Appendix C

Ecology report

4. Supplementary Results

4.1 Flora

4.1.1 Overview

The proposed pipeline route passes through a number of vegetation community types, including large sections of cleared agricultural and grazing land containing isolated paddock trees, small isolated stands of remnant native vegetation, larger stands of remnant native vegetation, riparian vegetation, native sedgelands, fragmented and regrowth native vegetation, and exotic plantations and crops (Figure 3).

The Glenquarry, Moss Vale – Werai, Sutton Forest – Exeter, and Murray's Flat – Goulburn sections of the proposed route are dominated by cleared agricultural land. These areas were feature a mixture of native and introduced pasture grasses and environmental weeds and are subject to intensive grazing of cattle and other livestock. These areas contain isolated paddock trees and small stands of remnant vegetation, often in a degraded state and lacking native understorey vegetation. Fenced road reserves and larger woodland patches have greater native species and structural diversity. Drainage lines in these sections are substantially degraded, with little to no native riparian vegetation, and are often dominated by Willow (*Salix* spp.), regrowth *Acacia* spp., and exotic weeds.

Large stands of native vegetation occur within the Paddy's River, Marulan, and Towrang areas and occur in varying levels of condition and age classes, ranging from established regrowth to mature stands, and from disturbed woodland (with signs of under-scrubbing and grazing pressure) through to large remnant stands in good condition.

The canopy stratum within the study area is highly diverse, reflecting variations in geology and disturbance through fire or clearing. Understorey species in most stands of vegetation occurring along the pipeline show signs of heavy grazing and the effects of drought, with some areas completely devoid of any shrubs and with little groundcover.

4.1.2 Additional Flora Species

A total of 265 species of plants from 57 families were recorded in the supplementary surveys, of which 83 (approximately 31 %) are exotic species. One threatened plant was recorded: Camden Woollybutt (*Eucalyptus macarthurii*), which is listed as Vulnerable under the TSC Act. Of the plants recorded, 112 species (33 exotic) and three families were not recorded in the initial EA surveys. The additional plant species detected probably reflects identification of seasonally flowering or short lived species that were not readily detected in Spring or Summer. It also reflects increased survey effort in habitats that were not sampled as intensively due to access restrictions. Notably, survey effort was increased in the Werai-Glenquarry and Moss Vale portions of the survey corridor yielding an increased number of plant species associated with Shale substrates, as well as exotic plants of disturbed agricultural land.

Based on the overall survey effort a total of 419 species of plants from 65 families have been recorded within the survey corridor of which 83 (approximately 20 %) are exotic species. Two threatened plant species were recorded Camden Woollybutt and Hoary Sunray (*Leucochrysum albicans* var*. tricolor*) (see Section 4.1.4).

No additional species of noxious weeds were recorded during the supplementary surveys.

The cumulative flora species list compiled through the assessment of this Project is presented in Appendix A.

4.1.3 Revisions to Vegetation Communities

Vegetation communities identified and mapped within the survey corridor are described in Table 6 and their distributions shown in Figure 3. Native vegetation communities occurring along the final pipeline route have been described according to definitions of vegetation types for the Hawkesbury-Nepean Catchment Management Area on the DECCW Biobanking Vegetation Types Database (DECCW, 2010c), and classified based on a 'best fit' basis within these community types. Two additional vegetation communities were identified during the supplementary surveys and are described in Table 5. The status and distribution of a number of vegetation communities has also been revised in response to the supplementary surveys, submissions on the EA and additional desktop assessment. The results of the supplementary vegetation area searches and habitat assessments are summarised in Appendix B.

Table 5 Additional Vegetation Communities Recorded within the Survey Corridor

Vegetation Community	Description of Vegetation	Landscape position and condition	TSC Act Status	EPBC Act Status
Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands	Open woodland or woodland with a sparse shrub layer and dense grassy groundcover. Canopy trees include Yellow Box (*Eucalyptus melliodora*), with occasional Blakely's Red Gum (*Eucalyptus blakelyi*) and Apple Box (*Eucalyptus bridgesiana*). Sparse shrub layer including *Cassinia* sp, *Lissanthe strigosa* and *Melichrus urceolatus*. Understorey of perennial native tussock grasses, including Kangaroo Grass (*Themeda australis*), Weeping Meadow Grass (*Microlaena stipoides*) and *Austrostipa rudis.*	This community has a localised distribution within the survey corridor on loamy soils on undulating terrain, mainly on lower slopes adjoining drainage lines. Intact patches are restricted to small areas near Brayton and north of Goulburn. The patches of this community that were sampled are in good condition with low weed invasion.	Box-gum Woodland EEC	Box-gum Woodland CEEC
Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands and South East Corner	Canopy of Sydney Peppermint (*E. piperita*) with Silvertop Ash (*E. sieberi*), Narrow-leaved Peppermint (*E. radiata*) and White Stringybark (*E. globoidea*) also present. Diverse understorey of shrubs including *Allocasuarina littoralis, Acacia longifolia, Petrophile peduncularis, Persoonia* spp., *Bossiaea obcordata*, and *Podolobium ilicifolium*. Diverse suite of grasses and herbs including *Caustis recurvexa, Pteridium exculentum, Lomandra* spp., *Entolasia marginata, Pomax umbellata*, and *Goodenia hederacea*.	This community occurred on undulating terrain as larger remnant latches along the Paddys River section of the proposed pipeline route. Occurs on sandstone-derived sandy loams on ridges and dry slopes. It was in a moderate to good condition with little to no weed invasion in most areas.	Not listed.	Not listed.

Intact patches of the Yellow Box - Blakely's Red Gum woodland are restricted to small areas near two properties at Brayton and the northern outskirts of Goulburn. Some areas of 'Disturbed Agricultural and

Grazing Land' mapped in the pipeline survey corridor may also comprise highly degraded remnants of this community.

Vegetation identified and mapped in the EA as 'Sydney Peppermint – Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin', which was assigned to the 'Southern Highlands Shale Woodlands (SHSW) in Sydney Basin Bioregion' EEC (GHD, 2010a), has now been reassigned to 'River Peppermint - Narrow-leaved Peppermint open forest on sheltered escarpment slopes, Sydney Basin and South East Corner', based on supplementary survey and desktop assessment. This revision was considered appropriate based on the following:

- Distribution, given the location of this vegetation community in the Southeastern Highlands:
  - 'ridges of the eastern tableland, South Eastern Highlands and South East Corner'; rather than
  - 'sandstone ridges of the upper Blue Mountains, Sydney Basin' (DECCW, 2010c); and
- Numbers of diagnostic species identified in the vegetation classification that forms the basis for these DECCW (2010c) vegetation types (Tozer et. al., 2006):
  - 21 and 19 positive diagnostic species for Silvertop Ash - Narrow-leaved Peppermint open forest recorded in two quadrats, where a quadrat located in this vegetation type is expected to contain a minimum of 11 of these species; whereas
  - 18 and 17 positive diagnostic species for Sydney Peppermint – Silvertop Ash heathy open forest recorded in the same two quadrats, where a quadrat located in this vegetation type is expected to contain 27 positive diagnostic species (Tozer *et. al*., 2006).

Based on substrate geology, vegetation structure and understorey species composition 'River Peppermint - Narrow-leaved Peppermint open forest on sheltered escarpment slopes' is not considered to comprise a form of the EEC SHSW, as described in Section 4.1.5.

The DECCW (2010d) note that two of the vegetation communities listed in the EA, namely (i) 'Ribbon Gum − Narrow Leaved Peppermint grassy open forest' and (ii) 'Swamp Gum − Ribbon Gum woodland' may have been misidentified as Southern Highlands Shale Woodlands (SHSW) instead of the Robertson Basalt Tall Open-forest (RBTO).

Areas of 'Ribbon Gum - Narrow-leaved Peppermint grassy open forest on basalt plateaux of the Sydney Basin and South Eastern Highlands' mapped and described in GHD (2010a) were re-assessed and are now considered to comprise a form of 'River Peppermint - Narrow-leaved Peppermint open forest on sheltered escarpment slopes, Sydney Basin and South East Corner'. All surveyed patches of this community are in valleys and along low-lying drainage areas rather than the undulating basalt tablelands and plateaux that would be expected to support the 'Ribbon Gum…forest' (DECCW, 2010c). Patches of this community were originally described as 'Ribbon Gum…forest' based on the abundance of Ribbon Gum (*Eucalyptus viminalis*) in the canopy however the species composition is also consistent with the description of 'River Peppermint …forest' and the geomorphic position is a better match for this community (DECCW, 2010 ; Tozer et. al., 2006). Further, GIS comparison with Mitchell Landscapes mapping revealed that all mapped occurrences of this community fell within the Moss Vale Highlands landscape which includes shale, rather than basalt substrates (DECC, 2008a). River Peppermint - Narrow-leaved Peppermint open forest is consistent with the EEC SHSW, as described in Section 4.1.5 below.

Supplementary assessment supports the identification of 'Swamp Gum − Ribbon Gum woodland' as SHSW. The vegetation structure and species composition matches the description of the SHSW EEC, noting that there is considerable overlap with the species composition of RBTO (DECCW, 2010b). However the geomorphic position of poorly drained flats and lower slopes is more appropriate to SHSW

than RBTO. GIS comparison with Mitchell Landscapes mapping revealed that all mapped occurrences of this community fell within the Moss Vale Shale landscape comprising rolling hills and rounded peaks with deep channel incision on horizontal Triassic alternating quartz sandstone and shale (DECC, 2008a). This mapping supports the field observations of GHD ecologists that these woodlands occurred on shale-derived soils on lower slopes or colluvium and alluvium on flats adjoining incised drainage lines.

The map unit 'Mixed Dwellings / Patchy Vegetation' was refined through supplementary survey and air photo interpretation. Ground-truthing revealed that many of these areas contained only exotic vegetation and so they were re-labelled 'Planted / Exotic Vegetation' or 'Disturbed Agricultural and Grazing Land' as appropriate. The remainder of this map unit was refined through detailed air photo interpretation using GIS. Based on this process it is now assumed that all areas of 'Mixed Dwellings / Patchy Vegetation' do not contain native vegetation types and so these areas were excluded from estimates of the extent of impacts on native vegetation presented in Section 5.1.3.

Estimates of the total mapped area of each vegetation community within the 400m survey corridor (as calculated in GIS) are presented in Table 6. A total of 3236.4 ha of vegetation was mapped within the survey corridor for the pipeline. The Disturbed Agricultural and Grazing Land vegetation community occupies most of the survey corridor, covering approximately 2160 ha of the study area. The relative extent of vegetation types has varied with revisions to mapped vegetation following the supplementary surveys.

Non-Native Vegetation Communities

- 11, Disturbed Pasture Lands / Grazing Land,
- 11ex, Disturbed Pasture Lands / Grazing Land, extrapolated - unsurveyed
- 13, Planted / Exotic vegetation,
- 13ex, Planted / Exotic vegetation, extrapolated - unsurveyed
- 14, Acacia regrowth,
- 14ex, Acacia regrowth, extrapolated - unsurveyed
- 18, Mixed Dwelling/Patchy Vegetation,
- 18ex, Mixed Dwelling/Patchy Vegetation, extrapolated - unsurveyed

Native Vegetation Communities

- 01, Broad-leaved Peppermint - Red Stringybark grassy open forest,
- 01ex, Broad-leaved Peppermint - Red Stringybark grassy open forest, extrapolated - unsurveyed
- 02, Inland Scribbly Gum - Brittle Gum low woodland,
- 02ex, Inland Scribbly Gum - Brittle Gum low woodland, extrapolated - unsurveyed
- 03ex, Narrow-leaved Peppermint - Mountain Gum - Brown Barrel moist open forest, extrapolated - unsurveyed
- 04, Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest,
- 04ex, Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest, extrapolated - unsurveyed
- 05, Ribbon Gum - Narrow-leaved Peppermint grassy open forest,
- 05ex, Ribbon Gum - Narrow-leaved Peppermint grassy open forest, extrapolated - unsurveyed
- 06, River Peppermint - Narrow-leaved Peppermint open forest,
- 06ex, River Peppermint - Narrow-leaved Peppermint open forest, extrapolated - unsurveyed
- 07, Silvertop Ash - Blue-leaved Stringybark shrubby open forest,
- 07ex, Silvertop Ash - Blue-leaved Stringybark shrubby open forest, extrapolated - unsurveyed
- 08, Swamp Gum - Ribbon Gum woodland,
- 08ex, Swamp Gum - Ribbon Gum woodland, extrapolated - unsurveyed
- 09, Sydney Peppermint - White Stringybark moist shrubby forest,
- 09ex, Sydney Peppermint - White Stringybark moist shrubby forest, extrapolated - unsurveyed
- 10, Riparian Vegetation,
- 10ex, Riparian Vegetation, extrapolated - unsurveyed
- 12, Freshwater Sedgelands,
- 12ex, Freshwater Sedgelands, extrapolated - unsurveyed
- 19, Silvertop Ash - Narrow Leaved Peppermint open forest,
- 19ex, Silvertop Ash - Narrow Leaved Peppermint open forest, extrapolated - unsurveyed
- 20, Yellow Box - Blakely's Red Gum grassy woodland,
- 20ex, Yellow Box - Blakely's Red Gum grassy woodland, extrapolated - unsurveyed

WHITES CREEK
WAITE STREET
MAIN SOUTHERN
MOSS VALE
ARGYLE STREET
ROBERTSON ROAD
THROSBY PARK
KELLYS CREEK
SHEEPWASH ROAD
GLENQUARRY
BILLY BILLY FLAT
WINGECARIBEE RESERVOIR
MOSS VALE UNANDERRA RAILWAY
SUTTON FOREST
NOWRA ROAD
ILLAWARRA HIGHWAY
Glenquarry
YARRUNGA
Werai-Moss Vale
MERYLA SF
MANCHESTER SQUARE
SOUTHERN RAILWAY

1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Final Pipeline Route
- Railway
- Rivers, Creeks
- PrimaryRoad
- ArterialRoad
- Lakes, Dams
- Local Government Area

CLIENTS | PEOPLE | PERFORMANCE

Goulburn Mulwaree Council
Highlands Source Project

Job Number	23-13312-15
Revision	0
Date	22 JUL 2010

Vegetation
Sector: Werai - Glenquarry

Figure 3(a)

G:\21\19089\GIS\Maps\MXD\21_19089__Z006_Vegetation_Fig2.mxd

Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly, qjchung

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Non-Native Vegetation Communities

- 11, Disturbed Pasture Lands / Grazing Land,
- 11ex, Disturbed Pasture Lands / Grazing Land, extrapolated - unsurveyed
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- 13ex, Planted / Exotic vegetation, extrapolated - unsurveyed
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- 02ex, Inland Scribbly Gum - Brittle Gum low woodland, extrapolated - unsurveyed
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- 04, Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest,
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ARGYLE STREET
SUTTON FOREST
PAYNES CREEK
HODDLES CROSS ROADS
ILLAWARRA HIGHWAY
HUME HIGHWAY
EXETER ROAD
MOORES FLATS
MAIN SOUTHERN RAILWAY
REEDY CREEK
BUNDANOON ROAD
LUTWYCHE
PENROSE SF

Sutton Forest-Exeter

1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Final Pipeline Route
- Railway
- Rivers, Creeks
- PrimaryRoad
- ArterialRoad
- Lakes, Dams
- Local Government Area

CLIENTS | PEOPLE | PERFORMANCE

Goulburn Mulwaree Council
Highlands Source Project

Job Number	23-13312-15
Revision	0
Date	22 JUL 2010

Vegetation
Sector: Sutton Forest-Exeter

Figure 3(b)

G:\21\19089\GIS\Maps\MXD\21_19089__Z006_Vegetation_Fig2.mxd

Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly, qjchung

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URINGALLA CREEK
HANGING ROCK
HUME HIGHWAY
HANGING ROCK SWAMP
PENROSE SF
GOULBURN MULWAREE COUNCIL
WINGECARIBEE SHIRE COUNCIL
PADDYS RIVER
Paddy's River
PADDYS RIVER
BACK CREEK

1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Final Pipeline Route
- Railway
- Rivers, Creeks
- PrimaryRoad
- ArterialRoad
- Lakes, Dams
- Local Government Area

CLIENTS | PEOPLE | PERFORMANCE

Goulburn Mulwaree Council
Highlands Source Project

Job Number	23-13312-15
Revision	0
Date	22 JUL 2010

Vegetation
Sector: Paddys River

Figure 3(c)

G:\21\19089\GIS\Maps\MXD\21_19089__Z006_Vegetation_Fig2.mxd

Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly, qjchung

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GOULBURN MULWAREE COUNCIL

WINGECARIBEE SHIRE COUNCIL

BACK CREEK

LOCKYERSLEIGH CREEK

URINGALLA CREEK

HUME HIGHWAY

MAIN SOUTHERN RAILWAY

MARULAN

WOOLSHED CREEK

RBERS CREEK

Marulan

1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Final Pipeline Route
- Railway
- Rivers, Creeks
- PrimaryRoad
- ArterialRoad
- Lakes, Dams
- Local Government Area

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Goulburn Mulwaree Council
Highlands Source Project

Job Number	23-13312-15
Revision	0
Date	22 JUL 2010

Vegetation
Sector: Marulan

Figure 3(d)

G:\21\19089\GIS\Maps\MXD\21_19089__Z006_Vegetation_Fig2.mxd

Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly, qjchung

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- 06, River Peppermint - Narrow-leaved Peppermint open forest,
- 06ex, River Peppermint - Narrow-leaved Peppermint open forest, extrapolated - unsurveyed
- 07, Silvertop Ash - Blue-leaved Stringybark shrubby open forest,
- 07ex, Silvertop Ash - Blue-leaved Stringybark shrubby open forest, extrapolated - unsurveyed
- 08, Swamp Gum - Ribbon Gum woodland,
- 08ex, Swamp Gum - Ribbon Gum woodland, extrapolated - unsurveyed
- 09, Sydney Peppermint - White Stringybark moist shrubby forest,
- 09ex, Sydney Peppermint - White Stringybark moist shrubby forest, extrapolated - unsurveyed
- 10, Riparian Vegetation,
- 10ex, Riparian Vegetation, extrapolated - unsurveyed
- 12, Freshwater Sedgelands,
- 12ex, Freshwater Sedgelands, extrapolated - unsurveyed
- 19, Silvertop Ash - Narrow Leaved Peppermint open forest,
- 19ex, Silvertop Ash - Narrow Leaved Peppermint open forest, extrapolated - unsurveyed
- 20, Yellow Box - Blakely's Red Gum grassy woodland,
- 20ex, Yellow Box - Blakely's Red Gum grassy woodland, extrapolated - unsurveyed

LOCKYERSLEIGH CREEK
TOWRANG
CARRICK
MAIN SOUTHERN RAILWAY
OSBORNS CREEK
SOUTHERN RAILWAY
WOLLONDILLY RIVER
SHELLYS FLAT
TOWRANG STOCKADE
HUME HIGHWAY
Towrang
HUME HIGHWAY
NARAMBULLA CREEK
Flat

1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Final Pipeline Route
- Railway
- Rivers, Creeks
- PrimaryRoad
- ArterialRoad
- Lakes, Dams
- Local Government Area

CLIENTS|PEOPLE|PERFORMANCE

Goulburn Mulwaree Council
Highlands Source Project

Job Number 23-13312-15
Revision 0
Date 22 JUL 2010

Vegetation
Sector: Towrang

Figure 3(e)

G:\21\19089\GIS\Maps\MXD\21_19089__Z006_Vegetation_Fig2.mxd

Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly, qjchung

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Non-Native Vegetation Communities

- 11, Disturbed Pasture Lands / Grazing Land,
- 11ex, Disturbed Pasture Lands / Grazing Land, extrapolated - unsurveyed
- 13, Planted / Exotic vegetation,
- 13ex, Planted / Exotic vegetation, extrapolated - unsurveyed
- 14, Acacia regrowth,
- 14ex, Acacia regrowth, extrapolated - unsurveyed
- 18, Mixed Dwelling/Patchy Vegetation,
- 18ex, Mixed Dwelling/Patchy Vegetation, extrapolated - unsurveyed

Native Vegetation Communities

- 01, Broad-leaved Peppermint - Red Stringybark grassy open forest,
- 01ex, Broad-leaved Peppermint - Red Stringybark grassy open forest, extrapolated - unsurveyed
- 02, Inland Scribbly Gum - Brittle Gum low woodland,
- 02ex, Inland Scribbly Gum - Brittle Gum low woodland, extrapolated - unsurveyed
- 03ex, Narrow-leaved Peppermint - Mountain Gum - Brown Barrel moist open forest, extrapolated - unsurveyed
- 04, Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest,
- 04ex, Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest, extrapolated - unsurveyed
- 05, Ribbon Gum - Narrow-leaved Peppermint grassy open forest,
- 05ex, Ribbon Gum - Narrow-leaved Peppermint grassy open forest, extrapolated - unsurveyed
- 06, River Peppermint - Narrow-leaved Peppermint open forest,
- 06ex, River Peppermint - Narrow-leaved Peppermint open forest, extrapolated - unsurveyed
- 07, Silvertop Ash - Blue-leaved Stringybark shrubby open forest,
- 07ex, Silvertop Ash - Blue-leaved Stringybark shrubby open forest, extrapolated - unsurveyed
- 08, Swamp Gum - Ribbon Gum woodland,
- 08ex, Swamp Gum - Ribbon Gum woodland, extrapolated - unsurveyed
- 09, Sydney Peppermint - White Stringybark moist shrubby forest,
- 09ex, Sydney Peppermint - White Stringybark moist shrubby forest, extrapolated - unsurveyed
- 10, Riparian Vegetation,
- 10ex, Riparian Vegetation, extrapolated - unsurveyed
- 12, Freshwater Sedgelands,
- 12ex, Freshwater Sedgelands, extrapolated - unsurveyed
- 19, Silvertop Ash - Narrow Leaved Peppermint open forest,
- 19ex, Silvertop Ash - Narrow Leaved Peppermint open forest, extrapolated - unsurveyed
- 20, Yellow Box - Blakely's Red Gum grassy woodland,
- 20ex, Yellow Box - Blakely's Red Gum grassy woodland, extrapolated - unsurveyed

NORWOOD
KENMORE
TARALGA ROAD
MAIN SOUTHERN RAILWAY
WOLLONDILLY RIVER
BAW BAW
BRADFORDVILLE
WOLLONDILLY RIVER
FITZROY STREET
NORTH GOULBURN
IFIELD
HUME HIGHWAY
LAGOON STREET
OLD HUME HIGHWAY
BAW BAW CROSSING
Goulburn
Murray's Flat
GOULBURN
GARFIELD
EASTGROVE
HUME STREET
RUN-O-WATERS

1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Final Pipeline Route
- Railway
- Rivers, Creeks
- PrimaryRoad
- ArterialRoad
- Lakes, Dams
- Local Government Area

CLIENTS | PEOPLE | PERFORMANCE

Goulburn Mulwaree Council
Highlands Source Project

Job Number	23-13312-15
Revision	0
Date	22 JUL 2010

Vegetation
Sector: Goulburn-Murrays Flat

Figure 3(f)

G:\21\19089\GIS\Maps\MXD\21_19089__Z006_Vegetation_Fig2.mxd

Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly, qjchung

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Table 6 Mapped Area of Vegetation Communities within the Survey Corridor

Vegetation Community	TSC Act Status	EPBC Act Status	EA Area (ha)	Revised (PPR) Area (ha)
Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills of the South Eastern Highlands	EEC (SHSW)		83.65	98.2
Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands			101.63	129.5
Narrow-leaved Peppermint - Mountain Gum - Brown Barrel moist open forest on high altitude ranges, northern South Eastern Highlands	EEC (RBTO)		0.49	0.5
Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands of the South Eastern Highlands			43.11	50.1
River Peppermint - Narrow-leaved Peppermint open forest on sheltered escarpment slopes, Sydney Basin and South East Corner	EEC (SHSW)		96.02	99.7
Silvertop Ash - Blue-leaved Stringybark shrubby open forest on ridges of the northeast South Eastern Highlands			230.72	254.8
Swamp Gum - Ribbon Gum woodland on poorly-drained flats of the South Eastern Highlands	EEC (SHSW)		4.99	5
Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands and South East Corner[b]			129.37	133.5
Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands	EEC (B-GW)	CEEC (B-GW)	0	21.9
Riparian Vegetation			11.69	15.5

Vegetation Community	TSC Act Status	EPBC Act Status	EA Area (ha)	Revised (PPR) Area (ha)
Freshwater Sedgelands			0.63	0.7
Disturbed Agricultural / Grazing Land			1957.61	2160
Planted / Exotic Vegetation			22.86	50.2
Acacia regrowth			3.34	6.1
Mixed Dwelling/Patchy Vegetation			550.23	210.7
Total			**3236.34**	**3236.4**

a -Includes 12.68 ha which was mapped as ‘Ribbon Gum - Narrow-leaved Peppermint grassy open forest on basalt plateaux of the Sydney Basin and South Eastern Highlands’ in GHD (2010a).

b -Includes areas mapped as ‘Sydney Peppermint – Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin’ in GHD (2010a).

