d). This species is known from the Sydney area, Wyong, Ulladulla and Braidwood in NSW, and Victoria (DECC, 2007d).
Netted Bottle Brush (*Callistemon linearifolius*)	V	-	This species grows in dry sclerophyll forest on the coast and adjacent ranges, chiefly from the Georges River to the Hawkesbury River, NSW (DECC, 2007d). This species is distributed from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW (DECC, 2007d).
Leafless Tongue Orchid (*Cryptostylis hunteriana*)	V	V	This species grows in swamp-heath on sandy soils, mostly in coastal districts (DECC, 2007d). It has been recorded from as far north as Gibraltar Range National Park south into Victoria (*ibid*.). It is known historically from a number of localities on the NSW south coast and has been observed in recent years at many sites between Batemans Bay and Nowra (although it is uncommon at all sites) (DECC, 2007d).
Darwinia biflora	V	V	This species inhabits heath on sandstone or in the understorey of woodland on shale-capped ridges (DECC, 2007d). It occurs in the northern and north-western suburbs of Sydney, in the Ryde, Baulkham Hills, Hornsby and Ku-Ring-Gai LGAs (DECC, 2007d).
Darwinia peduncularis	V	-	This species inhabits dry sclerophyll forest on sandstone hillsides and ridges (DECC, 2007d). This species occurs as local disjunct populations in coastal NSW and Blue Mountains (DECC, 2007d).

17 *Threatened Species Conservation Act 1995* (E = Endangered, V = Vulnerable)
18 *Environment Protection and Biodiversity Conservation Act 1999* (E = Endangered, V = Vulnerable)

Species	Conservation Status		Habitat and Known Distribution
	TSC Act[17]	EPBC Act[18]	
Epacris purpurascens var. *purpurascens*	V	-	This species is found in a variety of habitat types, however most have strong shale soil influences (NPWS, 2002a; DECC, 2007d). It is distributed from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in Southern NSW (DECC, 2007e).
Camfield's Stringybark (*Eucalyptus camfieldii*)	V	V	This species is rare and localised in its distribution, occurring mostly in coastal shrub heath on sandy soils on sandstone (DECC, 2007d). It has a restricted distribution in a narrow band with the most northerly records in the Raymond Terrace Area south to Waterfall.
Genoplesium baueri	V	-	Growing in sparse sclerophyll forest and moss gardens over sandstone, this species is found from the Hunter Valley to Nowra district in NSW (DECC, 2007d).
Narrow-leaf Finger Fern (*Grammitis stenophylla*)	E	-	This species grows on rocks in rainforest and in wet sclerophyll forest (DECC, 2007d). It occurs in eastern Queensland and eastern NSW. In NSW it has been found on the south, central and north coasts and as far west as Mount Kaputar National Park near Narrabrai.
Small-flower Grevillea (*Grevillea parviflora* subsp. *parvifora*)	V	V	This species is found mostly in heath or shrubby woodland, on clay and sandy soils (DECC, 2007d). This species is sporadically distributed throughout the Sydney Basin with the main occurrence centred around Picton, Appin and Bargo.
Haloragis exalata var. *exalata*	V	V	This species inhabits riparian habitats and is distributed in the central coast, south coast and north-western slopes botanical subdivisions of NSW (DECC, 2007d).
Hibbertia puberula	E	-	This species has largely been recorded on sandy soils, often associated with sandstone in coastal areas (DECC, 2007d). It has not been recorded in over 40 years, with early records of this species from the Hawkesbury River area and Frenchs Forest in northern Sydney, South Coogee in eastern Sydney, the Hacking River area in southern Sydney, and the Blue Mountains.
Lasiopetalum joyceae	V	V	This species grows in heath on sandstone. It has a restricted range occurring on lateritic to shaley ridgetops on the Hornsby Plateau south of the Hawkesbury River, NSW (DECC, 2007d).
Woronora Beard-heath (*Leucopogon exolasius*)	V	V	This species inhabits woodland on sandy alluvium and rocky sandstone hillsides near creeks (SRBG, 2007b). It is distributed along the upper Georges River area and in Heathcote National Park (DECC, 2007d).
Persoonia hirsuta subsp. *hirsuta*	E	E	This species has been recorded in the Sydney coastal area, the Blue Mountains and the Southern Highlands of NSW (DECC, 2007d).
Persoonia mollis subsp. *maxima*	E	E	This species occurs in sheltered aspects of deep gullies or on the steep upper hillsides of narrow gullies on Hawkesbury Sandstone. Its distribution is highly restricted, known from the Hornsby Heights–Mt Colah area north of Sydney in the Sydney Basin Bioregion (DECC, 2007d).
Jervis Bay Leek Orchid (*Prasophyllum affine*)	E	E	This species grows on poorly drained clay soils that support low heathland and sedgeland communities (DECC, 2007c). Its distribution is known from three areas on the South Coast (NSW) (DECC, 2007c, 2007d).
Villous Mintbush (*Prostanthera densa*)	V	V	This species inhabits sclerophyll forest and shrubland, on coastal headlands and near-coastal ranges, on sandstone (SRBG, 2007b). It is found from Nelson Bay to Beecroft Peninsula (NSW) (SRBG, 2007b.).

Species	Conservation Status		Habitat and Known Distribution
	TSC Act[17]	EPBC Act[18]	
Pterostylis saxicola	E	E	This species is most commonly found in pockets of shallow soil in depressions on sandstone rock shelves above cliff lines (DECC, 2007d). Its distribution is restricted to western Sydney (DECC, 2007d).
Tetratheca glandulosa	V	V	This species grows in sandy or rocky heath or scrub, from Mangrove Mountain to the Blue Mountains and Sydney (SRBG, 2007b).
Austral Toadflax (*Thesium australe*)	V	V	This species inhabits grassland or grassy woodland, often in association with Kangaroo Grass (*Themeda australis*) (DECC, 2007d). This species is distributed in small scattered populations across eastern NSW and is also found in Tasmania and Queensland and in eastern Asia (DECC, 2007d).

4.7 ROTAP SPECIES

Ten species listed as being of national conservation significance under the *Rare or Threatened Australian Plant* classification (RoTAP: Briggs & Leigh 1996) were recorded within the study area (Appendix D). These are: *Hibbertia nitida, Lissanthe sapida, Darwinia diminuta, Monotoca ledifolia, Darwinia grandiflora, Eucalyptus apiculata, Eucalyptus luehmanniana, Grevillea longifolia, Boronia serrulata* and *Lomandra fluviatilis*.

4.8 OTHER THREATENED FLORA SPECIES FOR WHICH THE SITE MAY CONTAIN HABITAT

The study area provides potential habitat for a number of interim candidate flora species of national (DEH and RoTAP) and state (NP&WS Atlas of NSW Wildlife) conservation significance. The potential for these species is discussed in Table 16 below.

Table 16 Potential habitat for flora species of National (DEH and RoTAP) and State (NP&WS Atlas of NSW Wildlife) conservation significance recorded within a 10km radius of the study area or selected on the basis of available habitats. Source: DEC Threatened Species profiles unless otherwise stated.

Botanical Name	Preferred Habitat	Potential habitat within study area
Acacia baueri subsp. *aspera*	'… *Coastal heath and on sandstone plateaus in exposed rocky and damp areas, north from the Illawarra region…'*(Morrison and Davies *ex.* Harden 1991)	Potential habitat occurs throughout areas of Map Units 2a and 2b and less so in parts of Map Unit 1a. No occurrences detected during current surveys.
Acacia bynoeana	"… *mainly in heath and dry sclerophyll forest on sandy soils* …" (Morrison and Davies *ex.* Harden 1991)	Potential habitat occurs throughout areas of Map Units 2a and 2b and less so in parts of Map Unit 1a and 1c. Detected during current surveys.
Acacia pubescens	Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravelly soils, often with ironstone. Known from Cataract CMA sub-region (DEC species profile). "… *Usually grows in open sclerophyll forest and woodland on clay soils; Bilpin to Georges R area, also recorded at Woodford*…" (Morrison & Davies *ex.* Harden 1992). No known habitat recorded within study area.	Unlikely to occur on subject site: species appears to prefer alluviums, shales and at the intergrade between such geological substrates, whereas the site consists of sandstone and lateritic soils. No occurrences detected during current surveys.

Botanical Name	Preferred Habitat	Potential habitat within study area
Boronia deanei	Grows in wet heath, often at the margins of open forest adjoining swamps or along streams. There are scattered populations of Deane's Boronia between the far south-east of NSW and the Blue Mountains (including the upper Kangaroo River near Carrington Falls, the Endrick River near Nerriga and Nalbaugh Plateau), mainly in conservation reserves (DEC species profile).	Potential habitat occurs throughout areas of Map Units 1a, 1b and 1c, also in parts of Map Unit 3a, 3b, 3c and 3d. No occurrences detected during current surveys.
Caladenia tessellata	"*Swansea south in coastal areas of NSW…favours low open forest with a heathy or sometimes grassy understorey…*" (Bishop, 1999). "*…Grows on clay loam or sandy soils; south from Swansea. CC, SC, ST, Vic.*" (Bernhardt *ex* Harden, 1993)	Potential habitat occurs throughout areas of Map Units 1a and 1c, and 2b and 2c. No occurrences detected during current surveys.
Callistemon linearifolius	"… Grows in dry sclero*phyll forest on the coast and adjacent ranges, cheifly from Georges R. to the Hawkesbury R.* …" (Spencer and Limney *ex.* Harden 1991)	Potential habitat occurs throughout areas of Map Units 1a, 1b and 1c, and to some extent in Map Unit 6a. No occurrences detected during current surveys.
Cryptostylis hunteriana	"*…through NSW as far north as Gibraltar Range* [north coast bioregion] *…generally rare. Favours swamp fringes in Victoria… in NSW it occupies habitats ranging from scrubby swamp fringes to steep bare hillsides in tall eucalypt forest…*" (Bishop, 1999). "*…grows in swamp-heath on sandy soils, chiefly coastal districts…NC CC SC NT, Vic.*" (Weston *ex* Harden, 1993). Bell (2001) notes the species' preference for woodland to open woodland with a "heathy" understorey in the Central Coast area.	Potential habitat occurs throughout areas of Map Units 3a, 3b, 3c and 3d, less so in parts of Map Unit 1a and 1c. No occurrences detected during current surveys.
Darwinia biflora	"… *Grows in heath on sandstone or in the understorey of Woodland on shale capped ridges* …" (Wilson *ex.* Harden 1991)	Potential habitat occurs throughout areas of Map Units 1a, 1b and 1c, and to some extent in Map Units 2b and 2c. No occurrences detected during current surveys.
Darwinia grandiflora	'… *Dry sclerophyll forest and woodland on poorly drained sandy soil…'* (Wilson *ex.* Harden 1991)	Potential habitat occurs throughout areas of Map Units 1a and 1c, and to some extent in Map Units 2b and 2c and possibly Map Units 3c and 3d. Detected during current surveys.
Darwinia peduncularis	"… *Grows in dry sclerophyll forest on sandstone hills and ridges; Hornsby to Hawkesbury R. and west to Glen Davis, rare* …" (Wilson *ex.* Harden 1991)	Potential habitat occurs throughout areas of Map Units 1a and 1c, and to some extent in Map Units 2b and 2c. No occurrences detected during current surveys.
Epacris purpurascens var. *purpurascens*	'…*Sclerophyll forest and scrub and near creeks and swamps on sandstone…'* (Williams and Chapman *ex.* Harden 1992). Large populations exist in protected water supply catchment lands in the vicinity of Picton Road (DEC species profile).	Potential habitat occurs throughout areas of Map Units 1a, 1c, 3a, 3b, 3c, 3d, 5a and 6a. Potential occurrences detected during current surveys, but unable to confirm identification due to lack of fertile material.
Eucalyptus apiculata	"... *Rare and localised, in mallee shrubland on skeletal sandy soil on sandstone* ..." (Hill, 1991)	Potential habitat occurs throughout areas of Map Units 2b and 2c. Detected during current surveys.