4.1.4 Threatened Flora Species

The desktop literature review indicates 47 threatened plant species that have been previously recorded or are predicted to occur within the survey corridor with 27 threatened plant species considered to have the potential to occur in the habitats present within the proposed corridor (GHD, 2010a).

Two threatened flora species were recorded during the field investigations for this assessment:

- Camden Woollybutt (*Eucalyptus macarthurii*); and
- Hoary Sunray (*Leucochrysum albicans* var*. tricolor*)

Camden Woollybutt (*Eucalyptus macarthurii*) listed as vulnerable under the NSW TSC Act, was recorded at a number of locations during targeted flora surveys. This species occurred as a component of the River Peppermint - Narrow-leaved Peppermint open forest vegetation community and as isolated paddock trees in areas of derived grassland.

The local population of Camden Woollybutt occurs from the eastern end of the pipeline corridor at Glenquarry through to Paddys River, with the largest populations occurring in the Paddys River, Moss Vale-Werai and Glenquarry areas.

Additional individuals of this species were recorded in the present assessment in areas not previously surveyed due to access restrictions (GHD, 2010a). A further 52 individuals were recorded in the Glenquarry and Werai – Moss Vale areas. The species occurs in relatively low densities in these areas, generally as isolated paddock trees. Micro-realignment of the final pipeline route has successfully avoided the majority of these individuals (refer Section 2.2).

Hoary Sunray (*Leucochrysum albicans* var*. tricolor*) listed as endangered under the EPBC Act, was recorded on the edge of Inland Scribbly Gum – Brittle Gum low woodland vegetation during the previous field surveys (GHD 2010a). This species was not recorded in the supplementary surveys, despite targeted survey effort, and so has not been recorded within the final pipeline construction corridor.

4.1.5 Endangered Ecological Communities

Three threatened ecological communities (TECs) were recorded as part of this assessment:

- Southern Highlands Shale Woodlands listed as endangered under the TSC Act, was recorded in the survey corridor and within the proposed construction corridor in GHD (2010). The distribution and extent of this TEC have been revised through the supplementary surveys and assessment presented in this report;
- Robertson Basalt Tall Open-forest, also listed as endangered under the TSC Act, was recorded immediately adjacent to the survey corridor, but not within the survey or construction corridors by (GHD, 2010a) or in the supplementary surveys; and
- White Box Yellow Box Blakely's Red Gum Woodland, listed as endangered under the TSC Act and critically endangered under the EPBC Act, was recorded within the Marulan area outside of the survey corridor in (GHD, 2010a) and was recorded at two points within the final pipeline construction during supplementary surveys. Supplementary assessment, including a specific Assessment of Significance for this TEC is presented in this report.

The mapped extents of these communities within the survey corridor are shown in Figure 4 and summarised in Table 7. The relative extent of EECs has varied with revisions to mapped vegetation as

following the supplementary surveys well as revisions to the status of some communities based on a review of identification criteria.

Table 7 Mapped Area of Threatened Ecological Communities Within the Survey Corridor

Threatened Ecological Community	EA Area (ha)	Revised Area (ha)
Southern Highlands Shale Woodlands	314	201
Robertson Basalt Tall Open-forest	0.5	0.5
Box-gum Woodland	0	21

Southern Highlands Shale Woodlands in the Sydney Basin Bioregion

Southern Highlands Shale Woodlands (SHSW) is the most extensive TEC within the survey corridor with a widespread distribution within the Glenquarry - Marulan area. The majority occurs as small stands of remnant vegetation of varying condition within the Glenquarry and Sutton – Exeter areas in grazing and agricultural land subject to edge effects, stock trampling, clearing, rubbish dumping, and weed invasion. Large stands exist within the Paddy's River and Marulan sectors within broader stands of native vegetation and are in moderate to good condition, with little to no grazing, clearing or weed invasion present in most stands.

The vegetation communities occurring within the proposed pipeline corridor that form a component of this EEC are listed in Table 6.

There is approximately 201 ha of SHSW within the survey corridor, with an estimated 2.3 ha to be removed within the construction corridor for the proposed pipeline. An assessment of significance of the impacts of the Project on this TEC was performed and is presented in Section Appendix C.

The extent of SHSW in the survey corridor has been revised downwards from the figure presented in the EA (GHD, 2010a), largely because the definition of Silvertop Ash - Narrow-leaved Peppermint open forest has been revised, as described above. The Silvertop Ash - Narrow-leaved Peppermint open forest is not considered to comprise SHSW EEC. The TEC occurs "on clay soils derived from Wianamatta Shale on the Southern Highlands" (DECCW, 2010a) whereas the Silvertop Ash - Narrow-leaved Peppermint open forest was located entirely on sandstone, with yellow, gravely, loamy sand soils typical of these substrates and not exhibiting any shale influence.

Robertson Basalt Tall Open-forest

Robertson Basalt Tall Open-forest (RBTO) was not directly recorded in the survey corridor by GHD (2010a) or in the supplementary surveys. Mitchell Landscape (DECC, 2008a) mapping was analysed in GIS and revealed areas of the 'Robertson Basalts' landscape in the survey corridor. This landscape comprises flat top hills and small plateau standing above undulating shale hills of the Moss Vale Highlands landscape on Tertiary basalt flows and would have formerly supported RBTO (DECC, 2008a). Mapped areas of this landscape did not coincide with any mapped areas of intact woodland intersecting the final pipeline route. These landscapes are located within the Glenquarry-Werai-Moss Vale portions of the pipeline corridor, which have been extensively cleared and converted to exotic pasture. No derived grasslands dominated by native species were observed along the final pipeline route. Therefore the

Project is not likely to directly affect any intact patches of RBTO or any derived grasslands with the capacity to regenerate and this EEC is not considered further in this report.

Box-gum Woodland

The definition and associated identification criteria for Box-Gum Woodland vary between the form listed under the TSC Act and that listed under the EPBC Act. There is greater emphasis at the federal level on vegetation condition with identification criteria for patch size and the composition and abundance of native groundcover species. The supplementary surveys were conducted in Autumn and Winter, when some understorey species may not be detected. Further, the surveys included area searches over lengthy sections of the final pipeline route whereas identification criteria depend upon data within vegetation quadrats. Therefore a conservative approach was adopted and all patches of vegetation characteristic of Box-gum Woodland were assumed to meet both TSC and EPBC Act identification criteria.

An assessment of the significance of impacts of the Project on this EEC, according to the EPBC Act assessment criteria, is presented in Appendix D and is discussed in Sections 5.4.2 and 5.5.2of this report.

806,000 808,000 810,000 812,000 814,000 816,000 818,000 820,000 822,000

6,174,000 6,172,000 6,170,000 6,168,000 6,166,000

STONY CR...
BERRIMA ROAD
WHITES CREEK
WAITE STREET
MAIN SOUTHERN RAILWAY
BERRIMA JUNCTION
ARGYLE ROAD
BONG BONG
CECIL HOSKINS NP
MOSS VALE
ARGYLE STREET
ROBERTSON ROAD
THROSBY PARK
SUTTON FOREST
NOWRA ROAD
ILLAWARRA HIGHWAY
Glenquarry
GLENQUARRY
SHEEPWASH ROAD
KELLYS CREEK
WINGECARIBEE RESERVOIR
BILLY BILLY FLAT
MOSS VALE UNANDERRA RAILWAY
40
YARRUNGA
Werai-Moss Vale
MERYLA SF
MANCHESTER SQUARE
SOUTHERN RAILWAY

1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Sector boundary
- Final Pipeline Route

Threatened Flora (Supplementary survey

- Eucalyptus macarthurii

Threatened Flora (EA Survey)

- Eucalyptus macarthurii (1-10 instances)
- Eucalyptus macarthurii (10+ instances, with count)
- Grassy Box-gum Woodland
- Robertson Basalt Tall Open-forest
- Southern Highlands Shale Woodlands

GHD CLIENTS|PEOPLE|PERFORMANCE

GOULBURN MULWAREE COUNCIL

Goulburn Mulwaree Council
Highlands Source Project

Job Number	23-13312-15
Revision	0
Date	30 JUL 2010

Threatened Flora
(TECs and Threatened Species)
Sector: Werai - Glenquarry

Figure 4(a)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly, qjchung

792,000 794,000 796,000 798,000 800,000 802,000 804,000 806,000 808,000

6,170,000 6,168,000 6,166,000 6,164,000 6,162,000

HODDLES CROSS ROADS
ILLAWARRA HIGHWAY
HUME HIGHWAY
PAYNES CREEK
SUTTON FOREST
EXETER ROAD
ARGYLE STREET
MOORES FLATS
MAIN SOUTHERN RAILWAY
REEDY CREEK
BUNDANOON ROAD
PENROSE SF
40

Sutton Forest-Exeter

1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Sector boundary
- Final Pipeline Route

Threatened Flora (Supplementary survey

- Eucalyptus macarthurii

Threatened Flora (EA Survey)

- Eucalyptus macarthurii (1-10 instances)
- Eucalyptus macarthurii (10+ instances, with count)

Threatened Ecological Communities

- Grassy Box-gum Woodland
- Robertson Basalt Tall Open-forest
- Southern Highlands Shale Woodlands

GHD CLIENTS|PEOPLE|PERFORMANCE

Goulburn Mulwaree Council

Goulburn Mulwaree Council
Highlands Source Project

Job Number	23-13312-15
Revision	0
Date	30 JUL 2010

Threatened Flora
(TECs and Threatened Species)
Sector: Sutton Forest-Exeter

Figure 4(b)

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Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly, qjchung

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

780,000 782,000 784,000 786,000 788,000 790,000 792,000 794,000 796,000

6,168,000 6,166,000 6,164,000 6,162,000 6,160,000

UPPER LACHLAN SHIRE COUNCIL

GOULBURN MULWAREE COUNCIL

WINGECARIBEE SHIRE COUNCIL

CANYONLEIGH

LONG SWAMP CREEK

URINGALLA CREEK

HANGING ROCK

HUME HIGHWAY

HANGING ROCK SWAMP

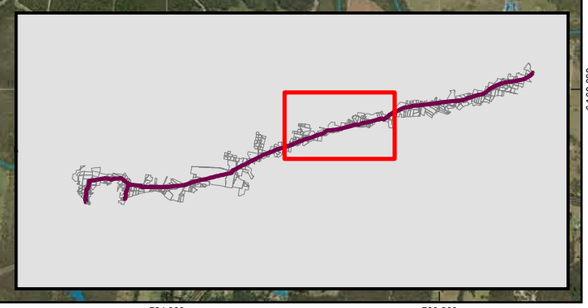
PENROSE SF

PADDYS RIVER

Paddy's River

PADDYS RIVER

BACK CREEK



780,000 782,000 784,000 786,000 788,000 790,000 792,000 794,000 796,000

1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Sector boundary
- Final Pipeline Route

Threatened Flora (Supplementary survey

- Eucalyptus macarthurii

Threatened Flora (EA Survey)

- Eucalyptus macarthurii (1-10 instances)
- Eucalyptus macarthurii (10+ instances, with count)
- Grassy Box-gum Woodland
- Robertson Basalt Tall Open-forest
- Southern Highlands Shale Woodlands

GHD

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GOULBURN MULWAREE COUNCIL

Goulburn Mulwaree Council
Highlands Source Project

Job Number	23-13312-15
Revision	0
Date	30 JUL 2010

Threatened Flora (TECs and Threatened Species) Sector: Paddys River

Figure 4(c)

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G:\21\19089\GIS\Maps\MXD\21_19089__Z008_Conservation_Significance_Fig4.mxd

Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly, qjchung

768,000 770,000 772,000 774,000 776,000 778,000 780,000 782,000 784,000

6,162,000 6,160,000 6,158,000 6,156,000 6,154,000

BRAYTON

CHAPMANS CREEK

JAORIMIN CREEK

LOCKYERSLEIGH CREEK

GOULBURN MULWAREE COUNCIL

WINGECARIBEE SHIRE COUNCIL

BACK CREEK

URINGALLA CREEK

HUME HIGHWAY

MAIN SOUTHERN RAILWAY

MARULAN

WOOLSHED CREEK

ROBERTS CREEK

Marulan

768,000 770,000 772,000 774,000 776,000 778,000 780,000 782,000 784,000

1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Sector boundary
- Final Pipeline Route

Threatened Flora (Supplementary survey

- Eucalyptus macarthurii

Threatened Flora (EA Survey)

- Eucalyptus macarthurii (1-10 instances)
- Eucalyptus macarthurii (10+ instances, with count)
- Grassy Box-gum Woodland
- Robertson Basalt Tall Open-forest
- Southern Highlands Shale Woodlands

GHD CLIENTS | PEOPLE | PERFORMANCE

GOULBURN MULWAREE COUNCIL

Goulburn Mulwaree Council
Highlands Source Project

Job Number	23-13312-15
Revision	0
Date	30 JUL 2010

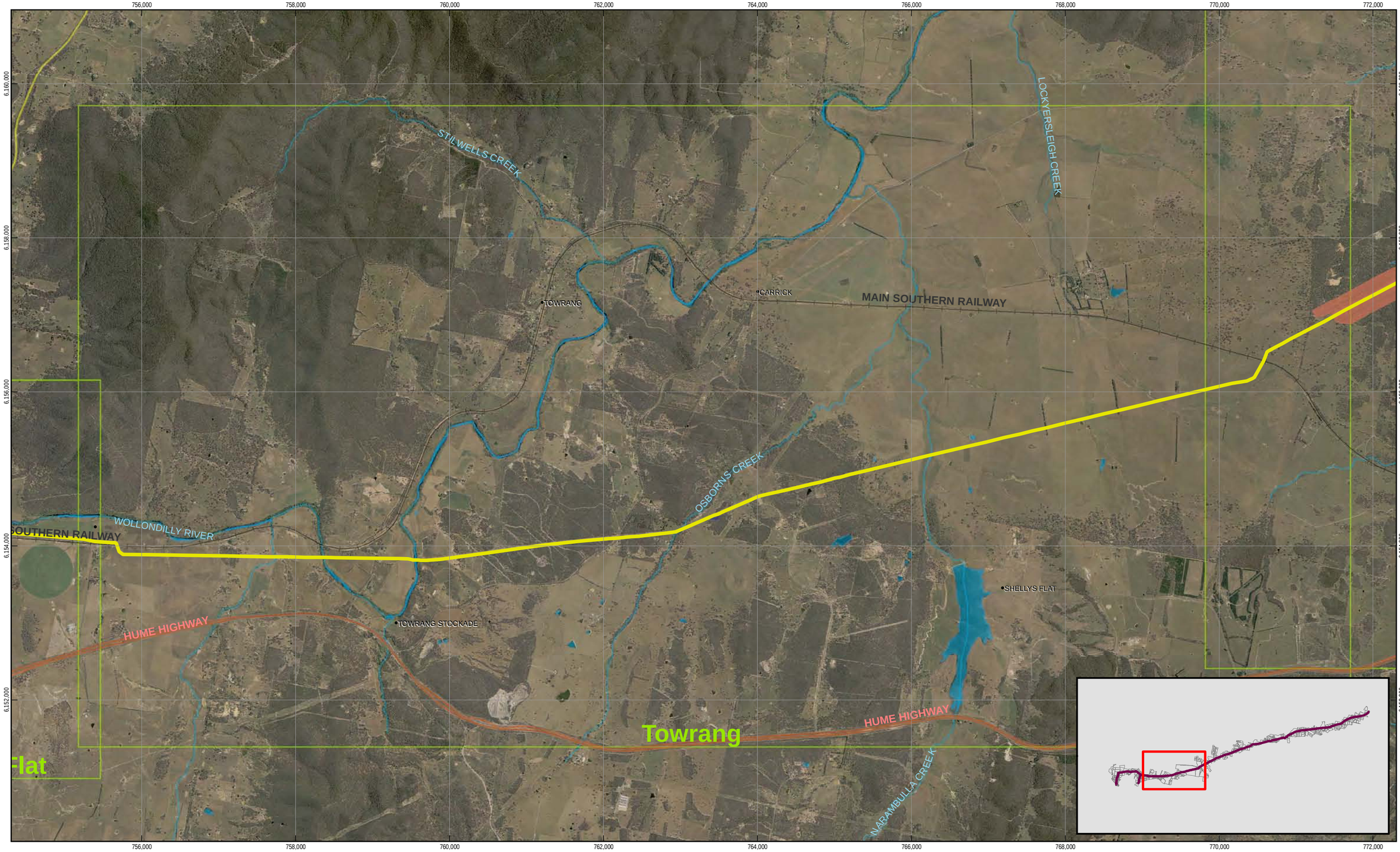
Threatened Flora
(TECs and Threatened Species)
Sector: Marulan

Figure 4(d)

G:\21\19089\GIS\Maps\MXD\21_19089__Z008_Conservation_Significance_Fig4.mxd

Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly, qjchung

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au



1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Sector boundary
- Final Pipeline Route

Threatened Flora (Supplementary survey

- Eucalyptus macarthurii

Threatened Flora (EA Survey)

- Eucalyptus macarthurii (1-10 instances)
- Eucalyptus macarthurii (10+ instances, with count)
- Grassy Box-gum Woodland
- Robertson Basalt Tall Open-forest
- Southern Highlands Shale Woodlands

GHD CLIENTS|PEOPLE|PERFORMANCE

GOULBURN MULWAREE COUNCIL

Goulburn Mulwaree Council
Highlands Source Project

Job Number	23-13312-15
Revision	0
Date	30 JUL 2010

Threatened Flora (TECs and Threatened Species) Sector: Towrang

Figure 4(e)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly, qjchung

1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Sector boundary
- Final Pipeline Route

Threatened Flora (Supplementary survey

- Eucalyptus macarthurii

Threatened Flora (EA Survey)

- Eucalyptus macarthurii (1-10 instances)
- Eucalyptus macarthurii (10+ instances, with count)
- Grassy Box-gum Woodland
- Robertson Basalt Tall Open-forest
- Southern Highlands Shale Woodlands

GHD CLIENTS|PEOPLE|PERFORMANCE

Goulburn Mulwaree Council
Highlands Source Project

Job Number	23-13312-15
Revision	0
Date	30 JUL 2010

Threatened Flora
(TECs and Threatened Species)
Sector: Goulburn-Murrays Flat

Figure 4(f)

G:\21\19089\GIS\Maps\MXD\21_19089__Z008_Conservation_Significance_Fig4.mxd

Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly, qjchung

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4.2 Fauna

4.2.1 Additional Fauna Species

A total 55 birds (of which four are exotic species), eight mammals (two exotic) and one frog were recorded during the supplementary surveys. Of the fauna species recorded, eight species (six birds and two mammals) were not recorded in the initial GHD (2010a) surveys. One additional threatened fauna species was recorded: the Speckled Warbler (*Pyrrholaemus sagittatus*), which is listed as Vulnerable under the TSC Act. The additional fauna species detected probably reflects additional survey effort, rather than any seasonal or spatial trends.

Throughout the overall survey period a total of 144 fauna species were recorded, including eight species of frogs, five reptiles, 104 birds and 25 mammals (including microchiropteran bats). The cumulative fauna species list compiled through the assessment of this Project is presented in Appendix A.

4.2.2 Fauna Habitats

Habitat features and resources are described in terms of the native fauna they may support with specific reference to threatened species previously recorded in the survey corridor.

The habitat assessment identified eight habitat types across the survey corridor. These are described in detail in GHD (2010a) and their distribution mapped in Figure 5. The total mapped area of each habitat type within the survey corridor (as calculated in GIS) is presented in Table 8. The results of the supplementary habitat assessments are summarised in Appendix B.

Table 8 Mapped Areas of Habitat Types within the 400m Survey Corridor

Habitat Type	EA Area (ha)	Supplementary Survey Area (ha)
Forest	583.4	654.1
Forest (Planted)	22.9	50.1
Grassland	1957.6	2080
Mixed Dwelling/Patchy Vegetation	550.2	297.4
Riparian Scrub	11.1	14.7
Sedgeland	1.3	0.7
Shrubland	3.3	6.1
Woodland	106.6	133
Total	**3236.4**	**3236.1**

806,000 808,000 810,000 812,000 814,000 816,000 818,000 820,000 822,000

6,174,000 6,172,000 6,170,000 6,168,000 6,166,000

Fauna Habitat Resources (EA Survey)
- Dense Albcasuarina Stand
- Hollow-Bearing Tree
- Native Aquatic Habitat
- Native Riparian Habitat
- Native Riparian and Aquatic Habitat
- Rock Fragments in Grassland / Grassy Woodland
- Rocky Outcrop
- Termite Mound

Threatened Fauna (EA Survey)
- Brown Treecreeper
- Eastern Bentwing-bat (Definite)
- Eastern Bentwing-bat (Probable)
- Eastern False Pipistrelle (Definite)
- Eastern False Pipistrelle (Probable)
- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Scarlet Robin
- Varied Sitella

Fauna Habitats
- Forest,
- Forest, extrapolated - unsurveyed
- Forest (Planted),
- Forest (Planted), extrapolated - unsurveyed
- Grassland,
- Grassland, extrapolated - unsurveyed
- Mixed Dwelling/Patchy Vegetation,
- Mixed Dwelling/Patchy Vegetation, extrapolated - unsurveyed
- Riparian Scrub,
- Riparian Scrub, extrapolated - unsurveyed
- Sedgeland,
- Sedgeland, extrapolated - unsurveyed
- Shrubland,
- Shrubland, extrapolated - unsurveyed
- Woodland,
- Woodland, extrapolated - unsurveyed

JUNCTION
ARGYLE ROAD
CECIL HOSKINS NP
BONG BONG
GLENQUARRY
GLENQUARRY
SHEEPWASH ROAD
BILLY BILLY FLAT
MOSS VALE
THROSBY PARK
ROBERTSON ROAD
ARGYLE STREET
KELLYS CREEK
WINGECARIBEE RESERVOIR
MOSS VALE UNANDERRA RAILWAY
SUTTON FOREST
NOWRA ROAD
ILLAWARRA HIGHWAY
Glenquarry
YARRUNGA
Werai-Moss Vale
MERYLA SF
MANCHESTER SQUARE
SOUTHERN RAILWAY

1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend
- Final Pipeline Route
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area

Threatened Fauna (Supplementary Survey)
- Scarlet Robin
- Speckled Warbler

Fauna Habitat Reasources (Supplementary Survey)
- Habitat Tree
- Threatened specie

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Fauna Habitat Resources and Threatened Fauna
Sector: Werai - Glenquarry

Figure 5(a)

G:\21\19089\GIS\Maps\MXD\21_19089_Z010_Fauna_Habitats.mxd

Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly, qjchung

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792,000 794,000 796,000 798,000 800,000 802,000 804,000 806,000 808,000

6,170,000 6,168,000 6,166,000 6,164,000 6,162,000

Fauna Habitat Resources (EA Survey)
- Dense Albcasuarina Stand
- Hollow-Bearing Tree
- Native Aquatic Habitat
- Native Riparian Habitat
- Native Riparian and Aquatic Habitat
- Rock Fragments in Grassland / Grassy Woodland
- Rocky Outcrop
- Termite Mound

Threatened Fauna (EA Survey)
- Brown Treecreeper
- Eastern Bentwing-bat (Definite)
- Eastern Bentwing-bat (Probable)
- Eastern False Pipistrelle (Definite)
- Eastern False Pipistrelle (Probable)
- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Scarlet Robin
- Varied Sitella

Fauna Habitats
- Forest,
- Forest, extrapolated - unsurveyed
- Forest (Planted),
- Forest (Planted), extrapolated - unsurveyed
- Grassland,
- Grassland, extrapolated - unsurveyed
- Mixed Dwelling/Patchy Vegetation,
- Mixed Dwelling/Patchy Vegetation, extrapolated - unsurveyed
- Riparian Scrub,
- Riparian Scrub, extrapolated - unsurveyed
- Sedgeland,
- Sedgeland, extrapolated - unsurveyed
- Shrubland,
- Shrubland, extrapolated - unsurveyed
- Woodland,
- Woodland, extrapolated - unsurveyed

ARGYLE STREET
E STREET
SUTTON FOREST
PAYNES CREEK
HODDLES CROSS ROADS
ILLAWARRA HIGHWAY
HUME HIGHWAY
EXETER ROAD
MOORES FLATS
MAIN SOUTHERN RAILWAY
REEDY CREEK
BUNDANOON ROAD
LUTWYCHE
PENROSE SF

Sutton Forest-Exeter

1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend
- Final Pipeline Route
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area

Threatened Fauna (Supplementary Survey)
- Scarlet Robin
- Speckled Warbler

Fauna Habitat Reasources (Supplementary Survey)
- Habitat Tree
- Threatened specie

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Fauna Habitat Resources and Threatened Fauna
Sector: Sutton Forest-Exeter

Figure 5(b)

G:\21\19089\GIS\Maps\MXD\21_19089_Z010_Fauna_Habitats.mxd

Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly, qjchung

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780,000 782,000 784,000 786,000 788,000 790,000 792,000 794,000 796,000

6,168,000 6,166,000 6,164,000 6,162,000 6,160,000

Fauna Habitat Resources (EA Survey)
- Dense Albcasuarina Stand
- Hollow-Bearing Tree
- Native Aquatic Habitat
- Native Riparian Habitat
- Native Riparian and Aquatic Habitat
- Rock Fragments in Grassland / Grassy Woodland
- Rocky Outcrop
- Termite Mound

Threatened Fauna (EA Survey)
- Brown Treecreeper
- Eastern Bentwing-bat (Definite)
- Eastern Bentwing-bat (Probable)
- Eastern False Pipistrelle (Definite)
- Eastern False Pipistrelle (Probable)
- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Scarlet Robin
- Varied Sitella

Fauna Habitats
- Forest,
- Forest, extrapolated - unsurveyed
- Forest (Planted),
- Forest (Planted), extrapolated - unsurveyed
- Grassland,
- Grassland, extrapolated - unsurveyed
- Mixed Dwelling/Patchy Vegetation,
- Mixed Dwelling/Patchy Vegetation, extrapolated - unsurveyed
- Riparian Scrub,
- Riparian Scrub, extrapolated - unsurveyed
- Sedgeland,
- Sedgeland, extrapolated - unsurveyed
- Shrubland,
- Shrubland, extrapolated - unsurveyed
- Woodland,
- Woodland, extrapolated - unsurveyed

CANYONLEIGH
LONG SWAMP CREEK
URINGALLA CREEK
HANGING ROCK
HUME HIGHWAY
HANGING ROCK SWAMP
GOULBURN MULWAREE COUNCIL
WINGECARIBEE SHIRE COUNCIL
PADDYS RIVER
Paddy's River
PADDYS RIVER
BACK CREEK
PENROSE SF

1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend
- Final Pipeline Route
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area

Threatened Fauna (Supplementary Survey)
- Scarlet Robin
- Speckled Warbler

Fauna Habitat Reasources (Supplementary Survey)
- Habitat Tree
- Threatened specie

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Fauna Habitat Resources and Threatened Fauna Sector: Paddys River

Figure 5(c)

G:\21\19089\GIS\Maps\MXD\21_19089_Z010_Fauna_Habitats.mxd

Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly, qjchung

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Fauna Habitat Resources (EA Survey)
- Dense Albcasuarina Stand
- Hollow-Bearing Tree
- Native Aquatic Habitat
- Native Riparian Habitat
- Native Riparian and Aquatic Habitat
- Rock Fragments in Grassland / Grassy Woodland
- Rocky Outcrop
- Termite Mound

Threatened Fauna (EA Survey)
- Brown Treecreeper
- Eastern Bentwing-bat (Definite)
- Eastern Bentwing-bat (Probable)
- Eastern False Pipistrelle (Definite)
- Eastern False Pipistrelle (Probable)
- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Scarlet Robin
- Varied Sitella

Fauna Habitats
- Forest,
- Forest, extrapolated - unsurveyed
- Forest (Planted),
- Forest (Planted), extrapolated - unsurveyed
- Grassland,
- Grassland, extrapolated - unsurveyed
- Mixed Dwelling/Patchy Vegetation,
- Mixed Dwelling/Patchy Vegetation, extrapolated - unsurveyed
- Riparian Scrub,
- Riparian Scrub, extrapolated - unsurveyed
- Sedgeland,
- Sedgeland, extrapolated - unsurveyed
- Shrubland,
- Shrubland, extrapolated - unsurveyed
- Woodland,
- Woodland, extrapolated - unsurveyed

768,000 770,000 772,000 774,000 776,000 778,000 780,000 782,000 784,000

6,162,000 6,160,000 6,158,000 6,156,000 6,154,000

GOULBURN MULWAREE COUNCIL

WINGECARIBEE SHIRE COUNCIL

JAORIMIN CREEK

BACK CREEK

SLEIGH CREEK

URINGALLA CREEK

HUME HIGHWAY

MAIN SOUTHERN RAILWAY

MARULAN

WOOLSHED CREEK

ROBERTS CREEK

Marulan

1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend
- Final Pipeline Route
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area

Threatened Fauna (Supplementary Survey)
- Scarlet Robin
- Speckled Warbler

Fauna Habitat Reasources (Supplementary Survey)
- Habitat Tree
- Threatened specie

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Fauna Habitat Resources and Threatened Fauna
Sector: Marulan

Figure 5(d)

G:\21\19089\GIS\Maps\MXD\21_19089_Z010_Fauna_Habitats.mxd

Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly, qjchung

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Fauna Habitat Resources (EA Survey)
- Dense Albcasuarina Stand
- Hollow-Bearing Tree
- Native Aquatic Habitat
- Native Riparian Habitat
- Native Riparian and Aquatic Habitat
- Rock Fragments in Grassland / Grassy Woodland
- Rocky Outcrop
- Termite Mound

Threatened Fauna (EA Survey)
- Brown Treecreeper
- Eastern Bentwing-bat (Definite)
- Eastern Bentwing-bat (Probable)
- Eastern False Pipistrelle (Definite)
- Eastern False Pipistrelle (Probable)
- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Scarlet Robin
- Varied Sitella

Fauna Habitats
- Forest,
- Forest, extrapolated - unsurveyed
- Forest (Planted),
- Forest (Planted), extrapolated - unsurveyed
- Grassland,
- Grassland, extrapolated - unsurveyed
- Mixed Dwelling/Patchy Vegetation,
- Mixed Dwelling/Patchy Vegetation, extrapolated - unsurveyed
- Riparian Scrub,
- Riparian Scrub, extrapolated - unsurveyed
- Sedgeland,
- Sedgeland, extrapolated - unsurveyed
- Shrubland,
- Shrubland, extrapolated - unsurveyed
- Woodland,
- Woodland, extrapolated - unsurveyed

1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend
- Final Pipeline Route
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area

Threatened Fauna (Supplementary Survey)
- Scarlet Robin
- Speckled Warbler

Fauna Habitat Reasources (Supplementary Survey)
- Habitat Tree
- Threatened specie

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Revision 1
Date 30 JUL 2010

Fauna Habitat Resources and Threatened Fauna
Sector: Towrang

Figure 5(e)

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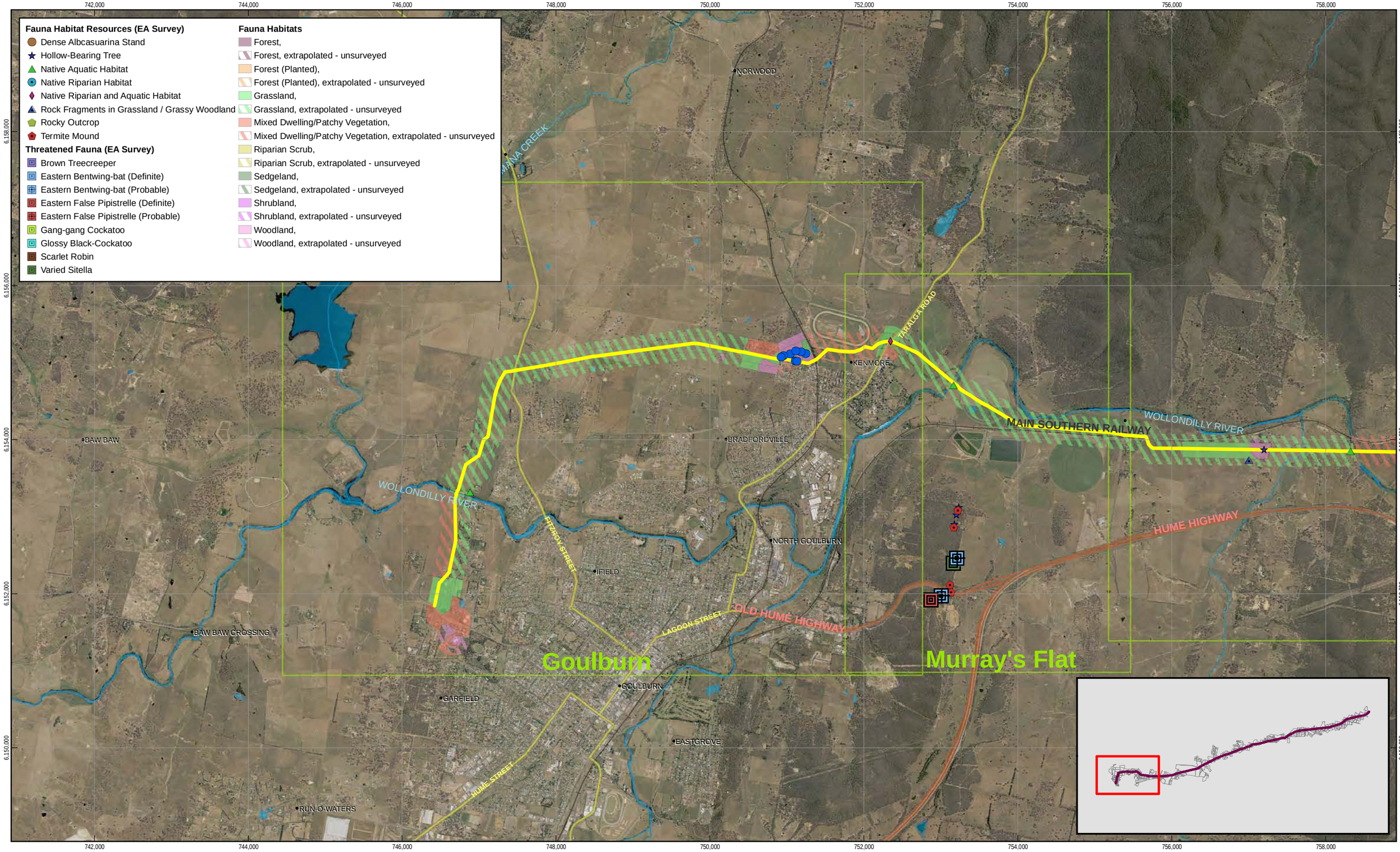
Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly, qjchung



1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Final Pipeline Route
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area

Threatened Fauna (Supplementary Survey)

- Scarlet Robin
- Speckled Warbler

Fauna Habitat Reasources (Supplementary Survey)

- Habitat Tree
- Threatened specie

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Fauna Habitat Resources and Threatened Fauna
Sector: Goulburn-Murrays Flat

Figure 5(f)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly, qjchung

4.2.3 Specific habitat resources

The DEC (2004) guidelines identify 'special habitats' (e.g. water bodies, rocky outcrops and cliffs) that are likely to support specific fauna assemblages. These resources may be significant for threatened species (DECCW, 2009b). The supplementary surveys included additional quantitative surveys for specific habitat resources.

Tree Hollows

The locations of all hollowing bearing trees within the supplementary survey area were captured with a handheld GPS and are shown on Figure 5. The majority of hollow-bearing (habitat) trees were recorded within forest and woodland habitats within the survey corridor, although there were also widely scattered large hollow-bearing paddock trees recorded within grazed pasture grasslands. GIS shape files containing the locations of hollow bearing trees were used in the detailed design process.

The entire final pipeline route has not been surveyed and GPS mapping of individual trees and the final pipeline route is not at a resolution that allows precise calculation of the number of trees that fall within the disturbance footprint. Therefore an estimate of the number of hollow bearing trees was presented in the EA based on broad hollow-bearing tree density classes. An estimated 2287 ha or 78% of the total survey corridor was classed as low density. The relatively low density of hollow-bearing trees can be attributed to past disturbance, associated with extensively modified agricultural landscapes in the eastern portions of the final pipeline route and the existing easements in the western portion.

Hollow-bearing trees may provide suitable diurnal roost sites for threatened tree-roosting microbats, parrots and cockatoos.

The survey corridor contains reasonable amounts of standing and fallen dead timber that would provide shelter and foraging resources for native invertebrates, reptiles and small terrestrial mammals.

Rock Outcrops

Rocky outcrops are present within forest areas on sandstone substrates in the eastern end of the Paddy's River section of the study area. These sections of the route also contain man-made rock piles associated with earthworks for the existing easements. Collectively these features contain shelter habitat for native reptiles and terrestrial mammals, potentially including the Spotted-tailed Quoll.

No caves large or sheltered enough to provide suitable sites for maternity colonies or significant diurnal roost sites for cave-roosting microbats were observed. There were no other large rock outcrops or substantial amounts of rock fragments observed on other substrates in the survey corridor. No areas of optimum habitat for the Pink-tailed Worm Lizard (*Aprasia parapulchella*) were noted in the survey corridor (i.e. native grasslands or grassy woodlands with large amounts of schist or other platey rock fragments - DECC, 2008b) during surveys.

Termite Mounds

The survey corridor contains low to moderate quantities of termite mounds, with the majority occurring in relatively undisturbed native vegetation in the Paddy's River sector but are largely absent from the eastern sectors of the proposed pipeline corridor (i.e. Glenquary, Werai, Moss Vale, Sutton Forest, Exeter), as shown in Figure 5.

4.2.4 Threatened Fauna Species

The Speckled Warbler (*Pyrrholaemus sagittatus*) was recorded in mixed-box grassy woodlands adjoining a drainage line in the Marulan section of the pipeline route. The species was considered a high likelihood of occurrence within the survey corridor in GHD (2010a) and was included in impact assessments and assessments of significance presented in that report.

Two species were recorded in the study area that were subject to a preliminary listing under the TSC Act at the time GHD (2010a) was prepared are now listed as Vulnerable under the Act:

- the Scarlet Robin (*Petroica boodang*); and
- Varied Sitella (*Daphoenositta chrysoptera*).

The Scarlet Robin was recorded at two additional locations in the supplementary surveys.

A total of nine threatened species have been directly recorded in GHD (2010a) and the present surveys:

- Speckled Warbler (*Pyrrholaemus sagittatus*) – Vulnerable (NSW TSC Act);
- Scarlet Robin (*Petroica boodang*) – Vulnerable (NSW TSC Act);
- Varied Sitella (*Daphoenositta chrysoptera*) – Vulnerable (NSW TSC Act);
- Gang-gang Cockatoo *(Callocephalon fimbriatum*) – Vulnerable (NSW TSC Act);
- Glossy Black-cockatoo *(Calyptorhynchus lathami*) – Vulnerable (NSW TSC Act);
- Brown Treecreeper (*Climacteris picumnus victoriae*) – Vulnerable (NSW TSC Act);
- Eastern Bentwing bat (*Miniopterus schreibersii oceanensis*) – Vulnerable (NSW TSC Act)
- Large-footed Myotis (*Myotis macropus*) Vulnerable (NSW TSC Act); and
- Eastern Falsistrellus (*Falsistrellus tasmaniensis*) - Vulnerable (NSW TSC Act).

Previous records and field habitat assessments indicate the potential presence of a further 25 threatened fauna species listed under the TSC or EBPC Acts. The full list of threatened fauna, including their conservation status, habitat requirements, previous records and likelihood of occurrence is presented in GHD (2010a).

4.3 Matters of National Environmental Significance

The EPBC Act MNES previously recorded or predicted to occur within the locality were identified by GHD (2010a) and assessed on their habitat requirements and likelihood of occurring in the survey corridor. The assessment concludes that six threatened fauna species, 22 flora species, no threatened ecological communities and 13 migratory species listed under the EPBC Act are likely to occur in the pipeline easement and hence could be affected by construction and operation of the Project (GHD, 2010a).

4.3.1 Threatened Flora Species

A total of 22 flora species listed under the EPBC Act (6 Endangered, 16 Vulnerable) were assessed as likely to occur in the pipeline easement (GHD, 2010a) and therefore could be affected by construction works.

Of these species one was recorded in field surveys: the Hoary Sunray (*Leucochrysum albicans* var. *tricolor*). This species is listed as endangered under the EPBC Act. A small number of Hoary Sunray

were recorded on the edge of Inland Scribbly Gum – Brittle Gum low woodland vegetation adjacent to the EA pipeline route behind an existing structure at the Goulburn water treatment plant (GHD, 2010a). This species was not recorded within the proposed construction corridor at this location, and was not recorded at any other location along the final pipeline route.

No other EPBC Act listed flora species were recorded during the supplementary surveys and there are no specific habitat resources within the final pipeline route corridor that would affect the likelihood of occurrence of EPBC Act listed flora or the magnitude of potential impacts.

4.3.2 Threatened Fauna Species

No threatened fauna species listed under the EPBC Act were recorded during field surveys. The assessment of likelihood of occurrence presented in GHD (2010a) reveals six threatened fauna species listed under the EPBC Act that could occur within the survey corridor and be affected by the Project. There are no specific habitat resources within the final pipeline route corridor that would affect the likelihood of occurrence of EPBC Act listed fauna or the magnitude of potential impacts.