Botanical Name	Preferred Habitat	Potential habitat within study area
Eucalyptus camfieldii	"… *Rare and localised, in coastal shrub heath on sandy soils on sandstone, often of restricted drainage* …" (Hill *ex.* Harden 1991)	Potential habitat occurs throughout areas of Map Units 1a and 1c, 2b and 2c, and less so along margins of Map Units 3a, 3b, 3c and 3d. No occurrences detected during current surveys.
Eucalyptus luehmanniana	"... *Rare and localised, in mallee shrubland on skeletal sandy soil on sandstone* ..." (Hill, 1991).	Potential habitat occurs throughout areas of Map Units 1a, 2c, 2b, 2c and possibly margins of 3c and 3d. Detected during current surveys.
Genoplesium baueri	'… *Drier heathy eucalypt forest or moss gardens in sandy soils on sandstone*…' (Bishop, 1999)	Potential habitat occurs throughout areas of Map Units 1a and 1c, and margins of Map Units 2a and 2b. No occurrences detected during current surveys.
Grammitis stenophylla	'…*Rocks in rainforest and wet sclerophyll forest*…' (Wilson *ex.* Harden 1990).	Potential habitat occurs in Map Unit 4a. No occurrences detected during current surveys.
Grevillea parviflora subsp. *parvifolia*	'… *Heath or shrubby woodland in sandy or light clay soils usually over thin shales* (Makinson *ex* Harden 2002). No known habitat recorded within study area.	Potential habitat in Map Units 1a, 1b and 1c. No occurrences detected during current surveys.
Haloragis exalata var. *exalata*	Square Raspwort occurs in 4 widely scattered localities in eastern NSW. It is disjunctly distributed in the central coast, south coast and north-western slopes botanical subdivisions of NSW. Require protected and shaded damp situations in riparian habitats (DEC species profile).	Potential habitat occurs in Map Units 4a and 6a. No occurrences detected during current surveys.
Hibbertia puberula	Occurs on sandy soil often associated with sandstone. Associated with Dry sclerophyll forests (shrubby sub-formation) in sub-regions of the Hawkesbury/Nepean CMA (DEC species profile). No known habitat recorded within study area.	Potential habitat occurs in Map Units 1a and 1c. amd 6a No occurrences detected during current surveys.
Lasiopetalum joyceae	"… *Grows in heath on sandstone; Hornsby Plateau* …" (Harden *ex.* Harden 1990)	Potential habitat occurs in Map Units 1a, 1c, 2a, 2b and 2c. No occurrences detected during current surveys.
Lissanthe sapida	"... *Grows in open woodland and dry sclerophyll forest on rocky sandstone ridges and hillsides on sandy soil* ..." (Powell, 1992)	Potential habitat occurs in Map Units 1a, 1c, 2a, 2b and 2c. No occurrences detected during current surveys.
Melaleuca deanei	"… *Grows in wet heath on sandstone; uncommon, coastal districts from Berowra to Nowra* …" (Wilson *ex.* Harden 1991)	Potential habitat occurs in Map Units 1a, 1c, 3a, 3b, 3c and 3d. No occurrences detected during current surveys. Recorded at one location within the LW18-19a study area in Map Unit 1b.
Monotoca ledifolia	Grows in exposed sites in dry sclerophyll forest and shrubland on sandstone in the Woronora Plateau and Blue Mtns area (PlantNet). Recorded during previous surveys (NPWS, 2003) within the study area.	Potential habitat occurs in Map Units 1a, 1c, 2a, 2b and 2c. No occurrences detected during current surveys.
Persoonia hirsuta subsp. hirsuta	"… *Grows in woodland to dry sclerophyll forest on sandstone; both subspecies occurring as isolated individuals or very small populations* …" (Weston *ex.* Harden 1991)	Potential habitat occurs in Map Units 1a, 1c and 6a. No occurrences detected during current surveys.

Botanical Name	Preferred Habitat	Potential habitat within study area
Persoonia mollis subsp. maxima	"… *In dry to wet sclerophyll forest on Hawkesbury Sandstone* …" (Weston *ex.* Harden 1991)	Potential habitat occurs in Map Units 1a, 1c, 3d and 6a. No occurrences detected during current surveys.
Prasophyllum affine	Grows on poorly drained clay soils that support low heathland and sedgeland communities. Jervis Bay Leek Orchid is currently known from three areas south-east of Nowra on South Coast. These are Kinghorne Point, Wowly Gully near the town of Callala Bay, and near the township of Vincentia.(DEC Species Profile).	Unlikely to occur on subject site: species appears to prefer poorly drained shales and is known from a restricted range of sites at lower elevation than provided at the site. No occurrences detected during current surveys.
Prostanthera densa	Recorded from the Currarong area in Jervis Bay, Royal National Park, Cronulla and Port Stephens (Gan Gan Hill, Nelson Bay). The Sydney and Royal NP populations have not been seen in recent times. Generally found on sandstone in sclerophyll forest and shrubland on coastal headlands (DEC Species Profile)	Potential habitat occurs in Map Units 1a and 1c and possibly 2a, 2b and 2c. No occurrences detected during current surveys.
Pterostylis saxicola	Away from coast, flat areas, either on top of stoney ridges or on mossy rocks in gullies "... *A narrow endemic restricted to the Central Coast of New South Wales where distributed between Picnic Point and Picton*... " (Jones *ex.* Orchadian 1997)	Potential habitat occurs in Map Units 1a, 2a, 2b, 2c, and 3d. No occurrences detected during current surveys.
Tetratheca glandulosa	"… *Grows in sandy or rocky heath or scrub* …" (Gardner and Murray *ex.* Harden 1992)	Potential habitat occurs in Map Units 1a, 2a, 2b, 2c, and 3d. No occurrences detected during current surveys.
Tetratheca neglecta	"... *Grows in sandy heath or dry sclerophyll forest* ..." (Gardner & Murray, 1992)	Potential habitat occurs in Map Units 1a, 2a, 2b, 2c, and 3d. No occurrences detected during current surveys.
Thesium australe	"…*grows in grassland or woodland, often in damp sites; widespread but rare and possibly endangered. NC CC NT ST NWS CWS; Qld, Vic, Tas, E Asia.*" (Wiecek *ex* Harden 1992).	Potential habitat occurs throughout areas of Map Units 1a and 3d. No occurrences detected during current surveys.

4.9 ENDANGERED POPULATIONS

The study area provides potential habitat for a number of endangered populations of state (Part 2 of Schedule 1 of the TSC Act) conservation significance. While no occurrences of any Endangered Populations were detected during field surveys within the study area, potential habitat for these species is discussed in Table 17 below.

Table 17 Potential habitat for Endangered Populations (NP&WS Atlas of NSW Wildlife) recorded within 10km of the project site. Source: DEC Threatened Species profiles unless otherwise stated.

Botanical Name	Habitat Type	Potential
Callitris endlicheri	Throughout its range, the species is usually found on stony hills or ridges, common, from the plains to the coastal ranges. The Woronora Plateau population is restricted to a single outcrop of sandstone c. 2 ha in area. The soil at this site is skeletal sandy loam and the heathlands on sandstone outcrops in the area are restricted and highly distinctive.	Potential habitat occurs in Map Units 1a, 2a, 2b and 2c. No occurrences detected during current surveys.

4.10 SEPP 44 – KOALA HABITAT PROTECTION

State Environmental Planning Policy No. 44 (SEPP 44) requires that development applications be assessed for potential and/or core koala habitat. Wollongong City Council and Wollondilly Shire Council are listed in Schedule 1 (LGAs) of the SEPP which determines LGAs regarded as containing potential habitat for koala populations.

One of the parameters which determine the likelihood of potential koala habitat is the presence of certain species of trees which are known to be sources of food and/or shelter, as listed under Schedule 2 of SEPP 44. SEPP 44 states that "potential koala habitat *means areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component*." Of the species listed under Schedule 2 of the SEPP, Broad-leaved Scribbly Gum *Eucalyptus haemastoma* was recorded as a dominant component of Map Units 1a, 1b, 1c, 1r, and an occasional component of Map Units 2b, 2c, 3a and 3d. Scribbly Gum occupies a very common component of Map Units 1a, 1b, 1c and 1r (approximately 30-80%). In the equivalent Map Unit (29), NPWS (2003) identify the presence of *Eucalyptus sclerophylla, E. racemosa* and *E. haemastoma* and hybrids between them, and although the former was not detected during current surveys, it is likely that hybrids between the latter two species are likely to be present. Estimates of *Eucalyptus haemastoma* are therefore broad, constituting between 30-80% of the canopy composition of the drier ridgetop communities.

Based on the above, the study area represents potential koala habitat.

5 CONCLUSIONS AND SUMMARY

- Seasonal field surveys were conducted during spring 2006, summer 2006/2007, autumn 2007 and spring/summer 2007/2008 over 41 days (equivalent to 704 person hours).
- Field investigations involved the application of general traverses throughout the site, according to the methods described in York et al. (1991). Specific searches for plant species of conservation significance known from the locality were conducted in areas of potential or suitable habitat, according to the methods set out in Cropper (1993).
- The design of all stages of the surveys (including the preliminary assessments, data and background information collection, general and threatened species field surveys and sampling techniques) accord with the requirements set out in the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft* (DEC, 2004).
- Within the study area, the vegetation has been classified into nineteen map units. Three threatened flora species have been recorded within the study area, namely Prickly Bush-pea (*Pultenaea aristata*), Bynoe's Wattle (*Acacia bynoeana*) and Thick-leaf Star-hair (*Astrotricha crassifolia*); Deane's Paperbark (*Melaleuca deanei*) has been recorded within the Longwalls 18-19a study area. Several specimens of *Leucopogon* species and *Epacris* species collected during field surveys have been identified potentially as *Leucopogon exolasius* and *Epacris purpurascens* var. *purpurascens*, though fertile material, required for their confirmation was not available during the surveys.
- One endangered ecological community ('Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion') was recorded in the study area. Additionally, 'O'Hares Creek Shale Forest' endangered ecological community occurs to the south in the vicinity of Longwalls 18-19A.

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7 ABBREVIATIONS

CMA	Catchment Management Authority
DEC	Department of Environment and Conservation (now DECC)
DECC	Department of Environment and Climate Change
DEH	Department of Environment and Heritage
DEWHA	Department of the Environment, Water, Heritage and the Arts
EEC	Endangered Ecological Community (TSC Act 1995)
EP&A Act	*Environmental Planning and Assessment Act, 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*
FPC	foliage protection cover
GIS	Geographic Information System
ha	hectare
IBRA	*Interim Biogeographic Regionalisation for Australia*
IROC	Illawarra Region of Councils
km	kilometre
km^2	square kilometre
LGA	local government area
m	metre
mm	millimetre
NCC	Nature Conservation Centre
NP	National park
NPWS	NSW National Parks and Wildlife Service (now DECC)
NSW	New South Wales
RVMP	Regional Vegetation Management Plan
SASPoM	*Special Areas Strategic Plan of Management*
SCA	Sydney Catchment Authority
SEPP	State Environmental Planning Policy
SMP	Subsidence Management Plan
SRBG	Sydney Royal Botanical Garden
TSC Act	NSW *Threatened Species Conservation Act, 1995*
WCC	Wollongong City Council