4.3.3 Endangered Ecological Communities

Box-gum Woodland, listed as critically endangered under the EPBC Act, was recorded within the Marulan area outside of the survey corridor in (GHD, 2010a) and was recorded at two points within the final pipeline construction during supplementary surveys. An assessment of the significance of impacts of the Project on this EEC according to the EPBC Act assessment criteria (DEWHA 2009a) is presented in Appendix D and is discussed in Section 5.5.2 of this report.

4.3.4 Migratory Species

A number of listed migratory bird species are likely to use habitats in the survey corridor based on direct observations during field surveys, habitat assessments and database search results (refer Appendix A and GHD, 2010a).

The migratory birds identified are wide ranging and nomadic across NSW and could occur within the final pipeline corridor on a transient or temporary basis, depending on season, weather patterns and breeding cycles. No important habitat resources for migratory species were identified in the final pipeline route corridor and so these species are only likely to occur in flight or temporarily during seasonal migrations.

5. Impact Assessment

This Chapter assesses the potential impacts of the Project during construction and operation on flora and fauna and their habitats.

5.1 Construction Impacts

5.1.1 Construction Activities

The assessment of the likely impacts of construction activities on flora and fauna is based on the description of the proposed works summarised in Section 2.2.3 and described in detail in GHD (2010). The key construction activities that will involve direct impacts on native biota will be (i) site preparation and vegetation clearing (ii) trenching for the pipeline and (iii) construction of waterways and infrastructure (i.e. rail, road and services) crossings.

Further details of these impacts are provided below.

5.1.2 Construction Footprints

The final pipeline would be approximately 81 km long as shown in (Figure 1), which is a reduction of two kilometres from the length of the raw water pipeline presented in the EA. Indicative footprints for the proposed project infrastructure are summarised in Table 9 along with an evaluation of potential impacts arising from their construction.

Table 9 Construction Footprints for Project Infrastructure and Evaluation of Impacts

Project Infrastructure	Temporary Impacts	Permanent Impacts
Final Pipeline Construction (trenching) and ancillary activities in native vegetation.	Direct disturbance of a 6 m wide temporary construction corridor (where not constrained by other services and topography), including vegetation removal, trenching, stockpiling of trench spoil and movement of machinery.	Maintenance of a 6 m wide easement as an access corridor for maintenance and monitoring activities, comprising rehabilitated grass land suitable for 4WD access.
Final Pipeline Construction (trenching) in non-native vegetation (pasture, grazing land, grassland, disturbed vegetation and plantations).	Direct disturbance of a 10 m wide temporary construction corridor, including vegetation removal, trenching, stockpiling of trench spoil and movement of machinery. Modification of habitat within a further 10 m corridor to be used for vehicle access, temporary stockpiles and workers compounds (a total disturbance footprint of up to 20 m wide, reduced wherever possible). Topsoil and groundcover vegetation will be removed for the entire	Maintenance of a 6 m wide easement as an access corridor for maintenance and monitoring activities, comprising rehabilitated grass land suitable for 4WD access.

Project Infrastructure	Temporary Impacts	Permanent Impacts
	construction corridor (up to 20 m wide) to prevent compaction of topsoil across the construction corridor. Topsoil will be stockpiled separately and reinstated post construction.	
Waterway crossing (underboring under Narrambulla Creek W84; pipe laying and anchoring across Wollondilly River crossings W105, W119 and W131).	Impacts on aquatic habitats, as assessed in GHD (2010c). Direct disturbance of a 6 m wide temporary construction corridor, including riparian vegetation removal, underboring and or pipelaying and associated movement of machinery.	Impacts on aquatic habitats, as assessed in GHD (2010c). Maintenance of a 6 m wide easement as an access corridor through adjoining riparian vegetation for maintenance and monitoring activities, comprising rehabilitated grass land, with allowance for 4WD access to, but not across waterways.

The final pipeline route corridor is located, for the most part, adjacent to existing infrastructure easements that have previously been cleared and either remain cleared or have regenerating vegetation present. From Wingecarribee Reservoir, the pipeline route corridor largely runs adjacent to existing power line easements until it crosses the Hume Highway. After crossing the Hume Highway, the pipeline route would be located adjacent to and outside of an existing gas pipeline easement (the Moomba to Sydney Gas Pipeline), which it follows almost the entire way to Goulburn.

5.1.3 Vegetation Clearing During Construction

Estimates of vegetation and fauna habitat clearing associated with construction activities were obtained by overlaying indicative construction footprints listed in Table 9 as buffers around the final pipeline route with GHD vegetation and habitat mapping using GIS. The locations and detailed design of project infrastructure and final construction details would not be finalised until a construction contractor is engaged. Therefore, this impact assessment is based on infrastructure footprints that have been located within an indicative construction corridor surrounding the final pipeline route. The centreline of the proposed pipeline easement has been used to calculate areas of permanent vegetation removal in GIS, with a 'buffer' of 3m (for a 6 m total width) either side of the centreline in areas of native vegetation and a buffer of 10 m (for a 20 m total width) either side of the centreline in areas of non-native vegetation. It is noted, however, that in practice, the pipeline trench and associated clearance corridor may not follow the centreline of the easement and therefore the estimates of vegetation clearance are approximate only.

The locations of temporary construction features, such as access roads, construction laydown areas and site compounds, are yet to be confirmed. The construction corridor would be confined to existing cleared, disturbed areas as far as is practicable. Therefore, the proposed construction corridor is presented as an estimated maximum direct disturbance area.

The nature and duration of both direct and indirect impacts arising from the Project are described in detail in the GHD (2010a) Ecological Impact Assessment. The type, severity and duration of impacts associated with construction of the final pipeline route are assumed to be equivalent to those presented in the EA. However, the extent of impacts and the vegetation communities affected has changed along with the realignment of the pipeline route as described below.

The construction corridor will be located, for most of its length, adjacent to existing cleared easements. Between Goulburn and Marulan the proposed pipeline corridor adjoins the southern boundary of the 25 m wide cleared easement for the Sydney-Moomba Gas Pipeline, and between Marulan and Wingecarribee, the pipeline adjoins a cleared power line easement. Hence, the clearing associated with the Project will essentially be widening existing easements, rather than creating a new easement through vegetated areas.

Construction of the Project would require the removal or modification of vegetation that currently occupies the final pipeline construction corridor, as follows:

- Permanent removal or modification of approximately 47 ha of vegetation of which approximately 9.8 ha (21 %) is native vegetation;
- Temporary disturbance of a total of 125 ha of non-native vegetation the majority of which is exotic pasture grasses within grazing land. Understorey vegetation would be allowed to regenerate within the 14 m of this corridor outside of the 6 m access corridor.

Table 10 presents the estimated extent of removal or modification of native vegetation by vegetation type and compares the extent of impacts with the estimates provided for the EA pipeline route (GHD, 2010a).

Table 11 presents the estimated extent of impacts on non-native vegetation communities and compares the extent of clearing with the estimates provided for the EA pipeline route (GHD, 2010a).

Table 12 presents the estimated extent of impacts of TECs and compares the extent of clearing with the estimates provided for the EA pipeline route (GHD, 2010a).

The total extent of clearing has been reduced through detailed design of the final pipeline route; however the quantum of clearing has also changed with revisions to vegetation mapping and the identification of EECs.

Table 10 Removal and Modification of Native Vegetation Communities within 6 m Construction Corridor

Vegetation Type	TSC Act Status	EPBC Act Status	EA Pipeline Route	Final Pipeline Route
Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills of the South Eastern Highlands	EEC (SHSW)		1.2	1.3
Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands			1.6	1.6
Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands of the South Eastern Highlands			0.7	0.7
River Peppermint - Narrow-leaved Peppermint open forest on sheltered escarpment slopes, Sydney Basin and South East Corner[a]	EEC (SHSW)		0.95	1
Silvertop Ash - Blue-leaved Stringybark shrubby open forest on ridges of the north east South Eastern Highlands			3.3	3.2
Swamp Gum - Ribbon Gum woodland on poorly-drained flats of the South Eastern Highlands	EEC (SHSW)		2.1	1.9
Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands and South East Corner[b]			0.06	<0.01
Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands	EEC (B-GW)	CEEC (B-GW)	0	0.1
Riparian Vegetation			0.2	<0.01
Freshwater Sedgelands			0.01	<0.01
Total			**10.2**	**9.8**

a -Includes 0.17 ha which was mapped as 'Ribbon Gum - Narrow-leaved Peppermint grassy open forest on basalt plateaux of the Sydney Basin and South Eastern Highlands' in GHD (2010a).

b -Includes all areas mapped as 'Sydney Peppermint – Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin' in GHD (2010a).

Table 11 Removal and Modification of Non-native Vegetation Communities during Construction

Vegetation Community	EA Pipeline Route		Final Pipeline Route	
	Permanent Removal	Temporary Disturbance	Permanent Removal	Temporary Disturbance
	10m wide	*20m wide*	*6 m wide*	*20m wide*
Acacia regrowth	0.23	0.4	0.1	0.5
Disturbed Agricultural and Grazing Land	48.98	98	34.2	114.2
Mixed Dwelling/Patchy Vegetation[a]	8.58	-	2.3	7.9
Planted / Exotic Vegetation	0.34	0.7	0.6	2.1
Total	**58.13**	**99.1**	**37.2**	**124.7**

a – treated as a 'native vegetation community in GHD (2010a).

Table 12 Removal and Modification of Threatened Ecological Communities during Construction (6m corridor)

Threatened Ecological Community	EA Pipeline Route		Final Pipeline Route	
	Mapped Area within survey corridor (ha)	Permanent Removal or Modification (ha)	Mapped Area within survey corridor (ha)	Permanent Removal or Modification (ha)
Southern Highlands Shale Woodlands	314	4.3 (1.4%)	201	2.3 (1.1%)
Robertson Basalt Tall Open-forest	0.49	0	0.5	0
Box-gum Woodland	0	0	20.6	0.1 (0.49%)

5.1.4 Impacts on Fauna and Habitats during Construction

The project would cause displacement or mortality of fauna that reside or roost within the construction corridor at the time of construction activities and remove habitat resources. Construction of the Project would have a direct negative effect on habitat for native flora and fauna through vegetation clearing and associated removal of foraging habitat and shelter, nesting and roosting resources. This clearing will have additional negative effects on the quality of habitats in the broader locality through edge effects, fragmentation of habitat and the disruption of vegetated habitat corridors. Given the extent of native vegetation within and adjacent to the survey corridor, it is likely that local fauna populations would persist in alternative habitat outside the construction corridor. There are approximately 1250 ha of habitat containing trees or shrubs within the 400 m survey corridor (Table 8) that could provide refuge and/or alternative habitat for displaced fauna, with much larger stands of similar habitat throughout the surrounding locality. The supplementary surveys did not reveal any additional records of fauna species or specific habitat resources that would increase the severity or duration of impacts associated with the final pipeline route relative to the assessment in the EA (GHD, 2010a and 2010b). The extent of habitat removal and the distribution of impacts have varied with the realignment of the pipeline as described below.

The areas (in hectares) of habitat types to be cleared during construction are listed below in Habitat trees, including hollow-bearing trees, are an important resource for hollow-dependent native fauna. Due to land access constraints and limitations of GIS it was not possible to obtain an accurate count of hollow bearing trees to be removed. As discussed in Section 4.2.3 estimates of the density of hollow bearing trees across the survey corridor were presented in GHD (2010a). It is estimated, based on large-scale density classes mapped in GIS that between 56 to 257 hollow-bearing trees would be removed for construction of the pipeline (GHD, 2010a). The quantum of these estimates has not changed with revision of the pipeline route because of the degree of variation in the estimate provided. A final count of the number of hollow bearing trees to be removed would be obtained from the proposed pre-clearing surveys and addressed in the Offset Plan (refer Section 6.5).

Table 13. The Project would require the permanent removal of approximately 9.8 ha of forest and woodland habitat during construction and conversion to a 6 m wide strip of derived grassland along the final pipeline route. This is a small proportion (0.01 %) of the estimated total of 787 ha of native woodland and forest within the survey corridor. The project would have a negligible effect on habitat resources in sedgeland and riparian scrub (<0.01The majority of habitat to be affected is derived grassland within agricultural country, which represents 69 % of the total area of permanent habitat removal.

The post-construction landform would be allowed to regenerate to grassland approximately equivalent to its pre-disturbance condition and would provide equivalent habitat value (as grazing land) for native fauna in the short to medium term.

Habitat trees, including hollow-bearing trees, are an important resource for hollow-dependent native fauna. Due to land access constraints and limitations of GIS it was not possible to obtain an accurate count of hollow bearing trees to be removed. As discussed in Section 4.2.3 estimates of the density of hollow bearing trees across the survey corridor were presented in GHD (2010a). It is estimated, based on large-scale density classes mapped in GIS that between 56 to 257 hollow-bearing trees would be removed for construction of the pipeline (GHD, 2010a). The quantum of these estimates has not changed with revision of the pipeline route because of the degree of variation in the estimate provided. A final count of the number of hollow bearing trees to be removed would be obtained from the proposed pre-clearing surveys and addressed in the Offset Plan (refer Section 6.5).

Table 13 Removal and Modification of Habitat Types during Construction

Habitat Type	EA Pipeline Route		Final Pipeline Route	
	Permanent Removal (ha)	Temporary Disturbance (ha)	Permanent Removal (ha)	Temporary Disturbance (ha)
Native vegetation construction corridor	*6m wide*	n/a	*6m wide*	n/a
Forest	8.25	"	8.4	"
Riparian Scrub	0.21	"	<0.01	"
Sedgeland	0.04	"	<0.01	"
Woodland	1.63	"	1.4	n/a
Non-native vegetation construction corridor	*10m wide*	*20m wide*	*6m wide*	*20m wide*
Forest (Planted)	0.34	0.65	0.6	2.1
Grassland	48.98	98.02	32.2	107.9
Mixed Dwelling/Patchy Vegetation[a]	8.58	n/a	4.3	14.2
Shrubland	0.23	0.43	0.1	0.5
Total	**68.26**	**99.10**	**47.02**	**124.7**

5.2 Operational Impacts

An assessment of the potential impacts on flora and fauna from the operational phase of the Project is provided in GHD (2010a). Changes to the operation of the Project will not result in any changes to the nature or magnitude of impacts on the natural environment. The supplementary surveys did not reveal any specific species or habitats that are likely to be more sensitive to operational activities. Therefore the Preferred Project would result in equivalent operational impacts equivalent to those described in the EA.

5.3 Key Threatening Processes

5.3.1 Identification of KTPs

The proposed activity will directly contribute to the operation of six key threatening processes (KTPs) as identified in GHD (2010a):

- Clearing of native vegetation;
- Loss of hollow-bearing trees;
- Removal of dead wood and dead trees;

- The degradation of native riparian vegetation along New South Wales water courses;
- Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.
- Invasion of native plant communities by exotic perennial grasses.

Of these KTPs two would have the magnitude or extent of their operation as a result of the Project affected by the proposed amendments presented in the PPR:

- The extent of 'Clearing of native vegetation' has been reduced by 0.35 ha (from 10.15 ha to 9.8 ha) through realignment of the pipeline and supplementary survey and identification of disturbed or cleared land as described in Section 5.1.3 ; and
- The extent of 'Loss of hollow-bearing trees' is likely to be reduced during construction, as the pipeline has been realigned to avoid more trees and vegetation than previously. However, the estimated number of hollow bearing trees to be removed has not been re-calculated, as described in Section 5.1.4.

With the implementation of mitigation and offset measures outlined in GHD (2010a), the revised Project is not likely to comprise a significant contribution to the operation of any KTPs.

5.4 Impacts on Threatened Biota

5.4.1 Assessments of Significance

GHD (2010a) prepared Assessments of Significance for all identified 'affected entities', including threatened flora species, EECs and threatened fauna species recorded or considered likely to occur within the survey corridor. These Assessments have been reconsidered, taking into account supplementary survey effort and amendments to the Project. The conclusion of these Assessments is that the construction and operation of the Project is unlikely to impose significant adverse effects on any populations of threatened biota, based on the following considerations:

- The quantity of habitat for threatened species and EECs to be removed is relatively small (9.8 ha of native vegetation, 0.01% of that present in the survey corridor) and the extent of clearing proposed is unlikely to fragment any populations or isolate any areas of habitat;
- The amount of vegetation and habitat to be removed for construction within the Final Pipeline route is equivalent, or less than, the impacts associated with the EA pipeline route;
- Direct impacts on threatened biota recorded within the survey corridor are likely to be relatively minor, specifically:
  - The numbers of individuals of Camden Woollybutt (*Eucalyptus macarthurii*) to be removed are likely to be relatively low in comparison to the total number recorded and to the areas of habitat that will remain unaffected on adjoining lands;
  - The proposed construction would permanently remove approximately 2.3 ha of SHSW which is a minor proportion (1.14%) of the total area mapped within the 400 m survey corridor and a small fraction of the total known distribution of this community;
  - The proposed construction is likely to affect a small proportion of resident threatened fauna populations, given the removal of only 9.8 ha of native vegetation, the maximum construction corridor width of 6 m and the presence of 787 ha of alternative native woodland and forest habitat in the survey corridor;

- Construction would remove some valuable habitat resources, including hollow-bearing trees, rock outcrops and termite mounds, but would affect a minor proportion of the total available resource in the surrounding locality. There is no evidence that any specific habitat resources to be removed are critical to the maintenance of any populations of threatened biota;
- Pre-clearing surveys, as proposed in GHD (2010a), would further reduce the numbers of threatened plants to be removed, the likelihood of direct impacts on threatened fauna and the quantity of hollow-bearing trees and other habitat resources to be removed; and
- The Project would not result in any permanent barriers, significant gaps in habitat or otherwise inhibit the movement of migratory or nomadic fauna along recognised corridors or linkages in the locality or region.

The TEC Box-gum Woodland was recorded in the disturbance footprint for the final pipeline route during the supplementary surveys and so a detailed consideration of impacts on the community is included below.

5.4.2 Box-gum Woodland

A Part 3A Assessment of Significance has been undertaken for the Box-gum Woodland and is provided in Appendix C. The outcome of this assessment is that the Project is not likely to have a significant adverse effect on Box-gum Woodland, based on the following considerations:

- Direct negative impacts arising from the Project will affect only 0.01 ha of Box-gum Woodland, comprising 0.49% of the mapped extent of the community within the survey corridor. The local population of the EEC would also include additional adjoining areas of native vegetation;
- The disturbance footprint would be restricted to a 6 m wide strip through the EEC and adjoining areas of native vegetation and would not significantly fragment or isolate any areas of habitat for the EEC or component species; and
- Standard environmental management measures are likely to mitigate against any additional impacts on the community outside of the immediate disturbance footprint.

Further, the proposed Offset Plan will include the conservation and management of Box-gum Woodland and related vegetation types within the offset sites. The Offset Plan would be developed so as to ensure that improvements in the extent and/or condition of the TEC within the offset sites would compensate for the removal of approximately 0.01 ha of the community and produce a net gain in its regional conservation.

5.5 Impacts on Matters of National Environmental Significance

5.5.1 Assessment of Impacts

GHD (2010a) prepared Assessments of the Significance of impacts on MNES recorded or considered likely to occur within the survey corridor with reference to the EPBC Act *Significant Impact Guidelines* (DEWHA, 2009a).

A number of species listed under the EPBC Act are known or predicted to occur in the survey corridor. The Project will remove potential habitat for these species. The assessment of the significance of impacts on EPBC Act listed threatened species referred to the Assessments of

Significance for TSC Act listed species (GHD 2010a). This approach was adopted since the EP&A Act Part 3A assessment criteria overlap with or mirror those for the EPBC Act. These Assessments have been reconsidered, taking into account supplementary survey effort and amendments to the Project. The conclusion of these Assessments is that the construction and operation of the Project is unlikely to impose significant adverse effects on any populations of threatened biota including EPBC Act listed species (refer Section 5.4.1).

Native vegetation consistent with the EPBC Act listed TEC Box-gum Woodland was recorded during the supplementary surveys. The Project would result in direct negative impacts on this CEEC and so a Referral to DEWHA will be prepared to determine whether the Project is a 'controlled action' within the meaning of the EPBC Act. Therefore an assessment of significance of impacts on this community has been prepared in accordance with the DEWHA (2009a) guidelines and is included as Appendix D and summarised below.

A number of listed migratory species were recorded during the field surveys or may occur within the locality based on the results of the desktop assessments. Direct negative impacts arising from the Project would affect only small areas of marginal migratory bird habitat and the Project is unlikely to impose 'a significant impact' on any of the listed migratory fauna species predicted to occur within the locality (GHD, 2010a). No additional migratory species or their habitats were recorded in the supplementary surveys that would affect the outcome of this assessment.

5.5.2 Box-gum Woodland

Direct negative impacts arising from the Project will directly affect only 0.01 ha of Box-gum Woodland, comprising 0.49% of the mapped extent of the community within the survey corridor. The local population of the EEC would include additional adjoining areas of native vegetation. The disturbance footprint would be restricted to a 6 m wide strip through the EEC and adjoining areas of native vegetation and would not significantly fragment or isolate any areas of habitat for the EEC or component species. Standard environmental management measures are likely to prevent any additional impacts. Therefore the Project is not likely to have a significant negative impact on Box-gum Woodland.

5.5.3 Conclusions

The Project would result in direct negative impacts on Box-gum Woodland and so a Referral to DEWHA will be prepared to assist the department determine whether the Project is a Controlled action in accordance with the EPBC Act. On the basis of the assessments undertaken, it is concluded that the Project is unlikely to impose a significant impact on Box-gum Woodland or any other MNES and hence is unlikely to constitute a controlled action as defined under the EPBC Act.

6. Mitigation of Impacts

6.1 Approach

Measures to mitigate biodiversity loss arising from the proposed pipeline construction are presented in GHD (2010a) according to the hierarchy of avoidance; mitigation and offsetting of impacts, as outlined in the guidelines for Part 3A projects adopted by DECCW (DEC and DPI, 2005). A Biodiversity Management Strategy for the Project has been developed through collaboration with the pipeline design team and GMC and through consultation with DECCW. Supplementary surveys conducted as part of this assessment comprise the first stage of the Strategy.

The avoidance and/or minimisation of impacts on the environment and contribution to the maintenance or improvement of biodiversity values are core principles for the Project. Conservation of the biological diversity of the local area has been a key issue during the alignment identification and selection process and through the detailed design phase (see below).

Specific mitigation measures have been incorporated into the Project design to minimise such impacts on the natural environment within the pipeline corridor, and in particular to reduce potential impacts on threatened species and their habitats. Despite the proposed mitigation, the pipeline construction would result in some unavoidable residual adverse impacts imposed upon some elements of the natural environment, including clearing of vegetation representative of EECs, threatened flora species and habitat for threatened fauna. An Offset Plan will be prepared to provide appropriate biodiversity offset to compensate for residual impacts of the Proposal that cannot be mitigated or avoided.

6.2 Biodiversity Management Strategy

A strategy for the further assessment and management of biodiversity values associated with the Project has been discussed and agreed with DECCW as part of the Adequacy Review of the EA (as per meeting 24/03/10). The key actions are:

- Additional targeted surveys to more accurately describe and quantify the biodiversity values of the survey corridor and the offset sites, completed in May and June 2010 and presented in this report;
- Refinement of the pipeline corridor through the detailed design phase, in response to data obtained from the additional field surveys to further avoid direct impacts on biodiversity values completed in May to July 2010 and presented in this report;
- Preparation of a Flora and Fauna Management Plan (FFMP) including detailed site-specific/species-specific mitigation measures and environmental management protocols to be implemented before, during and post construction to further avoid or reduce impacts on threatened biodiversity. The FFMP is currently under preparation and will be finalised before construction; and
- Preparation of an Offset Plan, developing the conceptual material presented in Section 6.5 of this Chapter. The Offset Plan is currently under preparation.

6.3 Avoidance of Impacts

Direct impacts on remnant forest and woodland and fauna habitats have been avoided to a large extent by aligning the final pipeline along existing easements to the greatest extent possible. The Project would widen the existing disturbed easements and hence for the majority of the alignment construction would affect a narrow linear strip of partially degraded habitat.

In addition, existing access are to be used as far as possible to access the pipeline during the construction and operational phases of the Project. Where additional access tracks are required they will be located through existing cleared lands.

Refinement of the final pipeline route through the detailed design phase has further avoided direct impacts on biodiversity values. Adjustments to the alignment of the pipeline in response to data obtained from field surveys has included avoidance of *Eucalyptus macarthurii*, EECs, mature trees and the Kenmore Creek wetland. Notably the pipeline was realigned to substantially avoid a patch of Box-gum Woodland that was detected during supplementary surveys. Residual impacts on this community have been reduced to the removal of just 0.1 ha of vegetation.

The results of the supplementary vegetation area searches and habitat assessments are summarised in Appendix B along with an assessment of the conservation significance of each portion of the pipeline and proposed mitigation measures. The majority of additional threatened biota and habitat resources identified through the supplementary surveys were avoided through realignment of the final pipeline route or restriction of construction impacts to a 6 m corridor.

Avoidance of the requirement to clear native vegetation and fauna habitats as far as possible has significantly reduced the potential for adverse impacts of the pipeline on biodiversity values.

6.4 Mitigation of Impacts

Specific mitigation measures have been incorporated into the Project design to minimise impacts on the natural environment as described in GHD (2010a).

A Flora and Fauna Management Plan (FFMP) is currently under preparation as a sub-plan to the CEMP and OEMP for the Project. The FFMP will be finalised in consultation with DECCW prior to the construction phase. The FFMP would include but not be restricted to the key generic protocols for the protection of threatened flora, fauna and their habitats outlined in GHD (2010a). More detailed species-specific management and mitigation protocols for threatened biota affected by the Project will be developed and documented in detail in the FFMP.

The FFMP will include measures for the management of additional ecological constraints identified in the supplementary surveys, such as Box-gum Woodland as well as respond to specific issues identified in submissions to the EA.

6.5 Offsetting of Impacts

The DEC and DPI (2005) guidelines include the requirement that the proposed activity must ‘improve or maintain’ biodiversity values (i.e. there is no net impact on threatened biota or native vegetation). GHD (2010a) identified residual impacts arising from the Project that will require biodiversity offsets in order to ‘improve or maintain’ biodiversity values. Residual impacts arising from the Project have been reduced through detailed design of the final pipeline route and other amendments presented in this report. The revised residual impacts that will require offsets are as follows:

- The removal or modification of up to 9.8 ha of native vegetation, including approximately 2.3 ha of Southern Highlands Shale Woodland and 0.1 ha of Box-gum Woodland;
- Removal of individuals of Camden Woollybutt; and
- Removal or modification of habitat resources for native fauna species, including threatened woodland birds and microchiropteran bat species listed under the TSC Act. Habitats to be removed include native vegetation, rock outcrops, termite mounds and hollow-bearing trees. These habitats (at least in part) constitute potential habitat for a range of threatened species.

The biodiversity Offset Plan will be developed through ongoing consultation with DECCW and other relevant stakeholders. The Plan will be informed by data collected as part of the current study and during pre-clearing surveys. The Offset Plan is underpinned by the offset sites proposed by GMC as described in GHD (2010a) but may include alternative or additional offset sites or actions. The Offset Plan will contain detailed information to demonstrate how unavoidable impacts on threatened flora and fauna species and ecological communities will be adequately compensated for in the final offset package.

7. Conclusions

7.1 Summary of Key Findings

The scope of the current investigation included supplementary field surveys and re-assessment of impacts on native biota based on revisions to the Project. Supplementary survey effort included:

- Flora quadrats (30 additional quadrats) and area searches, fauna habitat assessments and targeted threatened flora surveys over adjoining accessible portions of the survey corridor;
- Revised vegetation mapping;
- Diurnal bird surveys (40 mins at and additional 2 sites); and
- Call playback for forest owls and arboreal fauna (an additional 2 sites); and
- Spotlighting for nocturnal fauna (an additional 2 locations, 4 hours covering a distance of 2 km).

A number of additional Camden Woollybutt (*Eucalyptus macarthurii*) individuals were detected in previously unsurveyed portions of the pipeline corridor. The majority of these were isolated paddock trees that were successfully avoided through detailed design of the final pipeline route.

An additional EEC, Box-gum Woodland, was identified in the pipeline corridor and the final pipeline was re-aligned to minimise impacts on the largest single patch of the community. The extent and distribution of Southern Highlands Shale Woodlands was refined through supplementary survey and desktop refinement of vegetation mapping.

Supplementary surveys confirmed the presence of one additional species of threatened fauna: the Speckled Warbler. The extent and distribution of habitat resources for native fauna was refined through supplementary survey and desktop refinement of mapping.

The construction corridor is likely to provide habitat for the seven threatened fauna species identified within the survey corridor and a number of other species considered likely to occur (at least on occasion). Impacts on fauna would include potential displacement or mortality of individuals and removal of habitat resources. Clearing will have additional negative effects on the quality of habitats in the broader locality through edge effects and incremental fragmentation of habitat.

Estimates of vegetation removal obtained through GIS analysis suggest that construction of the final pipeline would result in the permanent clearing of 9.8 ha of native vegetation and disturbance of 124.7 ha of non-native vegetation. The majority of habitat to be affected is derived grassland within agricultural country which represents 69 % of the total area of the construction corridor. The post-construction landform in these areas would be allowed to regenerate to grassland approximately equivalent to its pre-disturbance condition and would provide equivalent habitat value (and grazing land) for native biota in the medium to long term. The 9.8 ha of native vegetation removed during construction would be converted to a 6 m wide strip of derived grassland along the final pipeline route. This is a small proportion (0.01 %) of the estimated total of 788 ha of native vegetation within the survey corridor and is likely to comprise a minor impact on populations of native biota.

The native vegetation to be permanently removed during construction includes 2.3 ha of Southern Highlands Shale Woodland, 0.1 ha of Box-gum Woodland as well as potentially up to 100 individuals and associated habitat for the Camden Woollybutt. No individuals of Hoary Sunray would be directly affected.

Measures to mitigate permanent unavoidable biodiversity loss arising from the proposed pipeline construction have been identified according to the hierarchy of 'avoidance-mitigation-offsetting' of impacts. A key measure in the avoidance of biodiversity loss has been the alignment of the final pipeline along existing cleared easements and impacts will be further substantially mitigated through the narrowing of the construction corridor to a maximum of 6 m width where sensitive environments occur, which includes native vegetation, creek crossings and wetlands.

A Biodiversity Management Strategy for the further assessment and management of biodiversity values associated with the Project is underway. As part of this Strategy, supplementary surveys have been completed and the final pipeline route has been realigned to further reduce direct impacts on biodiversity values.

A Flora and Fauna Management Plan (FFMP) and a Biodiversity Offset Plan are currently being prepared in consultation with GMC and DECCW and will include further detail of how to avoid and mitigate impacts and how residual impacts on threatened biota will be addressed through offset sites.

These actions will be included in the Final Statement of Commitments in the EA and if Project Approval is granted under Part 3A of the EP&A Act, would form part of the Conditions of Consent.

7.2 Key Thresholds

According to the DEC and DPI (2005) assessment guidelines for Part 3A projects, a justification of the preferred option based on the following key thresholds must be included. The application of these thresholds to the Project has been reassessed according to the amendments presented in this report.

Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts would maintain or improve biodiversity values.

The Project design includes measures to avoid, mitigate and offset impacts on biodiversity values associated with construction of the final pipeline as provided in Section 6. The final pipeline route has been selected to avoid significant adverse effects on biodiversity values by positioning the majority of the pipeline corridor adjacent to existing cleared easements. Impacts have been further reduced through micro-realignment of the final pipeline route to avoid threatened plants, TECs, mature trees and other constraints where possible.

Specific impact mitigation and environmental management measures will be developed for specific threatened species and EECs and included in a Flora and Fauna Management Plan (FFMP) (refer Section 6.4).

Despite the application of avoidance and mitigation measures the project would result in residual impacts on biodiversity values. Construction of the final pipeline would require the permanent removal of approximately 9.8 ha of native vegetation, of which approximately 2.4 ha is consistent with a TEC. These impacts are less than those presented in the GHD (2010a) assessment of the EA pipeline route, reflecting the avoidance of impacts through detailed design. An Offset Plan would be developed in consultation with DECCW to compensate for these residual impacts and to ensure that biodiversity values are maintained in the long-term (refer Section 6.5).

Whether or not the proposal is likely to reduce the long-term viability of a local population of any threatened species, population or ecological community.

The Project would have a relatively minor negative impact on the long-term survival of populations of threatened biota. This conclusion is based largely on the nature and condition of the habitats to be

removed, the narrow width of the construction corridor and the extent of undisturbed vegetation and alternative habitats in the locality. Retained vegetation would remain intact and contiguous with large areas of surrounding native vegetation that contain areas of known and potential habitat for threatened biota.

The project would directly disturb areas the TECs Southern Highlands Shale Woodland (2.3 ha) and Box-gum Woodland (0.1 ha) and remove up to 100 individuals of the threatened plant Camden Woollybutt. The proposed construction would also remove habitat for threatened flora and fauna species, including seven threatened fauna species recorded during the field surveys. Mitigation measures implemented prior to, during and post-construction would lessen the severity of potential impacts on threatened species. The proposed Offset Plan would also compensate for the loss of threatened species habitats and endangered ecological communities.

Therefore based on the limited extent of direct impacts and implementation of mitigation and offset measures, the Project is not likely to reduce the long-term viability of any local populations of threatened biota.

Whether or not the proposal is likely to accelerate the extinction of any species, population or ecological community or place it at risk of extinction.

The Project is highly unlikely to accelerate the extinction of any native biota based on the following considerations:

- The proposed construction is highly unlikely to remove an ecologically significant proportion of any native flora populations given the limited extent of vegetation clearing in comparison to the extent of native vegetation in the total survey corridor and the surrounding locality;
- The proposed construction is highly likely to cause the injury, displacement or mortality of an ecologically significant proportion of any native fauna populations given the limited extent of habitat to be directly affected and the proposed pre-clearing surveys and other measures to mitigate impacts;
- The proposed environmental management and impact mitigation measures are likely to limit impacts to the immediate disturbance footprint and the proposed operation of the Project would not result in any additional impacts on native biota;
- The Project is not likely to result in significant impacts on local populations of any threatened biota or any other identified species that may be at increased risk of extinction;
- Alternative habitat within and adjacent to the pipeline corridor is likely to be sufficient to maintain populations of native biota and the extent of clearing proposed is unlikely to fragment any populations or isolate any areas of habitat; and
- The Project would not result in any permanent barriers, significant gaps in habitat or otherwise inhibit the movement of migratory or nomadic fauna along recognised corridors or linkages in the locality or region.

Whether or not the proposal will adversely affect critical habitat.

No listed critical habitat will be removed or adversely affected as a result of the Project.

Summary

The Project has been designed to minimise environmental impact to the largest extent possible and where impacts are unavoidable, mitigation measures have been proposed that are likely to be successful in further reducing impacts on native biota and in particular threatened species and communities. Construction along the final pipeline route is likely to result in lesser impacts than those presented in the GHD (2010a) assessment of the EA pipeline route, reflecting the avoidance of impacts through detailed design.

No threatened species are likely to be significantly affected by the Project. No vegetation or habitat would be isolated or substantially further fragmented by the Project. A biodiversity Offset Plan will be developed in consultation with DECCW that would complement the specific mitigation measures incorporated into the Project and compensate for residual impacts on biodiversity. The Plan would ensure that biodiversity values equivalent to those being permanently removed from the construction corridor are protected and managed in perpetuity and that a 'maintain or improve' biodiversity outcome is achieved for the Project.

7.3 EPBC Act Assessment

The Project would result in direct negative impacts on Box-gum Woodland and so a Referral to DEWHA will be prepared to determine whether the Project is a controlled action as defined under the EPBC Act. On the basis of the assessments undertaken, it is concluded that the Project is unlikely to impose a significant impact on Box-gum Woodland or any other MNES and hence is unlikely to constitute a controlled action as defined under the EPBC Act.

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Appendix A

Species Lists

Table 14 Cumulative Flora Species List

Family	Botanical name	Common Name	TSC/ NPWS Status	EPBC Status	GHD (2010) Surveys	Supplementary Surveys					
						Moss Vale	Sutton Forest-Exeter	Paddy's River	Marulan	Goulburn-Murray's Flat	Towrang
Adiantaceae	*Cheilanthes austrotenuifolia*	Rock Fern	U					x		x	
Adiantaceae	*Cheilanthes sieberi*	Rock Fern	U		x						
Amygdalaceae	*Prunus laurocerasus**	Cherry Laurel	U			x					
Amygdalaceae	*Prunus persica**	Peach, nectarine	U			x					
Amygdalaceae	*Prunus spinosa**	Blackthorn	U			x					
Anthericaceae	*Alania endlicheri*		U		x						
Anthericaceae	*Laxmannia gracilis*	Slender Wire Lily	U						x		
Anthericaceae	*Tricoryne elatior*	Yellow Autumn-lily	U								
Apiaceae	*Centella cordifolia*		U		x						
Apiaceae	*Hydrocotyle algida*	Pennywort	U			x		x	x		
Apiaceae	*Hydrocotyle peduncularis*	A Pennywort	U		x						
Apiaceae	*Platysace ericoides*		U		x			x	x		
Apiaceae	*Platysace lanceolata*	Shrubby Platysace	U						x		
Apiaceae	*Platysace linearifolia*		U		x						
Apiaceae	*Scandix pecten-veneris**		U			x					
Apocynaceae	*Parsonsia straminea*	Common Silkpod	U				x				
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax	U		x	x					

Family	Botanical name	Common Name	TSC/ NPWS Status	EPBC Status	GHD (2010) Surveys	Supplementary Surveys					
						Moss Vale	Sutton Forest-Exeter	Paddy's River	Marulan	Goulburn-Murray's Flat	Towrang
Asteraceae	*Arctotheca calendula**	Capeweed	U			x					
Asteraceae	*Bidens tripartita**	Burr Marigold	U						x		
Asteraceae	*Calocephalus citreus*	Lemon Beauty-heads	U		x						
Asteraceae	*Calotis cuneifolia*		U		x				x		
Asteraceae	*Carthamus lanatus**	Saffron Thistle	U								
Asteraceae	*Cassinia amoena*		U			x					
Asteraceae	*Cassinia arcuata*	Sifton Bush	U		x	x		x	x	x	x
Asteraceae	*Cassinia cunninghamii*	Cunninham's Everlasting	U					x	x		
Asteraceae	*Cassinia laevis*	Cough Bush	U		x	x	x				
Asteraceae	*Cassinia longifolia*		U		x						
Asteraceae	*Cassinia uncata*	Sticky Cassinia	U		x	x	x		x		
Asteraceae	*Centaurea sp.*		U		x						
Asteraceae	*Chrysocephalum apiculatum*	Common Everlasting	U		x					x	
Asteraceae	*Chrysocephalum semipapposum*	Clustered Everlasting	U		x						
Asteraceae	*Cirsium vulgare**	Spear Thistle	U		x	x			x	x	
Asteraceae	*Conyza sumatrensis**	Tall fleabane	U						x		
Asteraceae	*Coronidium scorpioides*	Button Everlasting	U			x					

Family	Botanical name	Common Name	TSC/ NPWS Status	EPBC Status	GHD (2010) Surveys	Supplementary Surveys					
						Moss Vale	Sutton Forest-Exeter	Paddy's River	Marulan	Goulburn-Murray's Flat	Towrang
Asteraceae	*Coronidium waddelliae*		U					x			
Asteraceae	*Craspedia sp.*	Billy Buttons	P13					x	x		
Asteraceae	*Craspedia variabilis*	Common Billy-buttons	P13			x					
Asteraceae	*Euchiton sp.*	Creeping Cudweed	U		x						
Asteraceae	*Gnapholium sphaericum*		U			x					
Asteraceae	*Helichrysum sp.*		U		x						
Asteraceae	*Hypochaeris radicata**	Catsear	U			x	x	x	x	x	
Asteraceae	*Lactuca serriola**	Prickly Lettuce	U		x					x	
Asteraceae	*Leontodon taraxacoides**	Lesser Hawkbit	U		x						
Asteraceae	*Leucochrysum albicans subsp. albicans var. tricolor*	Hoary Sunray	U	E	x						
Asteraceae	*Olearia viscidula*	Wallaby Weed	U		x	x	x	x			
Asteraceae	*Onopordum acanthium**	Scotch Thistle	U		x						
Asteraceae	*Ozothamnus diosmifolius*	White Dogwood	U		x			x	x		x
Asteraceae	*Podolepis jaceoides*	Showy Copper-wire Daisy	U					x			
Asteraceae	*Pseudognaphalium luteoalbum*	Jersey Cudweed	U						x		x
Asteraceae	*Senecio hispidulus*	Hill Fireweed	U						x		

Family	Botanical name	Common Name	TSC/ NPWS Status	EPBC Status	GHD (2010) Surveys	Supplementary Surveys					
						Moss Vale	Sutton Forest-Exeter	Paddy's River	Marulan	Goulburn-Murray's Flat	Towrang
Asteraceae	*Senecio madagascariensis**	Fireweed	U		x	x					
Asteraceae	*Senecio quadridentatus*	Cotton Fireweed	U		x						
Asteraceae	*Senecio vagus subsp. vagus*	Saw Groundsel	U		x						
Asteraceae	*Sonchus oleraceus**	Common Sowthistle	U		x				x	x	
Asteraceae	*Vittadinia cuneata*	A Fuzzweed	U		x						
Asteraceae	*Vittadinia gracilis*	Woolly New Holland Daisy	U		x						
Asteraceae	*Xerochrysum viscosum*	Sticky Everlasting	U		x			x	x		
Berberidaceae	*Berberis aristata**		U			x					
Berberidaceae	*Berberis vulgaris**	Common Baberry	U		x						
Boraginaceae	*Echium plantagineum**	Patterson's Curse	U						x	x	
Boraginaceae	*Echium vulgare**	Viper's bugloss	U		x						
Brassicaceae	*Capsella bursa-pastoris**	Shepherd's Purse	U		x						
Brassicaceae	*Lepidium africanum**	Common Peppercress	U		x				x	x	
Brassicaceae	*Lepidium sp.**		U		x						
Cactaceae	*Opuntia sp.**	Prickly Pear	U		x						
Campanulaceae	*Wahlenbergia stricta*	False Sarsaparilla	U			x					
Caryophyllaceae	*Paronychia brasiliana**	Brazilian Whitlow	U						x		

Family	Botanical name	Common Name	TSC/ NPWS Status	EPBC Status	GHD (2010) Surveys	Supplementary Surveys					
						Moss Vale	Sutton Forest-Exeter	Paddy's River	Marulan	Goulburn-Murray's Flat	Towrang
Caryophyllaceae	*Scleranthus biflorus*	Two-flowered Knawel	U		x	x					
Caryophyllaceae	*Silene sp.*		U		x						
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak	U		x		x	x	x		
Chenopodiaceae	*Einadia hastata*	Berry Saltbush	U		x				x		
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush	U		x	x				x	
Chenopodiaceae	*Einadia trigonos*	Fishweed	U		x	x	x		x		
Clusiaceae	*Hypericum gramineum*	Small St John's Wort	U		x	x					
Clusiaceae	*Hypericum japonicum*		U						x		
Clusiaceae	*Hypericum perforatum**	St. Johns Wort	U		x					x	
Convolvulaceae	*Convolvulus erubescens*	Pink Bindweed	U		x						
Convolvulaceae	*Dichondra repens*	Kidney Weed	U		x	x	x	x	x	x	
Crassulaceae	*Crassula sieberiana*	Australian Stonecrop	U		x						
Cyperaceae	*Carex appressa*	Tall Sedge	U		x	x					
Cyperaceae	*Carex incomitata*		U							x	
Cyperaceae	*Carex tereticaulis*		U		x						
Cyperaceae	*Caustis flexuosa*	Curly Wig	P13						x		x
Cyperaceae	*Caustis recurvexa*		P13		x						
Cyperaceae	*Cyperus eragrostis**	Umbrella Sedge	U		x	x					
Cyperaceae	*Cyperus polystachyos*		U		x						