APPENDIX A

RESULTS OF DATABASE REVIEW FOR THREATENED FLORA SPECIES

Table A1
Results of Database Review for Threatened Flora Species

Scientific Name	Common Name	Conservation Status		DECC List		EPBC Act Protected Matters Search[5]	Species Records			Considered to Potentially Occur in the Study Area
		TSC Act[1]	EPBC Act[2]	Illawarra sub-region[3]	Sydney Cataract sub-region[4]		SRBG[6]	NPWS Atlas of NSW Wildlife[7]	Bangalay Botanical Surveys (2007)[8]	
Acacia baueri subsp. *aspera*	-	V	-	•	•	-	•	•	-	✓
Acacia bynoeana	Bynoe's Wattle	E	V	-	•	•	•	•	•	✓
Acacia pubescens	Downy Wattle	V	V	-	•	•	•	•	-	✓
Acacia terminalis subsp. *terminalis*	Sunshine Wattle	E	E	-	-	-	-	•	-	✗
Allocasuarina defungens	Dwarf Heath Casuarina	E	E	-	-	-	•	-	-	✓
Allocasuarina glareicola	-	E	E	-	•	-	-	-	-	✗
Amperea xiphoclada var. *pedicellata*	-	E	EXT	-	-	-	-	•	-	✗
Arthropteris palisotii	Lesser Creeping Fern	E	-	•	-	-	-	-	-	✗
Astrotricha crassifolia	Thick-leaf Star-hair	V	V	-	•	•	•	-	-	✓
Bertya ingramii	Narrow-leaved Bertya	E	E	-	-	-	•	-	-	✓
Boronia deanei	Deane's Boronia	V	V	-	-	-	•	-	-	✓
Caesia parviflora var. *minor*	Small Pale Grass-lily	E	-	-	•	-	-	-	-	✗
Caladenia tessellata	Tesselated Spider Orchid	E	V	-	•	•	•	•	-	✓
Callistemon linearifolius	Netted Bottle Brush	V	-	•	•	-	•	•	-	✓
Chamaesyce psammogeton	Sand Spurge	E	-	•	-	-	•	-	-	✓
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	•	-	•	-	-	-	✓
Cynanchum elegans	White-flowered Wax Plant	E	E	•	-	•	-	•	-	✓
Daphnandra sp. *C Illawarra*	Illawarra Socketwood	E	E	•	-	•	-	•	-	✓
Darwinia biflora	-	V	V	-	-	-	•	•	-	✓

Scientific Name	Common Name	Conservation Status		DECC List		EPBC Act Protected Matters Search[5]	Species Records			Considered to Potentially Occur in the Study Area
		TSC Act[1]	EPBC Act[2]	Illawarra sub-region[3]	Sydney Cataract sub-region[4]		SRBG[6]	NPWS Atlas of NSW Wildlife[7]	Bangalay Botanical Surveys (2007)[8]	
Darwinia peduncularis	-	V	-	-	-	-	-	•	-	✓
Distichlis distichophylla	Australian Salt Grass	E	-	•	-	-	-	-	-	×
Diuris aequalis	Doubletail Buttercup	E	V	-	•	-	-	•	-	×
Epacris purpurascens var. *purpurascens*	-	V	-	-	•	-	-	•	-	✓
Eucalyptus benthamii	Camden White Gum	V	V	-	-	•	-	•	-	✓
Eucalyptus camfieldii	Camfield's Stringybark	V	V	-	•	•	•	•	-	✓
Eucalyptus canobolensis	Silver-Leaf Candlebark	V	V	-	-	-	•	-	-	✓
Eucalyptus langleyi	Albatross Mallee	V	V	•	-	-	-	-	-	×
Eucalyptus macarthurii	Camden Woollybutt	V	-	-	-	-	-	•	-	✓
Eucalyptus saxicola?	Mt Canobolas Box	E	-	-	-	-	•	-	-	✓
Eucalyptus scoparia	Wallangarra White Gum	E	V	-	-	-	-	•	-	×
Genoplesium baueri	Bauer's Midge Orchid	V	-	•	•	-	•	•	-	✓
Grammitis stenophylla	Narrow-leaf Finger Fern	E	-	-	-	-	-	•	-	✓
Grevillea parviflora subsp. *parvifolia*	Small-flower Grevillea	V	V	-	•	•	•	•	-	✓
Gyrostemon thesioides	-	E	-	-	-	-	•	•	-	✓
Haloragis exalata subsp. *exalata*	Square Raspwort	V	V	•	-	-	•	•	-	✓
Hibbertia puberula	-	E	-	-	•	-	•	-	-	✓
Homoranthus darwinioides	-	V	V	-	-	-	•	-	-	✓
Hygrocybe anomala var. *ianthinomarginata*	-	V	-	-	•	-	-	-	-	×

Scientific Name	Common Name	Conservation Status		DECC List		EPBC Act Protected Matters Search[5]	Species Records			Considered to Potentially Occur in the Study Area
		TSC Act[1]	EPBC Act[2]	Illawarra sub-region[3]	Sydney Cataract sub-region[4]		SRBG[6]	NPWS Atlas of NSW Wildlife[7]	Bangalay Botanical Surveys (2007)[8]	
Irenepharsus trypherus	Illawarra Irene	E	E	•	-	-	-	-	-	✓
Isopogon fletcheri	Fletcher's Drumsticks	V	V	-	-	-	•	-	-	✓
Lasiopetalum joyceae	-	V	V	-	-	-	-	•	-	✓
Leionema ralstonii	Ralston's Leionema	V	V	-	-	-	•	-	-	✓
Leucopogon exolasius	Woronora Beard-heath	V	V	-	•	•	•	•	-	✓
Maundia triglochinoides	-	V	-	-	•	-	•	-	-	✓
Melaleuca deanei	Deane's Paperbark	V	V	-	•	•	•	•	•	✓
Persoonia bargoensis	Bargo Geebung	E	V	-	•	•	-	•	-	✓
Persoonia glaucescens	Mittagong Geebung	E	V	-	-	-	-	•	-	✓
Persoonia hirsuta	Hairy Geebung	E	E	-	•	-	-	•	-	✗
Persoonia hirsuta subsp. *hirsuta*	-	E	E	-	-	-	•	•	-	✓
Persoonia hirsuta subsp. evoluta	-	E	E	-	-	-	•	•	-	✓
Persoonia mollis subsp. *maxima*	-	E	E	-	-	-	-	•	-	✓
Persoonia nutans	Nodding Geebung	E	E	-	•	•	•	•	-	✓
Pimelea spicata	Spiked Rice-flower	E	E	•	-	•	•	•	-	✓
Pomaderris adnata	Sublime Point Pomaderris	E	-	•	-	-	•	•	-	✓
Pomaderris brunnea	Brown Pomaderris	V	V	-	-	•	•	•	-	✓
Prostanthera densa	Villous Mintbush	V	V	-	•	•	•	-	-	✓
Prostanthera marifolia	-	E	Ext	-	-	-	•	-	-	✓
Pterostylis gibbosa	Illawarra Greenhood	E	E	•	-	-	-	-	-	✓
Pterostylis pulchella	Waterfall Greenhood	V	V	•	-	-	-	-	-	✗

Scientific Name	Common Name	Conservation Status		DECC List		EPBC Act Protected Matters Search[5]	Species Records			Considered to Potentially Occur in the Study Area
		TSC Act[1]	EPBC Act[2]	Illawarra sub-region[3]	Sydney Cataract sub-region[4]		SRBG[6]	NPWS Atlas of NSW Wildlife[7]	Bangalay Botanical Surveys (2007)[8]	
Pterostylis saxicola	Sydney Plains Greenhood	E	E	-	•	•	•	•	-	✓
Pterostylis sp. *Botany Bay*	Botany Bay Bearded Orchid	E	E	-	-	-	-	•	-	×
Pultenaea aristata	Prickly Bush-pea	V	V	•	•	•	•	•	•	✓
Pultenaea pedunculata	Matted Bush-pea	E	-	-	-	-	•	•	-	✓
Senecio spathulatus	Coast Groundsel	E	-	-	-	-	•	-	-	✓
Senna acclinis	Rainforest Cassia	E	-	•	-	-	•	-	-	×
Solanum celatum	-	E	-	•	-	-	-	•	-	✓
Syzygium paniculatum	Magenta Lilly Pilly	V	V	•	•	•	•	•	-	×
Tetratheca glandulosa	-	V	V	-	-	-	-	•	-	✓
Tetratheca juncea	Black-eyed Susan	V	V	-	-	-	-	•	-	×
Thesium australe	Austral Toadflax	V	V	-	-	•	-	•	-	✓
Triplarina nowraensis	Nowra Heath Myrtle	E	E	•	-	-	-	-	-	×
Wilsonia backhousei	Narrow-leafed Wilsonia	V	-	•	•	-	-	-	-	×
Wilsonia rotundifolia	Round-leafed Wilsonia	E	-	•	•	-	•	-	-	✓
Zieria baeuerlenii	Bomaderry Zieria	E	E	•	-	-	-	-	-	×
Zieria buxijugum	Box Range Ziera	E	E	-	-	-	•	-	-	✓
Zieria formosa	Shapely Zieria	E	E	-	-	-	•	-	-	✓
Zieria granulata	Illawarra Zieria	E	E	•	-	-	-	•	-	✓
Zieria parrisiae	Parris' Zieria	E	E	-	-	-	•	-	-	✓
Zieria tuberculata	Warty Zieria	V	V	-	-	-	•	-	-	✓

[1] V Vulnerable; E Endangered; EXT Presumed Extinct
[2] V Vulnerable; E Endangered; EXT Listed as Extinct
[3] Department of Environment and Climate Change (DECC) (2007) *List of Threatened Species Known or Predicted to Occur in the Illawarra CMA Sub-region.* Date Accessed: 16 August 2007.
[4] Department of Environment and Climate Change (DECC) (2007) *List of Threatened Species Known or Predicted to Occur in the Sydney Cataract CMA Sub-region.* Date Accessed: 13 August 2007.
[5] Department of Environment and Water Resources (DEWR) (2007) *EPBC Act Protected Matters Search*. Search for co-ordinates: -34º 00' 00", -34º 23' 00", 150º 45', 151º 10'.
[6] Sydney Royal Botanic Gardens (SRBG) (2007) Database records within the following search area -34º 00' 00", -34º 23' 00", 150º 45', 151º 10'. Data received August 2007.
[7] National Parks and Wildlife Service (NPWS) (2007) *Threatened Species – DECC Atlas of NSW Wildlife*. *Database records for the Wollongong and Port Hacking 1:100,000 map sheets.* Data received August 2007.
[8] Bangalay Botanical Surveys (2007) *Metropolitan Colliery Longwalls 18, 19 and 19A Flora Survey and Assessment*. Report prepared for Helensburgh Coal Pty Ltd.

APPENDIX B

RESULTS OF DATABASE REVIEW FOR ENDANGERED POPULATIONS

Table B1
Results of Database Review for Endangered Populations

Endangered Population	Flora Species	DECC List	
		Illawarra sub-region[19]	Sydney Cataract sub-region [20]
Acacia prominens (Gosford Wattle) population in the Hurstville and Kogarah LGAs	Gosford Wattle (*Acacia prominens*)	-	•
Callitris endlicheri population at Woronora Plateau	Black Cypress (*Callitris endlicheri*)	-	•
Chorizema parviflorum Benth. (a shrub) population in the Wollongong and Shellharbour LGAs	*Chorizema parviflorum*	•	-
Lespedeza juncea subsp. *sericea* population in the Wollongong LGA	*Lespedeza juncea* subsp. *sericea*	•	-

[19] Department of Environment and Climate Change (DECC) (2007) *List of Threatened Species Known or Predicted to Occur in the Illawarra CMA Sub-region.* Date Accessed: 16 August 2007.

[20] Department of Environment and Climate Change (DECC) (2007) *List of Threatened Species Known or Predicted to Occur in the Sydney Cataract CMA Sub-region.* Date Accessed: 13 August 2007.

APPENDIX C

RESULTS OF DATABASE REVIEW FOR THREATENED ECOLOGICAL COMMUNITIES

Table C1
Results of Database Review for Threatened Ecological Communities

Threatened Ecological Community	Conservation Status		DECC List		EPBC Act Protected Matters Search[3]	SCA and NPWS (2003)	Considered to Potentially Occur in the Study Area
	TSC Act[1]	EPBC Act[2]	Illawarra sub-region	Sydney Cataract sub-region			
Blue Gum High Forest of the Sydney Basin Bioregion	CE	CE	-	•	-	-	×
Castlereagh Swamp Woodland Community	E	-	-	•	-	-	×
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions	E	-	•	•	-	-	×
Cumberland Plain Woodland	E	E	-	•	•	-	×
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	E	-	•	•	-	-	×
Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion	E	-	•	-	-	-	×
Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	E	-	•	-	-	-	×
Kurnell Dune Forest in the Sutherland Shire and City of Rockdale	E	-	-	•	-	-	×
Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions	E	-	•	•	-	-	×
Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion	E	-	•	-	-	-	×
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions	E	-	•	-	-	-	×
O'Hares Creek Shale Forest	E	-	-	-	-	•	✓
River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	E	-	•	•	-	-	×

Table C1 (Continued)
Results of Database Review for Threatened Ecological Communities

Threatened Ecological Community	Conservation Status		DECC List		EPBC Act Protected Matters Search[5]	SCA and NPWS (2003)[6]	Considered to Potentially Occur in the Study Area
	TSC Act[1]	EPBC Act[2]	Illawarra sub-region[3]	Sydney Cataract sub-region[4]			
Robertson Basalt Tall Open-forest in the Sydney Basin Bioregion	E	-	•	-	-	-	×
Robertson Rainforest in the Sydney Basin Bioregion	E	-	•	-	-	-	×
Shale Gravel Transition Forest in the Sydney Basin Bioregion	E	-	-	•	-	-	×
Shale/Sandstone Transition Forest	E	E	-	•	•	-	×
Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion	E	-	No data	No data	-	-	✓
Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	E	-	•	•	-	-	×
Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	E	-	•	•	-	-	×
Sydney Freshwater Wetlands in the Sydney Basin Bioregion	E	-	-	•	-	-	×
Sydney Turpentine-Ironbark Forest	E	CE	-	•	•	-	×

1 E Endangered
2 E Endangered CE Critically Endangered
3 Department of Environment and Climate Change (DECC) (2007) *List of Threatened Species Known or Predicted to Occur in the Illawarra CMA Sub-region.* Date Accessed: 16 August 2007.
4 Department of Environment and Climate Change (DECC) (2007) *List of Threatened Species Known or Predicted to Occur in the Sydney Cataract CMA Sub-region.* Date Accessed: 13 August 2007.
5 Department of Environment and Water Resources (DEWR) (2007) *EPBC Act Protected Matters Search*. Search for co-ordinates: -34º 00' 00", -34º 23' 00", 150º 45', 151º 10'.
6 Sydney Catchment Authority (SCA) and National Parks and Wildlife Service (NPWS) (2003) *Native Vegetation of the Woronora, O'Hares and Metropolitan Catchments*.

APPENDIX D

VASCULAR PLANT SPECIES RECORDED WITHIN THE STUDY AREA

Metropolitan Coal Project Baseline Flora Survey - Proposed Longwall Mining Area

Appendix D: Species List
March 2008

APPENDIX D: Vascular plant species recorded at the subject site

KEY to Status and Abundance	
Plant species of state conservation significance	
Threatened Plant species listed under the NSW *Threatened Species Conservation Act* 1995 (defined in the TSC Act 1995)	
Vs	Vulnerable. Refers to fauna and flora species that are likely to become endangered unless the circumstances & factors threatening its survival or evolutionary development cease to operate (Schedule 2, TSC Act 1995).
E1s	Endangered. Refers to fauna and flora species that are likely to become extinct in nature in NSW unless the circumstances and factors threatening its survival or evolutionary developments cease to operate; or, its numbers have been reduced to such a critical level, or its habitats have been so drastically reduced, that it is in immediate danger of extinction; or, it might already be extinct, but it is not presumed extinct (Schedule 1, Part 1, TSC Act 1995).
E2s	Endangered Population. Refers to a population where, in the opinion of the Scientific Committee, its numbers have been reduced to such a critical level, or its habitat has been so drastically reduced, that it is in immediate danger of extinction and it is not a population of a species already listed in Schedule 1, and: (a) it is disjunct and at or near the limit of its geographic range, or (b) it is or is likely to be genetically distinct, or (c) it is otherwise of significant conservation value. (Schedule 1, Part 2, TSC Act 1995).
Species protected under Schedule 13 of the *National Parks and Wildlife Act* 1974	
S13	Protected Species under the National Parks and Wildlife Act 1974
Plant species of national conservation significance	
Flora species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (as defined in s.179 of the EPBC Act 1999 - Categories of threatened species)	
V_n	Vulnerable
E_n	Endangered
R/----	Rare or Threatened Australian Plants - RoTAP (Briggs and Leigh 1996)
Introduced Species	
*	Introduced (Exotic) Species
**	Native species - introduced and although close to natural range (coastal) have become highly opportunistic in disturbed environments
H	Horticulturally introduced species
Regionally Rare Species	
Reg-L/R	Localised and rare (Wardell-Johnson *et al.* 1997)
Reg-Si	Occurring in less than 10 urban locations but inadequately reserved in a regional National Park (Sutherland Shire Council, 2000)
Reg-Sa	Occurring in less than 10 urban locations but adequately reserved in a regional National Park (Sutherland Shire Council, 2000)
Occurrence	
•	Recorded
X	Tentative identification (RBG) – no fertile material for positive identification available at time of survey

Group	Map Unit	SCA MU	Type	Stratified Unit
Sandstone Ridgetop Woodlands	1a	29	Exposed Sandstone Scribbly Gum Woodland	2
	1b	34	Sandstone Heath-Woodland	2
	1c	33	Silvertop Ash Ironstone Woodland	7
	1r	-	Disturbed and/or Regenerating Sandstone or Lateritic Communities	2/7
Mallees, Heaths and Scrubs	2a	38	Rock Pavement Heath	3
	2b	39	Rock Plate Heath-Mallee	3
	2c	40	Woronora Tall Mallee-heath	3
	2r	-	Disturbed and/or Regenerating Heath, Mallee Heath	3
Upland Swamp Variants	3a	42	Upland Swamp: Banksia Thicket	4
	3b	43	Upland Swamp: Tea Tree Thicket	4
	3c	44	Upland Swamp: Sedgeland-heath Complex	4
	3d	45	Upland Swamp: Fringing Eucalypt Woodland	4
Rainforest	4a	4	Sandstone Riparian Scrub	5
Tall Open Forests	5a	16	Tall Blackbutt-Apple Shale Forest	1
Sandstone Gully Forests	6a	25	SS Gully Apple-Peppermint Forest	6
	6r	-	Disturbed and/or Regenerating Gully Forest	6
Other	7a	49A	Acacia Scrub	8
	7b	50	Introduced/Cleared and disturbed	8
	8a	53	Water (fringing vegetation)	8

STATUS	SCIENTIFIC NAME	COMMON NAME	ABUNDANCE																	
			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
PSILOPSIDA (Fork Ferns)																					
	Psilotaceae																				
	Psilotum nudum	Skeleton Fork Fern	•												•		•				
LYCOPSIDA (Club Mosses)																					
	Lycopodiaceae																				
S13	*Lycopodium cernuum*	Scrambling Clubmoss									•	•	•								
S13	*Lycopodium deuterodensum*	Bushy Clubmoss															•	•			
	Selaginellaceae																				
	Selaginella uliginosa	-	•			•		•	•	•	•	•	•	•	•		•	•	•	•	
FILICOPSIDA (Ferns)																					
	Adiantaceae																				
S13	*Adiantum aethiopicum*	Maidenhair Fern													•	•	•	•			
S13	*Adiantum formosum*	Giant Maidenhair Fern													•						
	Aspleniaceae																				
S13	*Asplenium flabellifolium*	Necklace Fern													•		•				
	Blechnaceae																				
	Blechnum cartilagineum	Gristle Fern													•	•	•	•			
Reg/Sa	*Blechnum indicum*	Swamp Water Fern									•	•	•		•						
	Blechnum nudum	Fishbone Water Fern													•		•				
	Blechnum wattsii	Hard Water Fern													•		•	•			
	Doodia aspera	Rasp Fern													•	•	•				
	Davalliaceae																	•			
S13	*Calochlaena dubia*	Common Ground Fern													•	•	•	•	•		
	Dennstaedtiaceae																				
	Histiopteris incisa	Bat's Wing Fern									•	•			•	•	•				
S13	*Pteridium esculentum*	Bracken	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	•	
	Dryopteridaceae																				

STATUS	SCIENTIFIC NAME	COMMON NAME	ABUNDANCE																	
			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
	Lastreopsis decomposita	Trim Shield Fern													•	•					
	Polystichum australiense	Shield Fern														•	•				
	Gleicheniaceae																				
S13	*Gleichenia dicarpa*	Pouched Coral Fern	•	•		•					•	•	•	•	•		•	•	•		
	Gleichenia microphylla	Coral Fern									•	•			•		•				
S13	*Sticherus flabellatus*	Umbrella Fern													•		•	•			
	Hymenophyllaceae																				
	Hymenophyllum cupressiforme	Common Filmy Fern													•						
	Lindsaeaceae																				
	Lindsaea linearis	Screw Fern	•	•	•	•	•	•	•	•	•	•	•	•			•	•	•	•	
	Lindsaea microphylla	Lacy Wedge Fern												•	•	•	•				
	Osmundaceae																				
S13	*Todea barbara*	King Fern													•		•				
	Schizaeaceae																				
	Schizaea bifida	Fork Fern	•	•	•									•		•	•				
	Sinopteridaceae																				
	Cheilanthes distans	Bristly Cloak Fern	•					•	•	•					•						
	Cheilanthes sieberi	Mulga Fern		•	•	•	•						•			•	•	•	•	•	
	Pellaea falcata var. *falcata*	Sickle Fern													•	•	•				
CONIFEROPSIDA: Conifers																					
	Cupressaceae																				
	Callitris sp.	-	•																•	•	
	Pinaceae																				
*	*Pinus radiata*	Monterey Pine																	•	•	
MAGNOLIOPSIDA: Magnoliidae																					
	Acanthaceae																				
	Brunoniella australis	Bugle Flower			•											•	•	•			
	Pseuderanthemum variabile	Pastel Flower														•	•				
	Amaranthaceae																				

STATUS	SCIENTIFIC NAME	COMMON NAME	ABUNDANCE																	
			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
	Alternanthera denticulata	-									•	•	•		•						•
	Apiaceae																				
S13	*Actinotus helianthi*	Flannel Flower	•	•	•	•	•		•	•			•	•	•		•	•			
	Actinotus minor	Lesser Flannel Flower	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•			
	Centella asiatica	Swamp Pennywort				•					•	•	•	•	•	•	•	•	•	•	
*	*Ciclospermum leptophyllum*	Slender Celery				•												•	•	•	
*	*Hydrocotyle bonariensis*	Kurnell Curse				•												•	•	•	
	Hydrocotyle laxiflora	-													•	•	•	•		•	
	Hydrocotyle peduncularis	-		•	•	•				•	•	•	•	•	•	•	•	•	•	•	
	Platysace ericoides	-	•	•	•	•	•	•	•	•				•			•	•			
	Platysace lanceolata	-	•	•	•	•	•	•	•	•			•	•	•		•	•			
	Platysace linearifolia	Carrot Tops	•	•	•	•	•	•	•	•			•	•	•	•	•	•			
	Xanthosia pilosa forma A	Hairy Xanthosia	•	•	•	•	•	•	•	•			•	•	•	•	•	•			
	Xanthosia tridentata	-	•	•	•		•	•	•	•	•		•	•	•	•	•	•			
	Apocynaceae																				
*	*Araujia sericiflora*	Moth Vine																•	•	•	
*	*Asclepias curavassica*	Blood Root																	•		
*	*Gomphocarpus fruticosus*	Eastern Cottonbush				•													•	•	
	Marsdenia rostrata	Common Milk Vine													•	•	•				
	Marsdenia suaveolens	Scented Marsdenia																•			
	Parsonsia straminea	Common Silkpod														•	•		•	•	
	Tylophora barbata	Beared Tylophora													•	•	•				
	Araliaceae																				
Vs V_n 2VC-	***Astrotricha crassifolia***	**Thick-leaf Star-hair**	•						•						•		•	•			
	Astrotricha latifolia	-													•	•	•				
	Astrotricha longifolia	-													•		•				
	Polyscias sambucifolia subsp. A	Elderberry Panax	•			•									•	•	•	•			
	Asteraceae																				
*	*Ageratina adenophora*	Crofton Weed													•			•	•	•	
*	*Ageratina riparia*	Mist Flower													•				•		