Family	Botanical name	Common Name	TSC/ NPWS Status	EPBC Status	GHD (2010) Surveys	Supplementary Surveys					
						Moss Vale	Sutton Forest-Exeter	Paddy's River	Marulan	Goulburn-Murray's Flat	Towrang
Cyperaceae	*Cyperus sp.*		U						x		
Cyperaceae	*Eleocharis acuta*		U		x						
Cyperaceae	*Eleocharis gracilis*		U		x						
Cyperaceae	*Eleocharis sphacelata*	Tall Spike Rush	U			x					
Cyperaceae	*Lepidosperma concavum*		U		x						
Cyperaceae	*Lepidosperma filiforme*		U		x				x		x
Cyperaceae	*Lepidosperma gunnii*		U		x			x	x		x
Cyperaceae	*Lepidosperma viscidum*		U		x						
Cyperaceae	*Schoenoplectus validus*		U		x						
Dennstaedtiaceae	*Pteridium esculentum*	Bracken	U			x	x	x	x		
Dilleniaceae	*Hibbertia empetrifolia*		U		x			x			
Dilleniaceae	*Hibbertia obtusifolia*	Hoary guinea flower, Grey Guinea Flower	U		x			x	x		x
Dilleniaceae	*Hibbertia pedunculata*		U		x						
Elaeocarpaceae	*Tetratheca sp.*		U		x						
Ericaceae	*Astroloma humifusum*	Native Cranberry	U		x			x	x		x
Ericaceae	*Brachyloma daphnoides*	Daphne Heath	U		x			x	x		x
Ericaceae	*Leucopogon appressus*		U		x				x		
Ericaceae	*Leucopogon lanceolatus*		U		x			x			
Ericaceae	*Leucopogon muticus*		U		x						

Family	Botanical name	Common Name	TSC/ NPWS Status	EPBC Status	GHD (2010) Surveys	Supplementary Surveys					
						Moss Vale	Sutton Forest-Exeter	Paddy's River	Marulan	Goulburn-Murray's Flat	Towrang
Ericaceae	*Lissanthe strigosa*	Peach Heath	U		x				x		x
Ericaceae	*Melichrus urceolatus*		U		x			x	x		x
Ericaceae	*Monotoca ledifolia*		U		x						
Euphorbiaceae	*Amperea xiphoclada*		U		x			x			
Euphorbiaceae	*Chamaesyce drummondii*		U		x						
Euphorbiaceae	*Phyllanthus sp.*		U					x			
Euphorbiaceae	*Poranthera microphylla*	Small Poranthera	U					x			
FABACEAE	*Zornia dictiocarpa*	Zornia	U								
Fabaceae (Faboideae)	*Aotus ericoides*		U		x			x	x		
Fabaceae (Faboideae)	*Bossiaea buxifolia*		U		x	x					
Fabaceae (Faboideae)	*Bossiaea filosa*		U		x						
Fabaceae (Faboideae)	*Bossiaea obcordata*	Spiny Bossiaea	U		x			x			
Fabaceae (Faboideae)	*Bossiaea prostrata*		U		x						
Fabaceae (Faboideae)	*Cytisus scoparius**	Scotch Broom	U		x						
Fabaceae (Faboideae)	*Daviesia acicularis*		U		x				x		

Family	Botanical name	Common Name	TSC/ NPWS Status	EPBC Status	GHD (2010) Surveys	Supplementary Surveys					
						Moss Vale	Sutton Forest-Exeter	Paddy's River	Marulan	Goulburn-Murray's Flat	Towrang
Fabaceae (Faboideae)	*Daviesia corymbosa*		U			x					
Fabaceae (Faboideae)	*Daviesia latifolia*		U		x						
Fabaceae (Faboideae)	*Daviesia ulicifolia*	Gorse Bitter Pea	U		x			x	x		x
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil	U		x						
Fabaceae (Faboideae)	*Dillwynia phylocoides*		U		x						
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine	U		x	x		x			
Fabaceae (Faboideae)	*Glycine tabacina*		U		x						
Fabaceae (Faboideae)	*Gompholobium minus*	Dwarf Wedge Pea	U		x			x			
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla	U		x	x		x	x		x
Fabaceae (Faboideae)	*Hovea heterophylla*		U		x						
Fabaceae (Faboideae)	*Hovea linearis*		U		x			x	x		
Fabaceae (Faboideae)	*Indigofera australis*	Australian Indigo	U		x				x		x

Family	Botanical name	Common Name	TSC/ NPWS Status	EPBC Status	GHD (2010) Surveys	Supplementary Surveys					
						Moss Vale	Sutton Forest-Exeter	Paddy's River	Marulan	Goulburn-Murray's Flat	Towrang
Fabaceae (Faboideae)	*Jacksonia scoparia*	Dogwood	U		x						
Fabaceae (Faboideae)	*Kennedia prostrata*	Running Postman	U					x			
Fabaceae (Faboideae)	*Medicago polymorpha**	Burr Medic	U		x						
Fabaceae (Faboideae)	*Mirbelia platylobioides*		U		x			x	x		
Fabaceae (Faboideae)	*Platylobium formosum*		U		x						
Fabaceae (Faboideae)	*Platylobium sp.*		U		x						
Fabaceae (Faboideae)	*Podolobium ilicifolium*	Prickly Shaggy Pea	U		x			x	x		
Fabaceae (Faboideae)	*Pultenaea linophylla*		U		x						
Fabaceae (Faboideae)	*Pultenaea microphylla*	A Bush Pea	U						x		x
Fabaceae (Faboideae)	*Robinia pseudoacacia**	Black Locust	U		x						
Fabaceae (Faboideae)	*Trifolium hirsutum**	A Clover	U						x	x	
Fabaceae (Faboideae)	*Trifolium repens**	White Clover	U		x	x					

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						Moss Vale	Sutton Forest-Exeter	Paddy's River	Marulan	Goulburn-Murray's Flat	Towrang
Fabaceae (Faboideae)	*Trifolium striatum**	Knotted Clover	U			x					
Fabaceae (Mimosoideae)	*Acacia amoena*	Boomerang Wattle	U						x		
Fabaceae (Mimosoideae)	*Acacia brownii*	Heath Wattle	U		x				x		
Fabaceae (Mimosoideae)	*Acacia buxifolia*	Box-leaved Wattle	U		x						x
Fabaceae (Mimosoideae)	*Acacia dawsonii*	Poverty Wattle	U						x		
Fabaceae (Mimosoideae)	*Acacia deanei*	Dean's Wattle	U						x		
Fabaceae (Mimosoideae)	*Acacia decurrens*	Black Wattle	U		x		x		x		x
Fabaceae (Mimosoideae)	*Acacia elongata*	Swamp Wattle	U		x			x			
Fabaceae (Mimosoideae)	*Acacia falciformis*	Broad-leaved Hickory	U		x			x			
Fabaceae (Mimosoideae)	*Acacia genistifolia*	Early Wattle	U		x				x		x
Fabaceae (Mimosoideae)	*Acacia gunnii*	Ploughshare Wattle	U		x				x		
Fabaceae (Mimosoideae)	*Acacia longifolia*		U		x			x	x		

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Fabaceae (Mimosoideae)	*Acacia mearnsii*	Black Wattle	U		x	x	x	x			
Fabaceae (Mimosoideae)	*Acacia melanoxylon*	Blackwood	U		x	x					
Fabaceae (Mimosoideae)	*Acacia mucronata*		U		x						
Fabaceae (Mimosoideae)	*Acacia myrtifolia*	Red-stemmed Wattle	U					x			
Fabaceae (Mimosoideae)	*Acacia obliquinervia*	Mountain Hickory	U		x						
Fabaceae (Mimosoideae)	*Acacia obtusifolia*		U		x						
Fabaceae (Mimosoideae)	*Acacia paradoxa*	Kangaroo Thorn	U		x				x		
Fabaceae (Mimosoideae)	*Acacia parramattensis*	Parramatta Wattle	U		x			x	x		x
Fabaceae (Mimosoideae)	*Acacia rubida*		U		x						
Fabaceae (Mimosoideae)	*Acacia stricta*	Straight wattle	U		x						
Fabaceae (Mimosoideae)	*Acacia terminalis*	Sunshine Wattle	U		x			x			x
Fabaceae (Mimosoideae)	*Acacia ulicifolia*	Prickly Moses	U		x			x	x		
Geraniaceae	*Geranium homeanum*		U		x						

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						Moss Vale	Sutton Forest-Exeter	Paddy's River	Marulan	Goulburn-Murray's Flat	Towrang
Geraniaceae	*Geranium potentilloides*		U						x		
Geraniaceae	*Geranium solanderi*	Native Geranium	U						x		
Geraniaceae	*Pelargonium sp.**		U						x		
Goodeniaceae	*Dampiera stricta.*		U		x						
Goodeniaceae	*Goodenia bellidifolia*		U		x				x		
Goodeniaceae	*Goodenia hederacea*	Ivy Goodenia	U		x	x		x	x		x
Goodeniaceae	*Goodenia paniculata*		U		x						
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort	U		x			x	x		x
Haloragaceae	*Gonocarpus teucrioides*	Germander Raspwort	U			x			x		
Haloragaceae	*Haloragis heterophylla*	Variable Raspwort	U			x					
Haloragaceae	*Myriophyllum sp.*		U		x						
Haloragaceae	*Myriophyllum variifolium*		U			x					
Haloragaceae	*Myriopyhllum verrucosum*		U						x		
Iridaceae	*Patersonia glabrata*	Leafy Purple-flag	U						x		x
Iridaceae	*Patersonia sericea*	Silky Purple-Flag	U					x			
Juncaceae	*Juncus acutus**	Sharp Rush	U			x					
Juncaceae	*Juncus continuus*		U		x						
Juncaceae	*Juncus laeviusculus subsp. illawarrensis*		U			x					
Juncaceae	*Juncus sp.*		U						x		

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Juncaceae	*Juncus usitatus*		U		x						
Juncaginaceae	*Triglochin sp.*		U		x						
Lauraceae	*Cassytha glabella*		U		x						
Lauraceae	*Cassytha pubescens*		U		x						
Liliaceae	*Patersonia sericea*		U		x						
Liliaceae	*Patersonia sp.*		U		x						
Liliaceae	*Wahlenbergia sp.*	Bluebell	U		x						
Lobeliaceae	*Pratia purpurascens*	Whiteroot	U				x				
Lomandraceae	*Lomandra confertifolia subsp. rubiginosa*		U						x	x	x
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush	U		x	x					
Lomandraceae	*Lomandra filiformis subsp. coriacea*	Wattle Matt-rush	U			x					
Lomandraceae	*Lomandra glauca*	Pale Mat-rush	U					x			
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush	U		x	x		x			
Lomandraceae	*Lomandra multiflora*		U		x			x	x	x	x
Lomandraceae	*Lomandra obliqua*		U		x			x	x		
Loranthaceae	*Amyema miquelii*	Box Mistletoe	U		x				x		
Loranthaceae	*Denrophthoe glabrescens*		U		x						
Malaceae	*Crataegus monogyna**	Hawthorn	U		x	x					

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Malaceae	*Pyracantha angustifolia**	Orange Firethorn	U							x	
Malaceae	*Sorbus sp.**		U		x						
Malvaceae	*Malva nicaeensis**	Mallow of Nice	U							x	
Malvaceae	*Malva sp.**		U		x						
Malvaceae	*Modiola caroliana**	Small-flowering Mallow	U		x						
Myrsinaceae	*Anagallis arvensis*	Scarlet pimpernel	U		x						
Myrtaceae	*Calytrix sp.*		U		x						
Myrtaceae	*Corymbia gummifera*	Red Bloodwood	U		x						
Myrtaceae	*Eucalyptus agglomerata*	Blue-leaved Stringybark	U		x			x	x		x
Myrtaceae	*Eucalyptus aggregata*	Black gum	U		x						
Myrtaceae	*Eucalyptus amplifolia*	Cabbage Gum	U		x	x	x		x		
Myrtaceae	*Eucalyptus blakelyi*	Blakely's Red Gum	U		x					x	
Myrtaceae	*Eucalyptus bridgesiana*	Apple Box	U		x				x	x	
Myrtaceae	*Eucalyptus cinerea*	Argyle Apple	U		x			x	x		x
Myrtaceae	*Eucalyptus consideniana*	Yertchuk	U		x						
Myrtaceae	*Eucalyptus cypellocarpa*	Monkey Gum	U		x	x					
Myrtaceae	*Eucalyptus dalrympleana*		U			x					
Myrtaceae	*Eucalyptus dives*	Broad-leaved Peppermint	U		x				x		x

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Myrtaceae	*Eucalyptus elata*	River Peppermint	U		x		x				
Myrtaceae	*Eucalyptus eugenioides*	Brown Stringybark	U		x						
Myrtaceae	*Eucalyptus globoidea*	White Stringybark	U		x		x		x		x
Myrtaceae	*Eucalyptus goniocalyx*	Bundy	U		x				x		x
Myrtaceae	*Eucalyptus macarthurii*	Camden Woollybutt	U		x	x					
Myrtaceae	*Eucalyptus macrorhyncha*	Red Stringybark	U		x				x		x
Myrtaceae	*Eucalyptus mannifera subsp. gullickii*		U						x		x
Myrtaceae	*Eucalyptus mannifera subsp. mannifera*	Brittle Gum	U		x						
Myrtaceae	*Eucalyptus melliodora*	Yellow Box	U		x				x	x	x
Myrtaceae	*Eucalyptus muelleriana*	Yellow Stringybark	U		x						
Myrtaceae	*Eucalyptus obliqua*	Messmate	U		x						
Myrtaceae	*Eucalyptus ovata*	Swamp gum	U		x						
Myrtaceae	*Eucalyptus pauciflora*	White Sally	U		x	x					
Myrtaceae	*Eucalyptus piperita*	Sydney Peppermint	U					x			
Myrtaceae	*Eucalyptus piperita subsp. ersularis*	Sydney Peppermint	U		x						
Myrtaceae	*Eucalyptus polyanthemos*	Red box	U		x						
Myrtaceae	*Eucalyptus radiata*	Narrow-leaved Peppermint	U		x	x	x				

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Myrtaceae	*Eucalyptus rossii*	Inland Scribbly Gum	U		x			x	x		x
Myrtaceae	*Eucalyptus rubida*		U						x		
Myrtaceae	*Eucalyptus sclerophylla*	Hard-leaved Scribbly Gum	U		x			x	x		x
Myrtaceae	*Eucalyptus sieberi*	Silvertop Ash	U		x			x	x		x
Myrtaceae	*Eucalyptus stellulata*	Black Sally	U			x					
Myrtaceae	*Eucalyptus viminalis*	Ribbon Gum	U		x	x			x		
Myrtaceae	*Kunzea capitata.*		U		x						
Myrtaceae	*Kunzea parvifolia*	Violet Kunzea	U						x		
Myrtaceae	*Kunzea sp.*		U		x						
Myrtaceae	*Leptospermum multicaule*		U		x						
Myrtaceae	*Leptospermum polyanthum*		U						x		x
Myrtaceae	*Leptospermum polygalifolium*	Tantoon	U		x			x			
Myrtaceae	*Leptospermum trinervium*	Slender Tea-tree	U		x				x		
Oleaceae	*Ligustrum lucidum**	Large-leaved Privet	U		x	x					
Oleaceae	*Ligustrum sinense**	Small-leaved Privet	U			x					
Oleaceae	*Olea europea**	Common Olive	U			x					
Onagraceae	*Oenothera biennis**	Evening Primrose	U		x						
Orchidaceae	*Caladenia sp*		P13		x						

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						Moss Vale	Sutton Forest-Exeter	Paddy's River	Marulan	Goulburn-Murray's Flat	Towrang
Orchidaceae	*Dipodium punctatum*		P13		x						
Orchidaceae	*Diuris sp.*		P13		x						
Orchidaceae	*Thelymitra sp.*		P13		x						
Oxalidaceae	*Oxalis corniculata**	Creeping Oxalis	U			x					
Oxalidaceae	*Oxalis perennans*	Native Oxalis	U		x						
Oxalidaceae	*Oxalis sp.**	Oxalis	U		x						
Phormiaceae	*Dianella longifolia*	A Blue Flax Lily	U			x		x	x	x	x
Phormiaceae	*Dianella revoluta*	Blueberry Lily	U		x	x					
Phormiaceae	*Stypandra glauca*	Nodding Blue Lily	U		x		x		x		x
Phyllanthaceae	*Phyllanthus sp.*	Spurge	U		x						
Phyllanthaceae	*Poranthera microphylla*		U		x						
Phytolaccaceae	*Phytolacca octandra**	Inkweed	U		x				x		
Pinaceae	*Pinus radiata**	Radiata Pine	U		x	x		x		x	
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry	U		x	x		x			
Pittosporaceae	*Bursaria spinosa*	Blackthorn	U		x						
Plantaginaceae	*Plantago coronopus**	Buck's Horn Plantain	U		x				x		
Plantaginaceae	*Plantago debilis*	Shade Plantain	U						x		
Plantaginaceae	*Plantago lanceolata*	Plantain	U		x						
Plantaginaceae	*Plantago lanceolata**	Lamb's Tongues	U			x		x	x	x	

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						Moss Vale	Sutton Forest-Exeter	Paddy's River	Marulan	Goulburn-Murray's Flat	Towrang
Plantaginaceae	*Veronica plebeia*	Creeping Speedwell	U		x						
Poaceae	*Agrostis capillaris*	Brown top bent	U		x						
Poaceae	*Agrostis sp.*		U		x						
Poaceae	*Aira caryophyllea**	Silvery Hairgrass	U		x	x			x		x
Poaceae	*Aira cupaniana*	Silvery Hairgrass	U			x					
Poaceae	*Anisopogon avenaceus*	Oat Speargrass	U			x					
Poaceae	*Anthoxanthum odoratum**	Sweet Vernal Grass	U			x					
Poaceae	*Anthoxanum odoratum**	Sweet Vernal Grass	U		x						
Poaceae	*Aristida jerichoensis*	Jericho Wiregrass	U						x		x
Poaceae	*Aristida personata*	Purple Wiregrass	U					x	x		
Poaceae	*Aristida ramosa*	Purple wiregrass	U		x						
Poaceae	*Aristida sp*	A Wire Grass	U		x						
Poaceae	*Austrodanthonia fulva*	Wallaby Grass	U			x				x	
Poaceae	*Austrodanthonia monticola*		U		x						
Poaceae	*Austrodanthonia racemosa*	Wallaby Grass	U			x				x	
Poaceae	*Austrodanthonia sp.*	A Wallaby Grass	U					x			
Poaceae	*Austrodanthonia tenuior*	A Wallaby Grass	U		x				x		
Poaceae	*Austrostipa pubescens*		U						x		x

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						Moss Vale	Sutton Forest-Exeter	Paddy's River	Marulan	Goulburn-Murray's Flat	Towrang
Poaceae	*Austrostipa rudis*		U		x						
Poaceae	*Austrostipa rudis subsp. nervosa*	A Speargrass	U						x	x	x
Poaceae	*Avena fatua**	Wild Oats	U			x					
Poaceae	*Axonopus fissifolius**	Narrow-leafed Carpet Grass	U			x	x		x		
Poaceae	*Bothriochloa macra*	Red Grass	U					x	x	x	x
Poaceae	*Briza maxima**	Quaking Grass	U		x					x	
Poaceae	*Bromus catharticus**	Praire Grass	U		x	x					
Poaceae	*Bromus diandrus*	Great Brome	U		x						
Poaceae	*Bromus sp.*		U		x						
Poaceae	*Chionochloa pallidus*		U		x						
Poaceae	*Chloris truncata*	Windmill Grass	U			x			x		
Poaceae	*Chloris ventricosa*	Plump Windmill Grass	U						x		
Poaceae	*Cymbopogon refractus*	Barbed Wire-grass	U					x			
Poaceae	*Cynodon dactylon*	Common Couch	U		x	x			x		
Poaceae	*Dactylis glomerata**	Cocksfoot	U		x	x				x	
Poaceae	*Deyeuxia quadriseta*		U		x						
Poaceae	*Dichelachne crinata*		U		x						
Poaceae	*Dichelachne micrantha*		U		x						

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Poaceae	*Digitaria ciliaris**	Summer Grass	U						x	x	
Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass	U		x	x		x			
Poaceae	*Eleusine tristachya**	Goose Grass	U			x			x		
Poaceae	*Elymus scaber*		U		x						
Poaceae	*Entolasia marginata*	Bordered Panic	U		x	x					
Poaceae	*Entolasia stricta*	Wiry Panic	U		x			x	x		x
Poaceae	*Eragrostis benthamii*		U		x			x			
Poaceae	*Eragrostis brownii*	Brown's Lovegrass	U						x		
Poaceae	*Eragrostis cilianensis**	Stinkgrass	U			x		x			
Poaceae	*Eragrostis curvula**	African Lovegrass	U		x						
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass	U						x		x
Poaceae	*Eragrostis tenuifolia**	Elastic Grass	U						x		
Poaceae	*Holcus lanatus*		U		x						
Poaceae	*Joycea pallida*	Silvertop Wallaby Grass	U		x						
Poaceae	*Lolium perenne**	Perennial Ryegrass	U		x	x					
Poaceae	*Microlaena stipoides*	Weeping Grass	U		x	x	x	x	x	x	
Poaceae	*Nassella neesiana**	Chilean Needlegrass	U			x	x	x	x	x	
Poaceae	*Nassella trichotoma**	Serrated Tussock	U		x					x	x

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Poaceae	*Panicum effusum*		U		x						
Poaceae	*Paspalum dilatatum**	Paspalum	U		x	x			x	x	
Poaceae	*Phalaris aquatica**	Phalaris	U		x						
Poaceae	*Phragmites australis*	Common Reed	U		x	x					
Poaceae	*Poa affinis*		U			x					
Poaceae	*Poa labillardierei*		U		x						
Poaceae	*Poa sieberiana*	Snowgrass	U		x	x			x	x	x
Poaceae	*Poa spp.*		U		x						
Poaceae	*Setaria gracilis**	Slender Pigeon Grass	U			x			x		x
Poaceae	*Setaria pumila**	Pale Pigeon Grass	U						x		
Poaceae	*Sporobolus africanus**	Parramatta Grass	U		x	x					
Poaceae	*Themeda australis*	Kangaroo Grass	U		x	x		x	x		
Poaceae	*Vulpia sp.**		U		x						
Polygonaceae	*Acetosella vulgaris**	Sheep Sorrel	U		x	x			x	x	x
Polygonaceae	*Persicaria hydropiper*	Water Pepper	U			x					
Polygonaceae	*Rumex brownii*	Swamp Dock	U		x						
Polygonaceae	*Rumex crispus**	Curled Dock	U		x	x					
Proteaceae	*Banksia spinulosa*	Hairpin Banksia	P13		x			x	x		x
Proteaceae	*Grevillea acanthifolia*		U		x						

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Proteaceae	*Grevillea rosmarinifolia*	Rosemary Grevillea	U		x						
Proteaceae	*Hakea dactyloides*	Finger Hakea	U		x						
Proteaceae	*Hakea laevipes*		U		x				x		
Proteaceae	*Hakea sericea*	Needlebush	U		x			x			x
Proteaceae	*Lomatia fraseri*	Silky Lomatia	U		x						
Proteaceae	*Lomatia ilicifolia*	Holly Lomatia, Native Holly	U		x			x			
Proteaceae	*Persoonia confertiflora*		P13		x						
Proteaceae	*Persoonia laurina*		P13		x						
Proteaceae	*Persoonia laurina subsp. leiogyna*		P13					x			
Proteaceae	*Persoonia levis*	Broad-leaved Geebung	P13		x			x			
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung	P13		x			x	x		x
Proteaceae	*Persoonia mollis subsp. livens*		P13		x				x		
Proteaceae	*Persoonia mollis subsp. revoluta*		P13		x			x			
Proteaceae	*Persoonia mollis x P. linearis*		P13		x						
Proteaceae	*Persoonia sp.*		P13		x						
Proteaceae	*Petrophile pulchella*	Conesticks	P13					x			

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Proteaceae	*Petrophile sessilis*		P13		x						
Proteaceae	*Petrophille peduncularis*		P13		x						
Ranunculaceae	*Clematis aristata*	Old Man's Beard	U		x	x	x				
Ranunculaceae	*Ranunculus inundatus*	River Buttercup	U			x					
Ranunculaceae	*Ranunculus plebeius*		U			x					
Ranunculaceae	*Ranunculus sp.*		U		x						
Restionaceae	*Baloskion sp.*		U		x						
Rhamnaceae	*Cryptandra amara*	Bitter cryptandra	U		x						
Rhamnaceae	*Pomaderris andromedifolia*		U					x			
Rhamnaceae	*Pomaderris lanigera*		U					x			
Rosaceae	*Acaena novae-zelandiae*	Bidgee-widgee, Biddy Biddy	U					x			
Rosaceae	*Acaena ovina*	Acaena	U						x	x	
Rosaceae	*Acaena sp.*		U		x						
Rosaceae	*Potentilla anserine subsp. anserina*	Silver Weed	U		x						
Rosaceae	*Rosa rubiginosa**	Sweet Briar	U		x	x				x	
Rosaceae	*Rubus fruticosis aggregate species**	Blackberry	U		x						
Rosaceae	*Rubus fruticosus sp. agg.**	Blackberry complex	U			x			x	x	

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Rosaceae	*Rubus parviflorus*	Native raspberry	U								
Rubiaceae	*Galium propinquum*	Maori Bedstraw	U		x			x			
Rubiaceae	*Galium sp.*		U		x						
Rubiaceae	*Opercularia aspera*	Coarse Stinkweed	U			x		x	x		
Rubiaceae	*Opercularia diphylla*	Stinkweed	U						x		
Rubiaceae	*Opercularia varia*	Variable Stinkweed	U								
Rubiaceae	*Pomax umbellata*	Pomax	U		x			x	x		x
Salicaceae	*Populus alba**	White Poplar	U		x						
Salicaceae	*Salix alba*	Willow	U		x	x					
Santalaceae	*Exocarpos aphyllus*		U		x						
Santalaceae	*Exocarpos cupressiformis*	Native Cherry/Cherry Ballart	U		x	x	x	x			
Santalaceae	*Leptomeria drupacea*		U					x			
Santalaceae	*Leptomeria sp.*		U		x						
Sapindaceae	*Dodonaea multijuga*		U					x			
Scrophulariaceae	*Veronica plebeia*	Trailing Speedwell	U			x	x	x	x		x
Solanaceae	*Lycium ferocissimum**	African Boxthorn	U		x					x	
Solanaceae	*Solanum aviculare*	Kangaroo Apple	U			x					x
Solanaceae	*Solanum chenopodioides**	Whitetip Nightshade	U						x		

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Solanaceae	*Solanum nigrum**	Black-berry Nightshade	U			x					
Solanaceae	*Solanum prinophyllum*	Forest Nightshade	U						x		
Solanaceae	*Solanum sp.*		U		x						
Stackhousiaceae	*Stackhousia monogyna*	Creamy Candles	U		x	x					
Stackhousiaceae	*Stackhousia spathulata*		U					x			
Stackhousiaceae	*Stackhousia viminea*	Slender Stackhousia	U			x		x			
Thymelaeaceae	*Pimelea curviflora*		U		x						
Thymelaeaceae	*Pimelea curviflora var. sericea*		U					x			
Thymelaeaceae	*Pimelea linifolia subsp. linoides*		U						x		
Typhacaceae	*Typha domingoensis*	Narrow-leaved Cumbungi	U		x						
Verbenaceae	*Lantana camara**	Lantana	U		x						
Verbenaceae	*Verbena bonariensis**	Purpletop	U			x					
Verbenaceae	*Verbena rigida**	Veined Verbena	U		x						
Violaceae	*Viola betonicifolia*	Native Violet	U			x		x			
Violaceae	*Viola hederacea*	Ivy-leaved Violet	U			x		x			
Xanthorrhoeaceae	*Xanthorrhoea concava*		P13		x						
Xanthorrhoeaceae	*Xanthorrhoea resinosa*		P13					x	x		x

Status codes

***** Introduced species

P Protected under the NSW NPWS Act
U Unprotected
V Listed as vulnerable under TSC Act and/or EPBC Act.

M Listed migratory species under the EPBC Act.

Table 15 Cumulative Fauna Species List

Family	Scientific Name	Common Name	TSC/ NPW Act Status	EPBC Act Status	GHD (2010) Surveys	Supplementary Surveys					
						Werai-Glenquarry	Sutton Forest-Exeter	Paddys River	Marulan	Towrang	Goulburn Murrays-Flat
Frogs											
Hylidae	*Litoria dentata*	Bleating Tree Frog	P		X						
	Litoria peronii	Peron's Tree Frog	P		X						
	Litoria verreauxii	Verreaux's Frog	P		X						
Myobatrachidae	*Crinia parinsignifera*	Eastern Sign-bearing Froglet	P		X						
	Crinia signifera	Common Eastern Froglet	P		X	W				W	W
	Limnodynastes peronii	Striped Marsh Frog	P		X						
	Limnodynastes tasmaniensis	Spotted Marsh Frog	P		X						
	Uperoleia laevigata	Smooth Toadlet	P		X						
Birds											
Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	P		X	O			O		O
	Acanthiza lineata	Striated Thornbill	P		X			W	W		
	Acanthiza nana	Yellow Thornbill	P		X			O			
	Acanthiza pusilla	Brown Thornbill	P		X			O	O		
	Acanthiza reguloides	Buff-rumped Thornbill	P		X			W			

Family	Scientific Name	Common Name	TSC/ NPW Act Status	EPBC Act Status	GHD (2010) Surveys	Supplementary Surveys					
						Werai-Glenquarry	Sutton Forest-Exeter	Paddys River	Marulan	Towrang	Goulburn Murrays-Flat
	Gerygone albogularis	White-throated Gerygone	P		X						
	Gerygone fusca	Western Gerygone	P		X						
	Hylacola pyrrhopygia	Chestnut-rumped Heathwren	P		X						
	Pyrrholaemus saggitatus	Speckled Warbler	V						O		
	Sericornis frontalis	White-browed Scrubwren	P		X				O		
	Smicrornis brevirostris	Weebill	P		X			W	W		
Accipitridae	*Accipiter fasciatus*	Brown Goshawk	P		X						
	Aquila audax	Wedge-tailed Eagle	P		X						
	Elanus axillaris	Black-shouldered Kite	P				O				
Acrocephalidae	*Acrocephalus australis*	Australian Reed-warbler	P		X						
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar	P		X						
Alcedinidae	*Dacelo novaeguineae*	Laughing Kookaburra	P		X						
	Todiramphus sanctus	Sacred Kingfisher	P		X						
Anatidae	*Anas gracilis*	Grey Teal	P	M	X						
	Anas superciliosa	Pacific Black Duck	P	M	X						

Family	Scientific Name	Common Name	TSC/ NPW Act Status	EPBC Act Status	GHD (2010) Surveys	Supplementary Surveys					
						Werai-Glenquarry	Sutton Forest-Exeter	Paddys River	Marulan	Towrang	Goulburn Murrays-Flat
	Chenonetta jubata	Australian Wood Duck	P	M	X	O					
Ardeidae	*Egretta novaehollandiae*	White-faced Heron	P		X	O			O		
Artamidae	*Cracticus tibicen*	Australian Magpie	P		X	O		W	W		
	Cracticus torquatus	Grey Butcherbird	P		X	O		W	W		
	Strepera graculina	Pied Currawong	P		X			O	W		
	Strepera versicolor	Grey Currawong	P		X						
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo	P		X	O		W	W		O
	Cacatua sanguinea	Little Corella	P		X	O					
	Callocephalon fimbriatum	Gang-gang Cockatoo	V		X						
	Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	P		X			W			
	Calyptorhynchus lathami	Glossy Black-Cockatoo	V		X						
	Eolophus roseicapillus	Galah	P		X	O	O	O			O
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	P		X			O	O		
Charadriidae	*Vanellus miles*	Masked Lapwing	P	M	X						
Cisticolidae	*Cisticola exilis*	Golden-headed Cisticola	P		X						

Family	Scientific Name	Common Name	TSC/ NPW Act Status	EPBC Act Status	GHD (2010) Surveys	Supplementary Surveys					
						Werai-Glenquarry	Sutton Forest-Exeter	Paddys River	Marulan	Towrang	Goulburn Murrays-Flat
Climacteridae	*Climacteris picumnus*	Brown Treecreeper	V		X						
	Cormobates leucophaea	White-throated Treecreeper	P		X			O	W		
Columbidae	*Leucosarcia picata*	Wonga Pigeon	P		X						
	Ocyphaps lophotes	Crested Pigeon	P		X	O	O	O			O
Coraciidae	*Eurystomus orientalis*	Dollarbird	P		X						
Corcoracidae	*Corcorax melanorhamphos*	White-winged Chough	P		X				x		
	Struthidea cinerea	Apostlebird	P		X						
Corvidae	*Corvus coronoides*	Australian Raven	P		X	W	W	W	W		
	Corvus mellori	Little Raven	P		X	O		W			
	Corvus orru	Torresian Crow	P								W
Cuculidae	*Cacomantis pallidus*	Pallid Cuckoo	P		X						
	Cacomantis variolosus	Brush Cuckoo	P		X						
	Chalcites basalis	Horsfield's Bronze Cuckoo	P		X						
	Eudynamys orientalis	Eastern Koel	P		X						
	Scythrops novaehollandiae	Channel-billed Cuckoo	P		X						
Estrildidae	*Neochmia temporalis*	Red-browed Finch	P		X						
Falconidae	*Falco cenchroides*	Nankeen Kestrel	P		X		O				

Family	Scientific Name	Common Name	TSC/ NPW Act Status	EPBC Act Status	GHD (2010) Surveys	Supplementary Surveys					
						Werai-Glenquarry	Sutton Forest-Exeter	Paddys River	Marulan	Towrang	Goulburn Murrays-Flat
	Falco longipennis	Australian Hobby	P		X						
	Falco peregrinus	Peregrine Falcon	P					O			
Hirundinidae	*Hirundo neoxena*	Welcome Swallow	P		X	O	O	O			
	Petrochelidon ariel	Fairy Martin	P		X						
Maluridae	*Malurus cyaneus*	Superb Fairy-wren	P		X	O	O	O			
Megaluridae	*Cincloramphus mathewsi*	Rufous Songlark	P		X						
Meliphagidae	*Acanthorhynchus tenuirostris*	Eastern Spinebill	P		X			W			
	Anthochaera carunculata	Red Wattlebird	P		X			W	W		
	Lichenostomus chrysops	Yellow-faced Honeyeater	P		X			W			
	Lichenostomus leucotis	White-eared Honeyeater	P		X				W		
	Manorina melanocephala	Noisy Miner	P		X	O	O	O	O		O
	Meliphaga lewinii	Lewin's Honeyeater	P					W			
	Melithreptus brevirostris	Brown-headed Honeyeater	P		X				O		
	Melithreptus brevirostris	Brown-headed Honeyeater	P		X						
	Philemon corniculatus	Noisy Friarbird	P		X			W			

Family	Scientific Name	Common Name	TSC/ NPW Act Status	EPBC Act Status	GHD (2010) Surveys	Supplementary Surveys					
						Werai-Glenquarry	Sutton Forest-Exeter	Paddys River	Marulan	Towrang	Goulburn Murrays-Flat
Menuridae	*Menura novaehollandiae*	Superb Lyrebird	P		X						
Monarchidae	*Grallina cyanoleuca*	Magpie-lark	P		X	O	O	W	W		
	Myiagra rubecula	Leaden Flycatcher	P		X						
Motacillidae	*Anthus novaeseelandiae*	Australian Pipit	P		X						
Nectariniidae	*Dicaeum hirundinaceum*	Mistletoebird	P		X						
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V		X						
Oriolidae	*Oriolus sagittatus*	Olive-backed Oriole	P		X						
Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush	P		X	O		W			
	Pachycephala pectoralis	Golden Whistler	P		X						
	Pachycephala rufiventris	Rufous Whistler	P		X			W			
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote	P		X			W	W		
	Pardalotus striatus	Striated Pardalote	P		X	W		W	W		W
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican	P	M	X						
Petroicidae	*Eopsaltria australis*	Eastern Yellow Robin	P		X			W			
	Microeca fascinans	Jacky Winter	P		X						

Family	Scientific Name	Common Name	TSC/ NPW Act Status	EPBC Act Status	GHD (2010) Surveys	Supplementary Surveys					
						Werai-Glenquarry	Sutton Forest-Exeter	Paddys River	Marulan	Towrang	Goulburn Murrays-Flat
	Petroica boodang	Scarlet Robin	V		X			O			
	Petroica goodenovii	Red-capped Robin	P		X						
Phalacrocoracidae	*Microcarbo melanoleucos*	Little Pied Cormorant	P			O					
	Phalacrocorax varius	Pied Cormorant	P		X						
Podargidae	*Podargus strigoides*	Tawny Frogmouth	P		X						
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe	P		X						
Psittacidae	*Alisterus scapularis*	Australian King-Parrot	P		X			O			
	Platycercus adscitus eximius	Eastern Rosella	P		X	O		O	O		
	Platycercus elegans	Crimson Rosella	P		X	O		O	O		
	Psephotus haematonotus	Red-rumped Parrot	P		X						
Ptilonorhynchidae	*Ptilonorhynchus violaceus*	Satin Bowerbird	P		X						
Pycnonotidae	*Pycnonotus jocosus**	Red-whiskered Bulbul	U								W
Rallidae	*Fulica atra*	Eurasian Coot	P	M	X						
	Gallinula tenebrosa	Dusky Moorhen	P	M	X						
	Porphyrio porphyrio	Purple Swamphen	P	M	X						
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt	P	M	X						

Family	Scientific Name	Common Name	TSC/ NPW Act Status	EPBC Act Status	GHD (2010) Surveys	Supplementary Surveys					
						Werai-Glenquarry	Sutton Forest-Exeter	Paddys River	Marulan	Towrang	Goulburn Murrays-Flat
Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail	P		X	O		O			
	Rhipidura leucophrys	Willie Wagtail	P		X	O		O	O		
Strigidae	*Ninox novaeseelandiae*	Southern Boobook	P		X						
Sturnidae	*Sturnus tristis**	Common Myna	U		X						O
	*Sturnus vulgaris**	Common Starling	U		X		O				
Timaliidae	*Zosterops lateralis*	Silvereye	P		X						
Turdidae	*Turdus merula**	Eurasian Blackbird	U		X						W
Mammals											
Terrestrial Mammals											
Canidae	*Canis lupus familiaris**	Dog	U		X						
	*Canus lupus dingo**	Dingo	U		X						
	*Vulpes vulpes**	Fox	U		X				P		
Cervidae	*Cervus dama**	Fallow Deer	U		X						
Dasyuridae	*Antechinus stuartii*	Brown Antechinus	P		X						
Equidae	*Equus caballus**	Horse	U		X						
Leporidae	*Lepus capensis**	Brown Hare	U		X						
	*Oryctolagus cuniculus**	Rabbit	U		X	F		P	O		
Macropodidae	*Macropus gigantea*	Eastern Grey Kangaroo	P		X	O		P			
	Macropus robusta	Common Wallaroo	P		X						

Family	Scientific Name	Common Name	TSC/ NPW Act Status	EPBC Act Status	GHD (2010) Surveys	Supplementary Surveys					
						Werai-Glenquarry	Sutton Forest-Exeter	Paddys River	Marulan	Towrang	Goulburn Murrays-Flat
	Macropus rufogriseus	Red-necked Wallaby	P		X					O	
	Wallabia bicolor	Swamp Wallaby	P		X	P			O		
Tachyglossidae	*Tachyglossus aculeatus*	Echidna	P							O	
Vombatidae	*Vombatus ursinus*	Common Wombat	P		X	F		P	P		
Arboreal Mammals											
Petauridae	*Petaurus breviceps*	Sugar Glider	P							W	
Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum	P		X			O			
Pseudocheiridae	*Pseudocheirus peregrinus*	Common Ringtail Possum	P		X						
Microbats											
Molossidae	*Mormopterus sp 4*	Southern Freetail Bat	P		X						
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat	P		X						
	Chalinolobus morio	Chocolate Wattled Bat	P		X						
	Falsistrellus tasmaniensis	**Eastern Falsistrelle**	**V**		**X**						
	Miniopterus schreibersii oceanensis	**Eastern Bentwing Bat**	**V**		**X**						
	Myotis macropus	**Large-footed Myotis**	**V**		**X**						
	Vespadelus regulus	Southern Forest Bat	P		X						

Family	Scientific Name	Common Name	TSC/ NPW Act Status	EPBC Act Status	GHD (2010) Surveys	Supplementary Surveys					
						Werai-Glenquarry	Sutton Forest-Exeter	Paddys River	Marulan	Towrang	Goulburn Murrays-Flat
	Vespadelus vulturnus	Little Forest Bat	P		X						
		Unidentified Microbat	P							W	
Reptiles											
Agamidae	*Amphibolurus muricatus*	Jacky Lizard	P		X						
Scincidae	*Ctenotus taeniolatus*	Copper-tailed Skink	P		X						
	Hemiergis decresiensis	Three-toed Earless Skink	P		X						
	Saproscincus sp	Unidentified Shade-skink	P		X						
Varanidae	*Varanus varius*	Lace Monitor	P		X						
Fish											
Cyprinidae	*Cyprinus carpio**	Carp	U		X						

Notes:

Status codes

*****	Introduced species
P	Protected under the NSW NPWS Act
U	Unprotected
V	Listed as vulnerable under TSC Act and/or EPBC Act.
M	Listed migratory species under the EPBC Act.

Observation Codes

O	Observed (Seen)
W	Heard
P	Scat evidence
F	Tracks/scratching
X	Recorded during previous (GHD 2010) surveys

Appendix B

Supplementary Survey Results

Table 16 Supplementary Survey Results

Survey Area	Section	Vegetation Type	Habitat Resources	Conservation Significance	Management
62	Moss Vale - Werai	Disturbed Agricultural and Grazing Land	Few habitat trees – outside pipeline disturbance corridor.	Low	Standard
63	Moss Vale - Werai	River Peppermint - Narrow-leaved Peppermint open forest	Habitat trees within corridor	High- Southern Highlands Shale Woodland EEC, *E. macarthurii* individuals	6m max corridor with targeted pre-clearance surveys through, and adjacent to woodland patches. Retain and replace substrate and significant woody debris. Avoid EEC and *E. macarthurii*
64	Moss Vale - Werai	Derived grassland and exotic trees and shrubs.	Perennial creek with good in-stream vegetation, single *E. macarthurii* in riparian vegetation- outside pipeline disturbance corridor.	Low	Standard

Survey Area	Section	Vegetation Type	Habitat Resources	Conservation Significance	Management
65	Moss Vale - Werai	Disturbed Agricultural and Grazing Land; Patch of River Peppermint - Narrow-leaved Peppermint open forest	Habitat trees within pipeline disturbance corridor	Patches of High condition Southern Highlands Shale Woodland EEC, *E. macarthurii* individuals	6m max corridor with targeted pre-clearance surveys through, and adjacent to woodland patches. Retain and replace substrate and significant woody debris. Avoid EEC and *E. macarthurii*
66a (south)	Moss Vale - Werai	Cleared and highly modified, Strip of Swamp Gum Ribbon Gum Woodland (Southern Highlands Shale Woodland EEC) in road easement	Good condition native understorey in woodland, otherwise negligible	High- strip of Southern Highlands Shale Woodland EEC, *E. macarthurii* individuals	Ensure alignment avoids EEC patches and *E. macarthurii*. Directional drilling beneath road should avoid impacts.