STATUS	SCIENTIFIC NAME	COMMON NAME	ABUNDANCE																	
			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
*	*Arctotheca calendula*	Cape Weed				•												•	•	•	
*	*Aster subulatus*	Bushy Starwort																•	•	•	
*	*Bidens pilosa*	Cobblers Pegs				•												•	•	•	
	Brachycome angustifolia subsp. *angustifolia*	-			•	•										•				•	
	Cassinia longifolia	-														•	•				
*	*Cirsium vulgare*	Spear Thistle																•	•	•	
*	*Conyza bonariensis*	Flax-leaved Fleabane				•				•								•	•	•	
*	*Conyza canadensis* subsp. *canadensis*	Canadian Fleabane				•												•	•	•	
	Euchiton involucratus	Cudweed	•	•		•				•			•	•		•		•	•	•	
	Euchiton sphaericus	Cudweed	•	•	•	•				•						•		•	•	•	
	Helichrysum elatum	White Paper Daisy														•	•				
*	*Hypochaeris radicata*	Cats Ears				•				•						•		•	•	•	
	Lagenifera stipitata	-														•					
*	*Leontodon taraxacoides*	Lesser Hawkbit																	•	•	
	Olearia microphylla	Bridal Daisy Bush			•												•				
	Olearia tomentosa	-														•					
S13	*Ozothamnus diosmifolius*	Ball Everlasting			•											•	•	•		•	
	Pseudognaphalium luteoalbum	Jersey Cudweed		•	•	•				•						•	•	•			
	Senecio bipinnatisectus	-													•		•				
	Senecio diaschides	-																•			
	Senecio hispidulus var. *hispidulus*	Hill Fireweed				•										•	•	•		•	
	Senecio linearifolius	Fireweed Groundsel													•		•		•	•	
*	*Senecio madagascariensis*	Fireweed														•			•	•	
	Sigesbeckia orientalis	Indian Weed														•	•		•	•	
*	*Soliva pterosperma*	Jo-Jo				•													•	•	
*	*Sonchus oleraceus*	Sow Thistle				•				•								•	•	•	
*	*Taraxacum officinale*	Dandelion																	•	•	
	Baueraceae																				
	Bauera microphylla									•	•	•	•		•			•			

STATUS	SCIENTIFIC NAME	COMMON NAME	ABUNDANCE																	
			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
	Bauera rubioides														•		•	•			
	Bignoniaceae																				
	Pandorea pandorana	Wonga Wonga Vine													•	•	•				
	Cactaceae																				
*N	*Opuntia stricta*	Prickly Pear																	•		
	Campanulaceae																				
	Wahlenbergia communis	Tall Bluebell		•	•											•	•				
	Wahlenbergia gracilis	Native Bluebell	•	•	•	•		•	•	•			•	•		•	•	•			
	Caprifoliaceae																				
*	*Lonicera japonica*	Japanese Honeysuckle																	•	•	
	Caryophyllaceae																				
*	*Cerastium glomeratum*	Mouse-ear Chickweed																	•	•	
*	*Stellaria media*	Common Chickweed				•				•									•	•	
	Casuarinaceae																				
	Allocasuarina distyla	-	•	•		•	•	•	•	•	•		•				•	•			
	Allocasuarina littoralis	Black She-oak	•	•	•	•			•	•			•	•	•	•	•	•	•	•	
	Allocasuarina nana	-	•				•	•	•		•										
	Allocasuarina paludosa	-									•	•	•								
	Allocasuarina diminuta	-					•														
	Allocasuarina torulosa	Forest She-oak														•					
	Celastraceae																				
	Maytenus silvestris	Orangebark													•	•	•				
	Chloanthaceae																				
	Chloanthes stoechadis	-	•	•				•	•								•	•			
	Clusiaceae																				
	Hypericum gramineum	Small St. John's Wort		•	•	•				•			•	•		•	•	•	•	•	
	Convolvulaceae												•	•							
	Calystegia marginata	-													•	•					
	Convolvulus erubescens	Swamp Bindweed									•	•	•		•	•	•				

STATUS	SCIENTIFIC NAME	COMMON NAME	ABUNDANCE																	
			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
	Dichondra repens	Kidney Weed				•							•			•	•	•	•	•	
	Cunoniaceae																				
	Callicoma serratifolia	Black Wattle									•				•		•	•			
S13	*Ceratopetalum apetalum*	Coachwood													•			•			
	Ceratopetalum gummiferum	NSW Christmas Bush		•											•	•	•	•			
	Dilleniaceae																				
	Hibbertia aspera	Rough Guinea Flower			•								•	•	•	•	•	•			
	Hibbertia bracteata	-		•											•		•	•			
	Hibbertia cistoidea	-					•	•	•		•	•	•								
	Hibbertia cistiflora								•												
	Hibbertia dentata	Toothed Guinea Flower													•	•	•	•			
	Hibbertia diffusa	-	•	•	•			•	•	•			•		•	•	•	•			
	Hibbertia empetrifolia	-	•	•			•										•				
	Hibbertia fasciculata	-	•	•	•		•	•	•	•				•							
	Hibbertia linearis	-		•	•						•		•			•	•				
	Hibbertia monogyna	-	•		•								•				•				
R/2RC-	*Hibbertia nitida*	-													•		•				
	Hibbertia riparia	-	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•			
	Hibbertia rufa	-									•	•	•								
	Hibbertia scandens	Golden Guinea Flower		•											•	•	•	•			
	Droseraceae																				
	Drosera auriculata	Sundew										•			•						
	Drosera binata	Forked Sundew									•	•	•		•		•				
	Drosera peltata	Sundew	•			•		•	•		•	•	•	•	•		•	•			
	Drosera spatulata	Sundew	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•			•
	Elaeocarpaceae																				
	Elaeocarpus reticulatus	Blueberry Ash													•	•	•	•			
	Tetratheca ericifolia	Black-eyed Susan	•	•	•		•	•	•	•			•	•			•				
	Ericaceae subf. Styphelioideae																				

STATUS	SCIENTIFIC NAME	COMMON NAME	ABUNDANCE																	
			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
	Acrotriche divaricata	-	•												•		•				
	Astroloma humifusum	Cranberry Heath	•	•	•	•	•	•	•				•				•				
	Brachyloma daphnoides subsp. *daphnoides*	Daphne Heath	•	•	•	•	•	•	•	•			•	•		•	•	•			
	Dracophyllum secundum	-													•		•				
	Epacris longiflora	Fuchsia Heath	•	•								•	•		•	•	•	•			
	Epacris microphylla	Coral Heath	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•			
	Epacris obtusifolia	-	•						•		•	•	•	•	•		•	•			
	Epacris paludosa	-									•	•	•								
	Epacris pulchella	-	•	•	•	•	•	•	•	•			•	•		•	•	•		•	
V_s 2KC-	***Epacris purpurascens***	-	?	?	?				?						?		?				
	Leucopogon amplexicaulis	-	•								•				•	•	•	•			
	Leucopogon ericoides	Bearded Heath	•	•	•	•	•	•	•	•			•	•	•		•	•			
	Leucopogon esquamatus	-	•	•			•	•	•	•	•	•	•	•	•		•	•			
V_s V_n 2VC-	***Leucopogon exolasius***	**Woronora Bearded Heath**	?	?					?								?				
	Leucopogon juniperinus	-														•	•				
	Leucopogon lanceolatus	-													•	•	•				
	Leucopogon microphyllus var. microphyllus	-	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•			
	Leucopogon muticus	-															•				
	Lissanthe strigosa	Peach Heath		•	•										•	•	•				
	Melichrus procumbens	Jam Tarts	•	•	•		•	•	•				•	•							
R/3RC-	*Monotoca ledifolia*	Broom Heath					•														
	Monotoca scoparia	Broom Heath	•	•	•		•	•	•	•				•	•	•	•	•			
S13	*Sprengelia incarnata*	-									•	•	•	•	•						
	Styphelia laeta subsp. laeta	-		•													•				
	Styphelia tubiflora	Red Five Corners	•	•	•	•	•	•	•	•			•	•	•	•	•	•			
	Woollsia pungens	Woollsia	•	•		•	•	•	•	•	•		•	•	•		•	•			
	Euphorbiaceae																				
	Amperea xiphoclada		•													•		•			
	Breynia oblongifolia	Coffee Bush													•	•	•	•	•	•	

STATUS	SCIENTIFIC NAME	COMMON NAME	ABUNDANCE																	
			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
*	*Euphorbia peplus*	Petty Spurge																•	•	•	
	Glochidion ferdinandi var. *ferdinandi*	Cheese Tree														•	•	•	•	•	
	Micrantheum ericoides	-	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•			
	Monotaxis linifolia	-	•													•	•	•			
	Phyllanthus gasstroemii	-														•	•				
	Phyllantus hirtellus	Thyme Spurge	•	•	•	•			•	•			•	•		•	•	•		•	
	Poranthera ericifolia	-	•	•	•		•	•	•	•			•	•			•				
	Poranthera microphylla	-									•	•				•	•	•			
	Pseudanthus pimeleoides														•		•				
	Ricinocarpos pinifolius	Wedding Bush	•	•	•				•					•	•	•	•				
	Fabaceae subf. Caesalpinoideae																				
*	*Senna pendula* var. *glabrata*	Winter Senna				•												•	•	•	
	Fabaceae subf. Faboideae																				
	Almaleea paludosa	-									•	•	•		•						
	Aotus ericoides	-	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			
	Aotus subglauca	-	•						•								•				
	Bossiaea ensata	Leafless Bossiaea	•	•	•		•	•	•					•							
	Bossiaea heterophylla	Variable Bossiaea	•	•	•	•	•	•	•	•			•	•	•	•	•	•			
	Bossiaea obcordata	Spiny Bossiaea			•												•				
	Bossiaea scolopendria	Leafless Bossiaea	•	•	•	•	•	•	•	•			•	•			•	•			
	Daviesia corymbosa	-		•	•			•									•				
	Daviesia mimosoides subsp. mimosoides	-			•								•				•				
	Daviesia ulicifolia	Gorse Bitter Pea		•	•					•						•	•	•			
	Desmodium rhytidophyllum	-													•	•					
	Desmodium varians	Variable Tick Trefoil														•	•	•			
	Dillwynia elegans	-	•	•	•										•		•	•			
	Dillwynia floribunda	-				•			•	•	•	•	•	•	•	•	•				
	Dillwynia phylicoides	-	•	•				•	•				•	•			•				

STATUS	SCIENTIFIC NAME	COMMON NAME	ABUNDANCE																	
			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
	Dillwynia retorta sp. complex	-	●	●	●	●	●	●	●	●	●		●	●		●	●	●			
*	*Erythrina x sykesii*	Indian Coral Tree																	●	●	
	Glycine clandestina sp. complex	Love Creeper	●	●	●					●				●	●	●	●	●		●	
	Glycine tabacina	Love Creeper														●	●				
	Gompholobium glabratum	Wedge Pea		●	●												●				
	Gompholobium grandiflorum	Large Wedge Pea	●		●										●	●	●				
	Gompholobium latifolium	Golden Glory Pea														●		●			
	Gompholobium minus	Dwarf Wedge Pea	●	●	●	●	●	●	●	●			●	●			●				
	Gompholobium virgatum var. virgatum	-	●	●	●	●		●	●	●			●	●	●		●	●			
	Hardenbergia violacea	False Sarsaparilla	●	●	●	●			●	●				●	●	●	●	●	●	●	
	Hovea linearis	-	●	●	●										●		●				
	Jacksonia scoparia	Dogwood														●					
	Kennedia rubicunda	Dusky Coral Pea	●	●	●	●			●	●	●		●		●	●	●	●	●	●	
*	*Lotus suaveolens*	Hairy Bird's-foot Trefoil				●													●	●	
*	*Medicago polymorpha*	Burr Medic				●												●	●	●	
	Mirbelia rubiifolia	-	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●			
	Mirbelia speciosa	-	●																		
	Phyllota grandiflora	-	●	●			●	●	●		●	●	●	●							
	Phyllota phylicoides	-	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●			
	Platylobium formosum	-														●		●			
$V_s V_n$ 2v	***Pultenaea aristata***	-	●	●		●	●	●	●	●			●	●	●		●	●		●	
	Pultenaea daphnoides	-		●											●	●	●	●			
	Pultenaea flexilis	-																●			
	Pultenaea linophylla	-	●	●					●	●	●		●	●			●				
	Pultenaea retusa	-															●	●			
	Pultenaea stipularis	-	●	●	●	●	●	●	●	●				●	●	●	●	●			
	Pultenaea tuberculata	-	●	●	●	●	●	●	●	●	●		●	●			●				
	Pultenaea villosa	-														●					
	Sphaerolobium vimineum	-		●							●	●	●	●							

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			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
*	*Trifolium pratense*	Red Clover				•													•	•	
*	*Trifolium repens*	White Clover																	•	•	
*	*Vicia tetrasperma* subsp. *angustifolia*	Slender Vetch																•	•	•	
	Viminaria juncea	Native Broom			•	•				•	•	•	•	•	•		•	•		•	
	Fabaceae subf. Mimosoideae																				
	Acacia binervata	Two-veined Hickory														•	•	•			
	Acacia binervia	Coast Myall													•						
E_s V_n 3VC-	***Acacia bynoeana***	**Bynoe's Wattle**		•		•															
	Acacia elongata	Swamp Wattle									•	•	•		•			•			
	Acacia floribunda	White Sally Wattle													•	•	•				
	Acacia implexa	Hickory														•					
	Acacia irrorata subsp. *irrorata*	Green Wattle				•										•	•	•	•	•	
	Acacia linifolia	Flax-leaf Wattle	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	Acacia longifolia subsp. *longifolia*	Sydney Golden Wattle	•	•	•	•				•		•	•	•	•	•	•	•	•	•	
	Acacia longissima	Long-leaf Wattle														•	•				
	Acacia myrtifolia	Red-stemmed Wattle	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•			
	Acacia obtusifolia	-	•	•		•		•	•	•	•		•	•	•		•				
	Acacia suaveolens	Sweet-scented Wattle	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
	Acacia terminalis subsp. *angustifolia*	Sunshine Wattle	•	•	•				•	•		•	•	•	•	•	•	•			
	Acacia ulicifolia	Prickly Moses	•	•	•	•	•	•	•	•			•	•		•	•	•			
	Gentianaceae																				
*	*Centaurium tenuiflorum*	Common Centaury				•												•	•	•	
	Geraniaceae																				
	Geranium homeanum	-														•	•				
	Goodeniaceae																				
	Dampiera stricta	-	•	•	•	•	•	•	•	•	•		•	•		•	•	•			
	Goodenia bellidifolia subsp. *bellidifolia*	Daisy-leaved Goodenia	•	•	•						•		•	•	•	•		•			

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			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
	Goodenia hederacea var. *hederacea*	Ivy-leaved Goodenia	•	•	•	•		•	•	•			•	•		•	•				
	Goodenia ovata	-															•				
	Goodenia paniculata	-									•	•									
	Goodenia sp.												•								
	Goodenia stelligera	-									•				•		•				
	Scaevola ramosissima	Snake Flower	•	•	•			•	•	•				•			•				
	Haloragaceae																				
	Gonocarpus micranthus subsp. micranthus	-									•	•	•		•		•	•			
Reg/Sa	*Gonocarpus tetragynus*	Poverty Raspwort	•	•	•				•	•	•	•	•	•	•	•	•	•			
	Gonocarpus teucrioides	Germander Raspwort	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			
	Lamiaceae																				
	Hemigenia purpurea	-	•	•	•		•	•	•	•	•		•	•	•		•				
	Plectranthus parviflorus	-														•	•				
	Prostanthera linearis	Narrow-leaved Mint-bush													•		•				
*	*Prunella vulgaris*	Self-heal																•	•	•	
	Lauraceae																				
	Cassytha glabella	Slender Devil's Twine	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
	Cassytha pubescens	Devil's Twine	•	•	•	•						•	•	•	•	•	•	•	•		
	Lentibulariaceae																				
	Utricularia gibba	Bladderwort									•	•			•						
	Lobeliaceae																				
	Lobelia dentata	Toothed Lobelia										•		•	•		•	•			
	Pratia purpurascens	Whiteroot													•	•	•	•		•	
	Loganiaceae																				
	Logania albiflora	Logania													•		•	•			
	Mitrasacme paludosa	Mitre Plant													•						
	Mitrasacme pilosa var. *pilosa*	Mitre Plant					•				•	•	•								
	Mitrasacme polymorpha	Mitre Plant	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•			

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			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
	Loranthaceae																				
	Amyema pendulum	-	●	●	●											●	●				
	Muellerina celastroides	-	●	●	●				●								●				
	Muellerina eucalyptoides	-														●					
	Malvaceae																				
*	*Modiola caroliniana*	Red-flowered Mallow				●													●	●	
*	*Sida rhombifolia*	Paddys Lucerne				●										●		●	●	●	
	Meliaceae																				
	Melia azedarach var. *australasica*	White Cedar				●											●	●	●	●	
	Menispermaceae																				
	Stephania japonica var. *discolor*	Pearl Vine													●	●	●	●	●	●	
	Myrsinaceae																				
*	*Anagallis arvensis*	Scarlet Pimpernel				●				●								●	●		
	Rapanea variabilis	Muttonwood														●	●				
	Myrtaceae																				
	Acmena smithii	Lilly Pilly													●						
	Angophora costata	Smooth-barked Apple	●	●											●	●	●	●		●	
Reg-L/R Reg/Si	*Angophora costata* x *Angophora hispida*	Smooth-barked Apple x Dwarf Apple	●	●																	
S13	*Angophora hispida*	Dwarf Apple	●	●	●	●	●	●	●	●			●	●							
	Babingtonia densifolia	-	●	●	●		●	●	●		●	●	●	●							
	Babingtonia pluriflora	-													●		●				
	Baeckea brevifolia	-	●	●	●			●									●	●			
	Baeckea diosmifolia	-	●	●	●	●	●	●	●	●			●	●	●		●	●			
	Baeckea imbricata	-	●		●	●	●		●	●	●	●	●	●	●		●	●			
S13	*Baeckea linifolia*	-													●		●	●			
S13	*Callistemon citrinus*	Lemon-scented Bottlebrush	●			●					●	●	●	●	●		●	●			
S13	*Callistemon rigidus*	Stiff Bottlebrush	●	●	●	●			●				●	●				●			
	Calytrix tetragona	Fringe Myrtle	●	●	●	●	●	●	●	●		●	●	●			●				

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			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
S13	*Corymbia gummifera*	Red Bloodwood	•	•	•	•	•	•	•	•			•	•		•	•	•	•	•	
R/2RCi	*Darwinia diminuta*	-						•													
R/2RCi	*Darwinia grandiflora*	-	•	•	•	•		•	•				•	•							
	Darwinia fascicularis subsp. fascicularis	-	•	•		•	•	•	•	•			•	•			•	•			
	Darwinia leptantha	-	•	•	•	•	•	•	•				•	•				•			
	Darwinia sp.	-	•																		
	Eucalyptus agglomerata	Blue-leaved Stringybark													•		•	•			
R/3RC-	*Eucalyptus apiculata*	-	•	•				•	•												
	Eucalyptus botryoides	Bangalay														•					
	Eucalyptus globoidea	White Stringybark															•				
	Eucalyptus haemastoma	Broad-leaved Scribbly Gum	•	•	•	•		•	•	•		•	•	•			•		•		
R/2RCa	*Eucalyptus luehmanniana*	Yellow-top Ash	•	•				•	•	•											
Reg/Sa	*Eucalyptus multicaulis*	Whipstick Mallee Ash						•	•				•								
	Eucalyptus oblonga	Narrow-leaved Stringybark	•	•	•	•	•	•	•	•			•				•		•		
	Eucalyptus paniculata subsp. *paniculata*	Grey Ironbark														•					
	Eucalyptus pilularis	Blackbutt														•					
	Eucalyptus piperita	Sydney Peppermint		•											•	•	•	•	•	•	
	Eucalyptus punctata	Grey Gum															•				
	Eucalyptus racemosa	Narrow-leaved Scribbly Gum	•	•	•	•		•		•	•	•	•	•		•	•	•	•	•	
	Eucalyptus sieberi	Silvertop Ash	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	
	Eucalyptus stricta	Mallee Ash	•	•				•	•				•								
	Euryomyrtus ramosissima subsp. *ramosissima*	Rosy Baeckea	•	•	•		•	•	•	•	•	•	•	•			•				
S13	*Kunzea ambigua*	Tick Bush	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	
S13	*Kunzea capitata*	Burgan	•	•	•	•	•	•	•	•	•	•	•	•			•	•		•	
	Leptospermum arachnoides	-	•	•	•	•	•	•	•	•	•		•	•	•		•				
	Leptospermum continentale	Prickly Teatree									•	•	•		•						

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			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
	Leptospermum grandifolium	Woolly Teatree				•					•	•	•		•		•				
	Leptospermum juniperinum	-				•					•	•									
**	*Leptospermum laevigatum*	Coastal Tea Tree				•															
	Leptospermum morrisonii	-													•		•				
Reg/Si	*Leptospermum parvifolium*	-	•	•					•				•				•				
	Leptospermum polygalifolium subsp. *polygalifolium*	Yellow Teatree	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	Leptospermum squarrosum	-	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•		•	
	Leptospermum trinervium	Flaky-barked Teatree	•	•	•	•	•	•	•	•			•	•	•	•	•	•		•	
S13	*Melaleuca ericifolia*	-									•										
	Melaleuca hypericifolia	-	•	•	•	•		•	•	•					•		•	•		•	
	Melaleuca squarrosa	-									•				•						
	Melaleuca thymifolia	-	•	•	•		•	•		•	•	•	•	•			•				
	Syncarpia glomulifera	Turpentine														•					
	Tristaniopsis laurina	Kanuka													•						
	Tristania neriifolia	Water Gum													•		•	•			
	Olacaceae																				
	Olax stricta	-	•	•					•				•								
	Oleaceae																				
	Notolaea longifolia	Mock Olive														•	•				
	Oxalidaceae																				
*N	*Oxalis corniculata*	Creeping Oxalis				•										•	•		•	•	
	Oxalis exilis	-														•	•		•		
	Oxalis perennans	-			•	•										•					
*N	*Oxalis pes-caprae*	Soursob																•		•	
	Passifloraceae																				
*	*Passiflora edulis*	Passionfruit																	•		
	Passiflora herbertiana	-														•					
	Phytolaccaceae																				
*	*Phytolacca octandra*	Inkweed																	•	•	

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			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
	Pittosporaceae																				
	Billardiera scandens	Apple Berry	●	●	●	●		●	●	●			●	●	●	●	●	●			
	Pittosporum multiflorum	Orange Thorn															●				
	Pittosporum revolutum	Rough-fruit Pittosporum														●	●				
	Pittosporum undulatum	Sweet Pittosporum													●	●	●	●	●	●	
	Rhytidosporum procumbens	-		●											●	●	●	●	●	●	
	Plantaginaceae																				
	Plantago gaudichaudii	-														●					
*	*Plantago lanceolata*	Plantain				●				●						●		●	●	●	
	Veronica calycina	Trailing Speedwell			●	●							●	●	●		●	●	●	●	
	Veronica plebeia	Common Speedwell		●	●					●						●	●	●	●	●	
	Polygalaceae																				
	Comesperma defoliatum	-									●	●			●						
	Comesperma ericinum	Match Heads	●	●	●	●		●	●	●	●	●	●	●			●				
	Comesperma volubile	-									●										
	Polygonaceae																				
	Persicaria decipiens	Slender Knotweed													●				●		
	Rumex brownii	Dock													●	●					
*	*Rumex crispus*	Curled Dock				●						●						●	●		
	Proteaceae																				
S13	*Banksia ericifolia* subsp. *ericifolia*	Heath-leaved Banksia	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	
S13/**	*Banksia integrifolia* subsp. *integrifolia*	Coast Banksia				●												●			
S13	*Banksia marginata*		●	●	●			●					●	●			●	●			
S13	*Banksia oblongifolia*		●	●	●	●		●	●	●	●	●	●	●	●		●	●			
	Banksia paludosa subsp. *paludosa*										●	●	●								
S13	*Banksia robur*										●	●			●						
	Banksia serrata	Old Man Banksia	●	●	●	●	●	●	●	●			●	●	●	●	●	●			
S13	*Banksia spinulosa* var. *spinulosa*	Hairpin Banksia	●	●	●	●	●	●	●	●			●	●	●	●	●	●			