Survey Area	Section	Vegetation Type	Habitat Resources	Conservation Significance	Management
66b (north)	Moss Vale - Werai	Disturbed Agricultural and Grazing Land; Patch of River Peppermint - Narrow-leaved Peppermint open forest (Southern Highlands Shale Woodland EEC)	Negligible within final pipeline route	High- large patch of Southern Highlands Shale Woodland EEC	6m max corridor with targeted pre-clearance surveys through, and adjacent to woodland patches. Retain and replace substrate and significant woody debris. Avoid EEC: ensure alignment passes to north of this patch
66c (west)	Moss Vale - Werai	Exotic pasture land with small strip of River Peppermint - Narrow-leaved Peppermint open forest along road easement	Negligible within final pipeline route	High- strip of Southern Highlands Shale Woodland EEC, *E. macarthurii* individuals	Ensure alignment avoids EEC patches and *E. macarthurii*. Directional drilling beneath road should avoid impacts.
67	Moss Vale - Werai	Derived tussock grassland surrounded by good condition River Peppermint - Narrow-leaved Peppermint open forest	Hollow-bearing trees, good regeneration value	High- very good condition patches of Southern Highlands Shale Woodland EEC, including *E. macarthurii* individuals	Ensure alignment avoids EEC patches and *E. macarthurii* by using clearings

Survey Area	Section	Vegetation Type	Habitat Resources	Conservation Significance	Management
68	Moss Vale - Werai	Derived tussock grassland/ Sedgeland; large patches of excellent condition River Peppermint - Narrow-leaved Peppermint open forest (Southern Highlands Shale Woodland EEC)	Small patch of habitat trees, good fallen timber and wombat burrow within corridor	High- patches of excellent condition Southern Highlands Shale Woodland EEC	Ensure alignment avoids EEC patches by using clearings
69	Moss Vale - Werai	Planted / Exotic Vegetation	Negligible	Low	Standard
70	Sutton Forest-Exeter	Derived Tussock Grassland with narrow strip of at road crossing. Would remove 2-3 mature trees, few acacias and environmental weeds	Negligible	High- patch of Southern Highlands Shale Woodland EEC	6m max corridor with targeted pre-clearance surveys. Retain and replace substrate and significant woody debris. Avoid EEC where possible

Survey Area	Section	Vegetation Type	Habitat Resources	Conservation Significance	Management
71	Sutton Forest-Exeter	Derived tussock grassland with some native groundcover, Acacia sp. And single E. viminalis. Would remove old, senescing Acacias	Negligible	Low- pipeline follows existing cleared easement	Standard
72	Sutton Forest-Exeter	Grazed/cleared native grassland with patch of Southern Highlands Shale Woodland EEC Pipeline requires clearing of approx 6m strip of EEC	Very good woody debris	High- patch of Southern Highlands Shale Woodland EEC	6m max corridor with targeted pre-clearance surveys. Retain and replace substrate and significant woody debris. Avoid EEC where possible
73	Paddy's River	Pipeline follows existing cleared easement. Surrounding areas are exotic grassland with some mature *Pinus radiata*	Low	Low	Standard

Survey Area	Section	Vegetation Type	Habitat Resources	Conservation Significance	Management
74	Paddy's River	*Pinus radiata* with grazed/improved pasture understorey. Patch of *E. sieberi* woodland pipeline would remove max 3 young adult trees and mod diversity of sandstone understorey shrubs.	Negligible	Low	Standard
75	Paddy's River	Derived native grassland and existing cleared gas easement	Negligible	Low	Standard
76	Paddy's River	Heathy Open Forest of *E. sieberi, A. falciformis, E. piperita, E. agglomerate* and very diverse and dense understorey of sandstone shrubs and forbs. Ungrazed, good regeneration. Sandstone derived soils with 5-10% gravel, orange clayey sand.	Dense understorey, mature regenerating trees, DBH 20-60cm	Medium- good condition native vegetation	6m max corridor with targeted pre-clearance surveys. Retain and replace substrate and significant woody debris. Avoid hollow-bearing trees where possible

Survey Area	Section	Vegetation Type	Habitat Resources	Conservation Significance	Management
77	Paddy's River	In eastern portion passes through cleared easement, will remove 10 *P. radiata* but avoid native forest. In western portion will remove native and exotic grasses and regenerating native shrubs (*A. terminalis, A. longifolia, Kennedia prostrate, A. mearnsii, Pteridium esculentum*) Adjoining tall woodland of *E. agglomerata, E. piperita, A. littoralis* with heathy understorey. Sandstone derived soils, unlikely EEC	Negligible	Low	Standard

Survey Area	Section	Vegetation Type	Habitat Resources	Conservation Significance	Management
78	Paddy's River	Existing gas easement, underscrubbed. Pipeline will clear 6m of regenerating forest. Open forest of *E. sieberi, E. piperita, E. agglomerata* with heathy understorey. Pipeline will remove mainly shrubs, sub-mature eucs and Acacias	Several small termite mounds within pipeline corridor	Medium- good condition native vegetation	6m max corridor with targeted pre-clearance surveys. Retain and replace substrate and significant woody debris. Avoid hollow-bearing trees where possible

Survey Area	Section	Vegetation Type	Habitat Resources	Conservation Significance	Management
79	Marulan	Pipeline within existing gas easement adjacent to Stringybark Forest and *Pinus radiata* plantation. Stringybark Forest is remnant, mostly young regrowth open forest of *E. agglomerata* with *E. cinerea, E. globoidea, E. macroryncha and E. mannifera* with fairly open, shrubby understorey of C*assinia spp.* Few small Blue Stringybark may need to be removed as NE edge 260 along access rd	Several small termite mounds and hollow-bearing trees within pipeline corridor	Medium- good condition native vegetation	6m max corridor with targeted pre-clearance surveys. Retain and replace substrate and significant woody debris. Avoid hollow-bearing trees where possible

Survey Area	Section	Vegetation Type	Habitat Resources	Conservation Significance	Management
80	Marulan	Low open forest of Scribbly Gums with heathy understorey. Conglomerate and sandstone outcrops, platey fragments, excellent substrate. Intact shrub layer of *Proteaceae, Ericaceae* and *Myrtaceae.*	Very good woody debris, excellent substrate, rocky outcrops, dense small tree and shrub layer.	Medium- good condition native vegetation	6m max corridor with targeted pre-clearance surveys. Retain and replace substrate and significant woody debris. Avoid hollow-bearing trees where possible
81	Marulan	*E. sclerophylla* low open forest with sparse, overgrazed understorey, few perennial native grasses, herbs and shrubs. Pipeline accommodated in cleared land	Excellent substrate- woody debris and platey rock fragments. Few stags and hollow-bearing trees. Many termite mounds due to concentration along north-facing edge of patches of forest along easement	Medium- good condition native vegetation	6m max corridor with targeted pre-clearance surveys. Retain and replace substrate and significant woody debris. Avoid hollow-bearing trees where possible
82	Goulburn-Murray's Flat	Exotic grassland and scrub, including noxious weeds. Realignment has avoided wetland area.	Some fauna habitat value	Low	Standard

Survey Area	Section	Vegetation Type	Habitat Resources	Conservation Significance	Management
83	Goulburn-Murray's Flat	Near intact Grassy Low woodland of*E.blakelyi* modified EEC withgrassy understorey of *Themeda australis* and environmental weeds. Away from NE edge understorey condition very good: *Austrostipa spp., Austrodanthonia spp.,* sparse shrubs *Cassinia arcuata. E. melliodora* forms an open woodland structure with an *E. blakelyi* understorey. Moderate weed infestation but good cover and diversity of native understorey.	Rock outcrop	High- Box-gum Woodland	6m max corridor with targeted pre-clearance surveys. Current alignment would avoid removal of mature trees. Final pipeline predominantly passes through cleared asset protection easement outside of this patch of vegetation.
84	Marulan				

Survey Area	Section	Vegetation Type	Habitat Resources	Conservation Significance	Management
85a	Marulan	Eastern end. *E sclerophylla* and *E. macrorhynca* low woodland. Dense-patchy shrub layer of *Kunzea parvifolia, Daviesia ulicifolia, Leptospermum trinervium, Acacia deanii.* Diverse healthy grassy understorey of *Aristida, Austrostipa, Xanthorrhoea, Goodenia hederaceae.* Eastern end of scribbly gum transitions into *E. bridgesiana E. cinerea* woodland	Good rock fragments, leaf litter and woody debris. Patches of dense shrubby understorey	Medium- healthy and structurally diverse native vegetation. Risk of increased serrated tussock infestation.	6m max corridor with targeted pre-clearance surveys for hollow-dwelling fauna. Retain and reinstate fauna habitat resources

Survey Area	Section	Vegetation Type	Habitat Resources	Conservation Significance	Management
85b	Marulan	Central portion. Partially disturbed *E. bridgesiana, E. cinerea* and *E. mannifera* woodland. Dense *Kunzea parvifolia* shrub layer and *Austrostipa, Bothriochloa* grass layer, overall very slight weed infestation. Pipeline will remove 6m of intact veg- relatively few mature trees due to patchy woodland, shrubs and grasses		Medium- moderately good condition native vegetation with very slight weed infestation	6m max corridor with targeted pre-clearance surveys for hollow-dwelling fauna. Retain and reinstate fauna habitat resources

Survey Area	Section	Vegetation Type	Habitat Resources	Conservation Significance	Management
85c	Marulan	Western portion. Realigned route substantially avoids mature trees and intact woodland. Will remove *Kunzea parvifolia* and *Acacia spp.* Grassy understorey of *Aristida, Poa and Eragrostis spp.* Woodland of *E. bridgesiana, E. melliodora* and *E.cinerea* occurs closer to drainage line and road, with midstorey of *Acacia deanii* and *Kunzea,* patchy grassy understorey. Box-gum Woodland	Good leaf litter and rock outcrops. Creek downslope in very good condition with healthy and diverse in stream and riparian veg, *E. melliodora* and *E. bridgesiana.*	High- Box-gum Woodland	6m max corridor with targeted pre-clearance surveys. Current alignment would avoid removal of mature trees

Survey Area	Section	Vegetation Type	Habitat Resources	Conservation Significance	Management
86	Marulan	*E. sclerophylla, E. sieberi, E. agglomerata* open forest with *Cassinia arcuata, Acacia dawsonii, Daviesia ulicifolia* midstorey and open grassy understorey of *Aristida jerichoensis, Austrodanthonia spp, Austrostipa spp.* Pipeline will remove mature and over mature trees including good habitat trees	Very good habitat trees, good rock fragments, leaf litter and woody debris	Medium- good condition native vegetation with good fauna habitat values	6m max corridor with targeted pre-clearance surveys for hollow-dwelling fauna. Retain and reinstate fauna habitat resources

Survey Area	Section	Vegetation Type	Habitat Resources	Conservation Significance	Management
87	Towrang	Open forest of *E. ssclerophylla, sieberi and mannifera* with a shrub/grass understorey- same community as 86 with very similar suite of species and habitat resources. Impacts may be contained in the gas easement as doesn't appear to be Powertel easement.	Relatively few habitat trees	Medium- good condition native vegetation with good fauna habitat values	6m max corridor with targeted pre-clearance surveys for hollow-dwelling fauna. Retain and reinstate fauna habitat resources
88	Goulburn- Murray's Flat	Derived grassland- Grassy box woodland habitat but highly modified and with little value. Some perennial native grasses, but cover dominated by exotic grasses and environmental weeds	Negligible	Low	Standard

Survey Area	Section	Vegetation Type	Habitat Resources	Conservation Significance	Management
89	Towrang	Open forest-woodland of *E. macroryncha, E. rossii, E. goniocalyx, E. globoidea*. Few *E. melliodora* suggesting EEC remnants at far eastern end, but substantially removed (veg patch along pipeline = non EEC). Sparse, heavily grazed understorey.	Very good woody debris, leaf litter and rock fragments.	Medium- moderately good condition native vegetation with good fauna habitat resources	Max 6m clearing (contain in overcleared easement where possible). Retain and reinstate fauna resources where possible.

Appendix C

Part 3A Assessments of Significance

White Box Yellow Box Blakely's Red Gum Woodland (Box-gum Woodland)	
Criteria	
i) How is the Project likely to affect the lifecycle of a threatened species and/or population?	
a) displaces or disturbs threatened species and/or populations; b) disrupts breeding cycle; c) disturbs the dormancy period; d) disrupts roosting behaviour; e) changes foraging behaviour; f) disrupts pollination cycle; g) disturbs seedbanks; or h) disrupts recruitment (i.e. germination and establishment of plants); i) affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations); and j) affects migration and dispersal ability.	N/A to the assessment of this EEC.
ii) How is the project likely to affect the habitat of a threatened species, population or ecological community?	
a) disturbs any permanent, semi permanent or ephemeral water bodies;	Construction of the final pipeline may remove riparian and in-stream vegetation and interrupt flow within a number of water bodies with the magnitude of impacts dependant upon construction techniques at specific waterway crossings as outlined in the GHD (2010c) Aquatic Ecology Assessment. There are no water bodies within the 0.1 ha of Box-gum Woodland that would be directly affected by construction. Further, this community is not dependant upon any habitat resources that may be affected by construction impacts on water bodies. Therefore impacts of the Project on water bodies would have a negligible effect on Box-gum Woodland.
b) degrades soil quality;	Soil quality along the proposed pipeline corridor would be initially degraded through disturbance of topsoil by earthworks, removal of vegetation. This would affect 0.1 ha of Box-gum Woodland within the construction corridor. Standard mitigation measures within the remainder of the construction corridor, including sediment control and the retention and re-spreading of topsoil, are likely to avoid negative effects on adjacent areas of the community.
c) clears or modifies native vegetation;	The Project would permanently remove 0.1 ha of Box-gum Woodland within the construction corridor. The Project would also remove or modify a further 8.8 ha of other native vegetation communities which may support component species of Box-gum Woodland. Standard mitigation measures within the remainder of the construction corridor, including sediment and surface water control and weed management are likely to avoid the modification of any additional areas of the EEC or other native vegetation.

d) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;	The majority of the proposed pipeline corridor occurs through grazed agricultural land containing high levels of weeds such as pasture grasses, herbaceous and woody weeds and contains a number of noxious weeds. Fragmented small stands of remnant Box-gum Woodland within the survey corridor featured moderate weed infestation Moderate to severe infestations of weeds occurred around the margins of woodland patches adjoining disturbed or cleared land. The proposed activity would involve the permanent removal of approximately 0.1 ha of native vegetation consistent with Box-gum Woodland, to be permanently maintained as a cleared easement. It is likely that weed infestation would increase within the maintained area of easement, as well as the potential for some weed invasion through edge effects on adjacent areas of vegetation. Standard environmental management measures would mitigate the risk of weed invasion to a degree. Given the limited direct disturbance footprint, proposed mitigation and the degree of existing weed infestation in the EEC and adjoining areas, the Project would make a minor contribution to the negative effect of exotic species.
e) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;	N/A for EEC assessment
f) affects natural revegetation and recolonisation of existing species following disturbance.	Clearing of Box-gum Woodland for the proposed pipeline will occur as a 6m wide strip. This strip is to be permanently maintained free of canopy and mid-storey vegetation and will not be allowed to regenerate naturally. Pollination and seed dispersal of the majority of plant species within this EEC is likely to continue across this gap. Similarly, the majority of fauna species would readily traverse such a gap in habitat. Natural revegetation and recruitment taking place within adjacent areas of this EEC are likely to remain unaffected by the proposed works, apart from short term changes along the disturbance edge, where increased light and exposure to wind and water loss may alter regeneration in the short to medium term.
iii) Does the Project affect any threatened species or populations that are at the limit of its known distribution?	N/A for EEC Assessment
iv) How is the project likely to affect current disturbance regimes?	
a) modifies the intensity and frequency of fires;	The Project is not predicted to directly affect the intensity and frequency of fires in a significant way. However, the proposed clearing would potentially offer a broader firebreak across the landscape between larger remnant patches of vegetation in some areas, which may act as a fire break in the event of a localised fire event.
b) modifies flooding flows;	Box-gum Woodland is not ecologically dependant upon flooding flows. Secondary impacts resulting from changes to flooding flows are also unlikely given the following considerations: waterway crossing are to be designed such that they will not significantly alter the flow of any waterway from existing regimes (GHD, 2010c); environmental management measures would mitigate the impacts of temporary removal of vegetation during construction; and permanent modification of vegetation is likely to have a minor impact on flood regimes given the limited disturbance footprint and extent of existing clearing in the survey corridor.
v) How is the project likely to affect habitat connectivity?	

a) creates a barrier to fauna movement;	Clearing of Box-gum Woodland for the proposed pipeline will occur as a 6m wide strip. The majority of component fauna species within this EEC are likely to readily traverse such a gap in habitat.
b) removes remnant vegetation or wildlife corridors; and	The proposed construction would permanently remove approximately 0.01 ha of remnant native vegetation consistent with Box-gum Woodland and convert it to a 6 m wide strip of derived grassland. This magnitude of clearing would not completely remove or significantly interrupt a wildlife corridor.
c) modifies remnant vegetation or wildlife corridors.	Clearing of Box-gum Woodland for the proposed pipeline will occur as a 6m wide strip. This strip is to be permanently maintained free of canopy and mid-storey vegetation and will not be allowed to regenerate naturally. Pollination and seed dispersal of the majority of component plant species within this EEC is likely to continue across this gap. Similarly, the majority of fauna species would readily traverse such a gap in habitat. There would be a minor effect on natural revegetation and recruitment taking place within adjacent areas of this EEC along the disturbance edge, where increased light and exposure to wind and water loss may alter regeneration in the short to medium term. Overall this would comprise a minor effect on the local population of the EEC and on remnant native vegetation and wildlife corridors in surrounding areas.
iv) How is the project likely to affect critical habitat?	There is no listed critical habitat for Box-gum Woodland or of relevance to this assessment.
Conclusion	Negative impacts arising from the Project will directly affect only 0.01 ha of Box-gum Woodland, comprising 0.49% of the mapped extent of the community within the survey corridor. The local population of the EEC would include additional adjoining areas of native vegetation. The disturbance footprint would be restricted to a 6 m wide strip through the EEC and adjoining areas of native vegetation and would not significantly fragment or isolate any areas of habitat for the EEC or component species. Standard environmental management measures are likely to mitigate against any additional impacts. Therefore the Project is not likely to have a significant negative impact on Box-gum Woodland.

Appendix D

EPBC Act Assessment of Significance

EPBC Act Significant Impact Assessment – Box-gum Woodland

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

• reduce the extent of an ecological community

Construction of the final pipeline will reduce the extent of Box-gum woodland by 0.01 ha, comprising 0.49% of the mapped extent of the community within the survey corridor. The local population of the EEC would include additional adjoining areas of native vegetation. Standard environmental management measures are likely to mitigate against any additional impacts. Therefore the extent of the EEC is not likely to decline further through any secondary effects.

• fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines

Construction of the final pipeline will involve the clearing of 0.01 ha of Box-gum woodland comprising a 6 m wide strip through the EEC and adjoining areas of native vegetation. This strip is to be permanently maintained free of canopy and mid-storey vegetation and will not be allowed to regenerate naturally. Pollination and seed dispersal of the majority of component plant species within this EEC is likely to continue across this gap. Similarly, the majority of fauna species would readily traverse such a gap in habitat. There would be a minor effect on natural revegetation and recruitment taking place within adjacent areas of this EEC along the disturbance edge, where increased light and exposure to wind and water loss may alter regeneration in the short to medium term. Overall this would comprise a minor effect on the local population of the EEC and on remnant native vegetation and would not significantly fragment any areas of habitat for the EEC or component species.

• adversely affect habitat critical to the survival of an ecological community

Direct negative impacts arising from the Project will directly affect only 0.01 ha of Box-gum Woodland, comprising 0.49% of the mapped extent of the community within the survey corridor. The local population of the EEC would include additional adjoining areas of native vegetation. The disturbance footprint would be restricted to a 6 m wide strip through the EEC and adjoining areas of native vegetation and would not significantly fragment or isolate any areas of habitat for the EEC or component species. Standard environmental management measures are likely to mitigate against any additional impacts. Therefore the

total area of habitat to be affected by the Project is highly unlikely to be critical to the survival of the ecological community.

• modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns

Soil quality along the proposed pipeline corridor would be initially degraded through disturbance of topsoil by earthworks, removal of vegetation. This would affect the 0.1 ha of Box-gum Woodland within the construction corridor. Standard mitigation measures within the remainder of the construction corridor, including sediment control and the retention and re-spreading of topsoil are likely to avoid negative effects on adjacent areas of the community.

Secondary impacts resulting from changes to surface or groundwater flows are unlikely. The final pipeline design has been developed to avoid impacts on groundwater flows and waterway crossing have been designed such that they will not significantly alter the flow of any waterway from existing regimes (GHD, 2010c). Environmental management measures would mitigate the impacts of temporary removal of vegetation during construction; and permanent modification of vegetation is likely to have a minor impact on either surface water flows or groundwater levels given the limited disturbance footprint and extent of existing clearing in the survey corridor.

• cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting

The Project would directly affect component species of the community within 0.1 ha of Box-gum Woodland within the construction corridor. Impacts would be limited to a 6 m wide strip which is highly unlikely to contain an ecologically significant proportion of the population of any functionally important species. The Project would not permanently modify the natural environment in any way that would affect the species composition of the community beyond the immediate disturbance footprint.

• cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

-- assisting invasive species, that are harmful to the listed ecological community, to become established

The majority of the proposed pipeline corridor occurs through grazed agricultural land containing high levels of weeds such as pasture grasses, herbaceous and woody weeds and contains a number of noxious weeds. Fragmented small stands of remnant Box-gum Woodland within the survey corridor featured moderate weed infestation Moderate to severe infestations of weeds occurred around the margins of woodland patches adjoining disturbed or cleared land.

The proposed activity would involve the permanent removal of approximately 0.1 ha of native vegetation consistent with Box-gum Woodland, to be permanently maintained as a cleared easement. It is likely that weed infestation would increase within the maintained area of easement, as well as the potential for some weed invasion through edge effects on adjacent areas of vegetation. Standard environmental management measures would mitigate the risk of weed invasion to a degree.

Given the limited direct disturbance footprint, proposed mitigation and the degree of existing weed infestation in the EEC and adjoining areas, the Project would make a minor contribution to the negative effect of exotic species.

-- causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community

Standard environmental management measures would substantially reduce the risk of the mobilisation of fuel or any other pollutants during the construction period. The Project does not involve the storage or transport of any pollutants through its operational life.

• interfere with the recovery of an ecological community.

Direct negative impacts arising from the Project will directly affect 0.01 ha of Box-gum Woodland, comprising 0.49% of the mapped extent of the community within the survey corridor, which would comprise a negligible effect on the recovery of the community.

Conclusion

Construction of the final pipeline will reduce the extent of Box-gum woodland by a relatively small amount, when compared to the mapped extent of the community within the survey corridor and to the extent occurring within the region. The stand of Box-gum Woodland recorded within the survey corridor is contiguous with adjoining areas of native vegetation and so this is not likely to comprise a significant or notable reduction in the extent of the community.

The Project is not likely to contribute to any other of the above-listed factors.

Therefore the Project is not likely to have a significant impact on Box-gum Woodland, as per the DEWHA (2009a) guidelines.

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