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			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
	Conospermum ellipticum	Smoke Bush	•	•	•	•	•	•	•	•	•	•	•	•				•			
	Conospermum ericifolium	-	•	•		•	•		•				•	•							
	Conospermum longifolium subsp. angustifolium	-	•	•	•	•	•	•	•				•	•	•		•				
	Conospermum taxifolium	-	•	•																	
	Conospermum tenuifolium	-	•	•			•	•	•				•								
	Grevillea buxifolia	Grey Spider Flower	•	•	•	•	•	•	•	•	•		•	•			•	•			
	Grevillea diffusa subsp. *diffusa*	-	•	•	•	•	•	•	•	•			•	•	•		•	•			
S13 R/2RC-	*Grevillea longifolia*	-													•		•				
	Grevillea mucronulata	-	•														•				
	Grevillea oleoides	Red Spider Flower	•	•	•	•		•	•	•	•		•	•	•		•				
	Grevillea sericea	Pink Spider Flower	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			
	Grevillea sphacelata	-	•	•	•	•	•	•	•	•			•	•			•	•			
S13	*Hakea dactyloides*	Finger Hakea	•	•	•	•	•	•	•	•	•		•	•		•	•	•			
	Hakea gibbosa	-	•	•	•	•	•	•	•	•	•	•	•			•	•	•			
S13	*Hakea laevipes*	Finger Hakea	•	•	•	•		•					•		•	•	•	•			
	Hakea propinqua	-	•	•			•	•					•				•				
	Hakea salicifolia	Willow-leaved Hakea													•						
	Hakea sericea	Silky Hakea	•	•	•	•	•	•			•		•	•			•	•			
	Hakea teretifolia	Dagger Bush	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	
	Hakea salicifolia	Willow-leaved Hakea													•		•				
S13	*Isopogon anemonifolius*	Drumsticks	•	•	•	•	•	•	•	•	•	•	•	•			•	•			
S13	*Isopogon anethifolius*	Drumsticks	•	•			•														
	Lambertia formosa	Mountain Devil	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			
	Lomatia myricoides	River Lomatia													•		•	•			
S13	*Lomatia silaifolia*	Crinkle Bush	•	•	•					•			•	•		•	•	•	•		
S13	*Persoonia lanceolata*	Lance-leaved Geebung	•	•	•	•	•	•	•	•	•	•	•	•			•	•		•	
S13	*Persoonia laurina subsp. intermedia*	-	•	•					•												
S13	*Persoonia levis*	Broad-leaved Geebung	•	•	•	•		•	•	•	•	•	•	•		•	•	•			
S13	*Persoonia linearis*	Narrow-leaved Geebung		•	•	•										•	•	•			

STATUS	SCIENTIFIC NAME	COMMON NAME	ABUNDANCE																	
			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
	Persoonia mollis subsp. *mollis*	-	●	●				●			●					●	●				
	Persoonia mollis subsp. *nectens*	-	●														●				
S13	*Persoonia pinifolia*	Pine-leaved Geebung	●	●		●		●	●			●	●	●	●		●	●			
S13	*Petrophile pulchella*	Conesticks	●	●	●	●	●	●	●	●	●		●	●	●		●	●			
S13	*Petrophile sessilis*	-	●	●			●	●	●		●	●	●				●	●			
	Symphionema paludosum	-									●	●	●	●	●						
S13	*Telopea speciosissima*	Waratah	●	●	●												●	●			
S13	*Xylomelum pyriforme*	Woody Pear		●	●											●	●				
	Ranunculaceae																				
	Clematis aristata	Forest Clematis														●	●				
	Clematis glycinoides	Old Man's Beard													●	●	●	●			
	Ranunculus inundatus	-													●		●				
*	*Ranunculus repens*	Creeping Buttercup																●	●	●	
	Rhamnaceae																				
	Cryptandra amara	-	●					●	●												
	Cryptandra ericoides	-						●			●										
	Pomaderris elliptica	-																●			
	Rosaceae																				
*N	*Rubus fruticosus*	Blackberry																	●	●	
	Rubus parviflorus	Native Raspberry													●		●				
	Rubiaceae																				
	Asperula conferta	Woodruff													●		●				
	Galium propinquum	-														●	●				
	Opercularia aspera	Coarse Stinkweed																●			
	Opercularia diphylla	Thin-leaved Stinkweed	●	●				●	●	●			●	●		●	●	●	●	●	
	Opercularia hispida	Hairy Stinkweed	●	●		●					●		●	●	●		●	●			
	Pomax umbellata	Pomax	●	●	●	●			●	●			●			●	●	●			
	Rutaceae																				
S13	*Boronia anethifolia*	-	●	●			●	●	●				●	●			●				
S13	*Boronia ledifolia*	-	●	●	●	●	●	●	●	●			●	●	●	●	●	●			

STATUS	SCIENTIFIC NAME	COMMON NAME	ABUNDANCE																		
			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
S13	*Boronia parviflora*	Swamp Boronia					•				•	•	•	•				•			
S13	*Boronia rigens*	-		•				•					•								
S13 R/2RC-	*Boronia serrulata*	-	•				•	•	•				•				•				
	Eriostemon australasius	Wax Flower	•	•	•	•	•	•	•	•			•	•	•	•	•	•			
	Phebalium dentatum	-																•			
S13	*Phebalium squamulosum subsp. squamulosum*	Scaly Phebalium	•	•	•		•	•		•			•		•	•	•				
S13	*Philotheca buxifolia*	-	•	•	•	•	•	•	•	•			•	•			•				
S13	*Philotheca scabra*	-	•	•	•	•	•	•	•	•	•	•	•	•	•		•				
	Zieria pilosa	-	•				•								•	•		•			
	Zieria smithii	Sandfly Zieria													•		•				
	Santalaceae																				
	Choretrum candollei	White Sour Bush	•														•				
	Exocarpos cupressiformis	Cherry Ballart													•	•	•				
	Leptomeria acida	Native Currant	•	•	•												•	•			
	Sapindaceae																				
	Dodonaea camfieldii	-	•	•	•			•	•												
	Dodonaea triquetra	Hop Bush	•	•	•	•				•				•	•	•	•	•	•	•	
	Solanaceae																				
*N	*Lycium ferocissimum*	African Boxthorn																	•		
*	*Solanum mauritianum*	Wild Tobacco																•	•	•	
*	*Solanum nigrum*	Black Nightshade				•												•	•	•	
	Solanum prinophyllum	Forest Nightshade														•					
	Stackhousiaceae																				
	Stackhousia nuda	-						•			•	•	•								
	Stackhousia viminea	Slender Stackhousia	•	•	•	•	•	•	•	•			•	•	•		•				
	Sterculiaceae																				
	Lasiopetalum ferrugineum var. ferrugineum	Rusty Petals	•	•	•		•	•	•	•			•	•	•	•	•	•			
	Lasiopetalum macrophyllum	-		•											•		•				

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			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
	Thymeleaceae																				
	Pimelea linfolia subsp. *linifolia*	Rice Flower	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			
	Verbenaceae																				
	Clerodendrum tomentosum	Hairy Clerodendrum														•	•				
*N	*Lantana camara*	Lantana														•		•	•	•	
*	*Verbena bonariensis*	Veined Verbena				•										•		•	•	•	
*	*Verbena rigida*	Purple Top				•												•	•	•	
	Violaceae																				
	Hybanthus monopetalus	Slender Violet-bush		•				•	•	•			•	•			•				
	Hybanthus vernonii	-			•			•	•	•	•	•									
	Viola hederacea form D	Native Violet				•				•		•	•		•	•	•		•	•	
	Vitaceae																				
	Cayratia clematidea	Slender Grape													•	•	•	•	•	•	
MAGNOLIOPSIDA: Liliidae																					
	Amaryllidaceae																				
*H	*Agapanthus praecox*	Agapanthus																	•	•	
	Anthericaceae																				
	Arthropodium milleflorum	Pale Vanilla Lily			•							•	•								
	Caesia parviflora var. vittata	Grass Lily	•	•	•		•	•	•	•	•	•	•	•		•	•				
*	*Chlorophytum comosum*	Spider Plant																	•	•	
	Dichopogon fimbriatus	Chocolate Lily		•	•								•								
	Laxmannia gracilis	Slender Wire Lily	•	•	•		•	•	•	•	•	•	•	•		•					
	Sowerbaea juncea	Vanilla Plant	•	•	•				•		•	•	•	•	•		•				
	Thysanotus tuberosus	Fringe Lily	•	•	•		•	•	•	•		•	•	•			•	•			
	Tricoryne simplex	-	•	•	•								•	•			•				
	Asparagaceae																				
*N	*Myrsiphyllum asparagoides*	Florists Smilax																	•	•	
*	*Protosparagus aethiopicus*	Asparagus Fern																•	•	•	
	Blandfordiaceae																				

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			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
S13	*Blandfordia nobilis*	Christmas Bells		•	•			•	•		•	•	•	•	•		•				
	Centrolepidaceae																				
	Centrolepis fascicularis	-	•	•							•	•			•						
	Centrolepis strigosa	-					•		•		•		•		•		•				
	Colchicaceae																				
	Burchardia umbellata	Milkmaids	•	•	•				•		•	•	•	•							
	Commelinaceae																				
	Commelina cyanea	Scurvy Weed				•					•				•	•	•	•	•	•	
	Pollia crispata	-															•				
*	*Tradescantia fluminense*	Wandering Jew																•	•	•	
	Cyperaceae																				
	Baumea acuta	-									•										
	Baumea nuda	Bare Twig Rush	•					•			•	•	•								
	Baumea rubiginosa	Twig Rush		•	•	•		•	•	•	•	•	•	•	•		•	•			
	Baumea teretifolia	-									•	•	•	•							
	Carex appressa	-									•	•			•						
	Carex longebrachiata	Bergalia Tussock														•	•				
S13	*Caustis flexuosa*	Curly Wigs	•	•	•	•	•	•	•	•				•		•	•	•			
S13	*Caustis pentandra*	-	•	•		•	•	•	•					•	•		•	•			
	Chorizandra cymbaria	Heron Bristle Rush									•	•	•		•						•
	Chorizandra sp.	-									•	•									
	Chorizandra sphaerocephala	-									•	•	•		•						
	Cyathochaeta diandra	-	•	•	•	•	•	•	•	•	•	•	•	•			•	•			
*	*Cyperus brevifolius*	Mullumbimby Couch																•	•		
	Cyperus difformis	-													•				•	•	•
	Eleocharis acuta	-									•										
	Eleocharis pusilla	-									•	•									•
	Eleocharis sphacelata	Tall Spike Rush									•	•			•						•
	Fimbristylis dichotoma	-			•								•				•				
	Gahnia clarkei	Saw Sedge									•	•					•				

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			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
	Gahnia erythrocarpa	-					•										•				
	Gahnia radula	-																•			
S13	*Gahnia sieberiana*	Saw Sedge		•						•	•	•	•		•	•	•	•	•	•	•
	Gymnoschoenus sphaerocephalus	Button Grass									•	•									
	Isolepis inundatus	-									•	•	•	•	•		•				•
	Isolepis nodosa	Knobby Clubrush																			•
	Lepidosperma filiforme	Rapier Sedge	•	•			•	•	•		•	•	•	•	•		•				
	Lepidosperma flexuosum	Rapier Sedge													•						
	Lepidosperma forsythii	Rapier Sedge							•		•	•	•		•						
	Lepidosperma gunnii	-	•	•	•			•					•		•		•				
	Lepidosperma laterale	Sword Sedge	•	•	•	•	•	•	•	•			•	•	•	•	•	•			
	Lepidosperma limicola	Sword Sedge									•	•									
	Lepidosperma urophorum	-									•	•	•								
	Lepidosperma longitudinale	-										•									
	Lepidosperma viscidum	-									•	•	•		•						
	Ptilothrix deusta	-	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•			
	Schoenus brevifolius	Bog Rush									•	•	•	•	•		•	•			•
	Schoenus imberbis	-	•	•		•	•	•	•	•					•		•				
	Schoenus melanostachys	Black Bog Rush													•		•	•			
	Schoenus pachylepis	-	•				•	•			•	•	•	•			•				
	Schoenus paludosus	-										•	•								
	Doryanthaceae																				
S13	*Doryanthes excelsa*	Gymea Lily	•		•	•									•	•	•	•			
	Haemodoraceae																				
	Haemodorum corymbosum	Blood Root	•	•	•	•	•	•	•		•		•	•				•			
	Haemodorum planifolium	Blood Root	•	•	•		•	•	•	•	•	•	•	•							
	Hypoxidaceae																				
	Hypoxis hygrometrica var. *hygrometrica*	Yellow Stars	•	•	•	•			•	•	•	•	•	•		•	•	•			
	Iridaceae																				
	Patersonia fragilis	Purple Flag	•				•										•				

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			1a	1b	1c	1r	2a	2b	2c	2r	3a	3b	3c	3d	4a	5a	6a	6r	7a	7b	8a
			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
	Patersonia glabrata	-	•	•	•	•		•	•	•			•	•		•	•	•			
	Patersonia longifolia	-																			
	Patersonia sericea	Silky Purple Flag	•	•	•	•	•	•	•	•			•	•		•	•	•		•	
*N	*Romulea rosea*	Onion Grass																	•		
	Juncaceae																				
	Juncus planifolius	-									•				•						•
	Juncus usitatus	Common Rush													•		•		•	•	•
	Lemnaceae																				
	Spirodela punctata	Duck Weed													•						•
	Lomandraceae																				
	Lomandra cylindrica	-	•	•	•			•			•		•	•	•		•				
	Lomandra filiformis subsp. coriacea	-	•	•	•				•						•		•	•			
	Lomandra filiformis subsp. *filiformis*	-	•	•	•	•	•	•	•	•			•	•		•	•	•			
R/3RCa	*Lomandra fluviatilis*	-													•		•				
	Lomandra glauca	Pale Mat Rush	•	•	•	•	•	•	•	•		•	•	•		•	•	•			
	Lomandra gracilis	-									•							•			
	Lomandra longifolia	Spiny-headed Mat Rush		•							•				•	•	•	•	•	•	
	Lomandra multiflora subsp. *multiflora*	Many-flowered Mat Rush	•	•	•	•				•						•	•				
Reg/Si	*Lomandra micrantha subsp. tuberculata*	Small-flowered Mat-rush		•	•											•		•			
	Lomandra obliqua	Fish Bones	•	•	•	•	•	•	•	•		•	•	•			•	•			
	Luzuriagaceae																				
	Eustrephus latifolius	Wombat Berry													•	•	•				
	Geitonoplesium cymosum	Scrambling Lily		•		•										•	•	•			
	Orchidaceae															•					
	Acianthus exsertus	Mosquito Orchid			•													•			
	Acianthus sp.	-		•	•																
S13	*Caleana major*	Large Duck Orchid	•	•													•				
	Corybas aconitiflorus	Spurred Helmet Orchid														•					

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			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
S13	*Cryptostylis erecta*	Bonnet Orchid																			
S13	*Cryptostylis subulata*	Large Tongue Orchid	•	•													•				
	Cryptostylis sp.	-																•			
S13	*Dendrobium speciosum*	Rock Orchid	•														•				
S13	*Dipodium variegatum*	Hyacinth Orchid															•				
S13	*Microtis parviflora*	Slender Onion Orchid	•	•													•				
	Pterostylis sp.	-			•											•					
S13	*Thelymitra* sp.	-																			
	Phormiaceae																				
S13	*Dianella caerulea* var. *producta*	Blue Flax Lily	•	•	•	•		•		•			•	•	•	•	•	•			
	Dianella longifolia var. *longifolia*	Flax Lily		•												•	•				
	Poaceae																				
	Agrostis avenacea	Blown Grass									•		•								
*	*Andropogon virginicus*	Whiskey Grass				•				•								•	•	•	
	Anisopogon avenaceus	Oat Speargrass	•	•	•	•	•	•	•	•			•	•			•	•			
	Aristida ramosa var. *ramosa*	Three-awn Speargrass	•	•	•	•	•	•		•			•	•		•	•	•	•	•	
	Aristida vagans	Three-awn Speargrass			•											•	•	•			
	Austrodanthonia pilosa	Wallaby Grass	•	•	•	•				•						•	•	•	•	•	
	Austrodanthonia tenuior	Wallaby Grass		•	•		•	•	•	•			•	•		•	•	•	•	•	
	Austrostipa pubescens	Spear Grass	•	•	•	•	•	•	•	•			•	•			•				
	Austrostipa sp.	-	•	•	•			•			•							•			
	Austrostipa verticillata	Slender Bamboo Grass									•										
*	*Briza maxima*	Quaking Grass				•													•	•	
*	*Briza minor*	Trembling Grass																	•	•	
*	*Bromus catharticus*	Prairie Grass				•													•	•	
*	*Chloris gayana*	Rhodes Grass				•				•									•	•	
*N	*Cortaderia selloana*	Pampas Grass				•													•	•	
	Cymbopogon refractus	Barbed Wire Grass			•											•	•			•	
	Cynodon dactylon	Common Couch				•				•						•		•	•	•	
	Dichelachne crinita	Plume Grass	•	•	•			•	•					•							
	Dichelachne micrantha	Shorthair Plume Grass		•	•								•			•	•				

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			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
*	*Digitaria sanguinalis*	Summer Grass				•				•								•	•	•	
	Echinopogon caespitosus	Hedgehog Grass														•	•			•	
	Echinopogon ovatus	Forest Hedgehog Grass														•	•				
*	*Ehrharta erecta*	Panic Veldt Grass				•												•	•	•	
	Entolasia marginata	Bordered Panic		•	•	•				•	•	•	•	•	•	•	•	•			
	Entolasia stricta	Wiry Panic	•	•	•	•	•	•	•	•	•		•	•		•	•	•		•	
	Eragrostis brownii	Brown's Love Grass	•	•		•			•	•			•	•		•	•	•		•	
*N	*Eragrostis curvula*	African Love Grass				•												•	•	•	
	Eragrostis leptostachya	Love Grass	•			•									•						
	Imperata cylindrica var. *major*	Blady Grass		•		•				•						•	•	•	•	•	
	Joycea pallida	Silver-top Wallaby Grass			•								•			•	•				
	Lachnagrostis filiformis	Blown Grass				•				•	•	•	•	•	•	•	•	•			
	Microlaena stipoides var. *stipoides*	Weeping Meadow Grass				•					•				•	•	•	•		•	
	Oplismenus aemulus	Basket Grass													•	•	•	•			
	Oplismenus imbecillis	Basket Grass													•	•	•		•	•	
	Panicum simile	Two Colour Panic		•	•												•				
	Paspalidium distans	-	•					•									•				
	Paspalidium radiatum	-	•	•					•					•		•					
*	*Paspalum dilatatum*	Paspalum				•				•								•	•	•	
	Paspalum distichum	Water Couch													•						
*	*Pennisetum clandestinum*	Kikuyu																	•	•	
	Poa labillardieri	Tussock Grass											•		•	•	•				
	Poa sp.			•																	
*	*Setaria pumila*	Pale Pigeon Grass				•												•	•	•	
*	*Setaria viridis*	Pigeon Grass																•	•	•	
*	*Sporobolus indicus* var. *capensis*	Slender Rats-tail Grass				•				•								•	•	•	
*	*Stenotaphrum secundatum*	Buffalo Grass				•				•									•	•	
	Tetrarrhena juncea	Wiry Ricegrass						•			•	•			•		•	•			
	Tetrarrhena turfosa	-									•	•	•					•			

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			29	34	33	-	38	39	40	-	42	43	44	45	4	16	25	-	50	49	53
	Themeda australis	Kangaroo Grass		•	•	•										•	•	•		•	
	Restionaceae																				
	Empodisma minus	-			•			•	•		•	•	•	•	•		•	•			
	Eurychorda complanata	-									•	•			•						
	Guringalia dimorpha	-	•	•							•	•	•		•		•				
	Hypolaena fastigiata	-									•	•	•		•						
	Leptocarpus tenax	Tassel Rush	•	•	•	•	•	•	•		•	•	•	•	•		•				
	Lepyrodia anarthria	-		•							•	•	•	•	•		•	•			
	Lepyrodia scariosa	-	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•			
	Restio dimorphus	-	•					•													
	Restio fastigatus	-	•						•						•						
	Restio fimbriatus	-						•				•									
	Restio sp.												•								
	Saropsis fastigiata	-	•	•		•	•	•	•	•	•	•	•	•	•						
	Smilacaceae																				
	Smilax glyciphylla	Native Sarsaparilla	•												•	•	•	•			
	Stylidiaceae																				
	Stylidium graminifolium	Grass Triggerplant	•	•	•	•	•	•	•	•	•		•	•			•	•			
	Stylidium lineare	Narrow-leaved Triggerplant	•	•			•	•			•	•									
	Stylidium productum	Triggerplant	•	•	•	•			•	•	•		•	•	•	•	•	•			
	Xanthorrhoeaceae																				
S13	*Xanthorrhoea arborea*	Grass Tree														•	•	•			
S13	*Xanthorrhoea concava*	-	•	•	•		•	•	•		•	•	•	•	•	•		•			
S13	*Xanthorrhoea resinifera*	-	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•			
	Xyridaceae																				
	Xyris complanata	-											•								
	Xyris gracilis subsp. *gracilis*	Slender Yellow-eye		•	•	•	•	•	•	•	•	•	•	•	•		•	•			
	Xyris operculata	Tall Yellow-eye									•	•	•		•						
	Xyris sp.	-											•								

APPENDIX E

ROYAL BOTANIC GARDENS CORRESPONDENCE

ROYAL BOTANIC GARDENS SYDNEY

Mr Steven CHAMBERLAIN
Bangalay Botanical Surveys
16 Pacific Crescent
Maianbar, NSW 2230
AUSTRALIA

Inquiry No: 12207
Botanical.Is@rbgsyd.nsw.gov.au
Fax No: (02) 9251 1952
Ph No: (02) 9231 8111
Date: 20 December 2006

Dear Mr CHAMBERLAIN,

In reply to your inquiry of 19-Dec-06 the following information is supplied:

Persoonia sp. #1 has been identified by Dr Peter Wilson as *Persoonia lanceolata*

Dr Darren Crayn and Dr Elizabeth Brown examined the Ericaceae specimens with mixed and mostly little success. As you have yourself discovered the absence of flowering and fruiting material is critical to distinguish some of the member so this family. Dr Brown also commented that habit notes might have helped in a couple of instances with the Epacris specimens.

Epacris sp. #1 *E.* probably *pulchella*
#2 *E.* probably *purpurascens*
#3 *E.* probably *purpurascens*
#4 *E.* probably *longiflora*
#5 *E.* probably *pulchella*
#6 *E.* probably *longiflora*
#7 *E.* either *pulchella* or *longifolia*
#8 *E.* ?either *pulchella* or *longifolia*
#9 *E.* ?*pulchella*
#10 *E.* ?*pulchella*

Dr Brown also asked that you use newspaper or at least envelopes to present specimens in future as a lot of material was lost from already skimpy specimens trying to gain access via stapled sheets of paper

Dr Crayn was able to identify Leucopogon specimens #1, #2, #5 and #6 as *Leucopogon ericoides*.

He was unable to provide identifications for Leucopogon #3, #4, #7, #8, #9, #10, #11, #12 in the absence of fruiting material.

Please send all future botanical enquiries via the Botanical Information Service. We will ensure that the correct botanist examines the specimens promptly.

Plantnet

Go to our online Botanical Information Services at plantnet.rbgsyd.nsw.gov.au to find out more about plants of New South Wales

The Botanical Information Email address is Botanical.Is@rbgsyd.nsw.gov.au
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