

Wandoan Coal Project

Southern Coal Seam Methane Water Supply Pipeline

Supplementary Terrestrial Ecology Assessment

September, 2009

Wandoan Joint Venture



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Acronyms

Acronym	Definition
CAMBA	China Australia Migratory bird Agreement
CHPP	Coal Handling and Preparation Plant
CG	Coordinator-General
DEWHA	The Department of the Environment, Water, Heritage and the Arts
DERM	Department of Environment and Resource Management
EPP	Environmental Protection Policy
EIS	Environmental Impact Statement
EP Act	Environmental Protection Act 1994
EPA	The former Environmental Protection Agency. Now part of the Department of Environment and Resource Management (DERM).
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EA	Environmental Authority as issued under the EP Act.
GAB	Great Artesian Basin
IDAS	Integrated Development Assessment System
IP Act	Integrated Planning Act 1997
JAMBA	Japan Australia Migratory bird Agreement
KCP	Nature Conservation (Koala) Conservation Plan 2006
LP Act	<i>Land Protection (Pest and Stock Route Management) Act 2002</i>
MDL	mineral development licence
ML	Million litres
MLA	Mining lease application
MNES	Matters of National Environmental Significance
MR Act	<i>Mineral Resources Act 1989</i>
Mt/a	million tonnes per annum
NC Act	<i>Nature Conservation Act 1992</i>
NC Regulation	Nature Conservation (Wildlife) Regulation 2006
NRW	The former Department of Natural Resources and Water. Now part of the Department of Environment and Resource Management (DERM).
QPWS	Queensland Parks and Wildlife Service
RE	Regional Ecosystem
ROM coal	Run of Mine coal
SDPWO Act	<i>State Development and Public Works Organisation Act 1971</i>
TOR	Terms of Reference
VM Act	<i>Vegetation Management Act 1999</i>
WJV	Wandoan Joint Venture

Executive summary

This report presents the findings of the supplementary terrestrial ecology survey and assessment completed for the southern coal seam methane (CSM) water supply pipeline associated with the Wandoan Coal Project (the Project).

As part of the Environmental Assessment for the Project, a terrestrial ecological assessment was completed. The Terms of Reference (ToR) for the Project indicated that seasonal surveys would need to be completed. A commitment was made in the Environmental Assessment that seasonal surveys would be completed for the southern CSM water supply pipeline and the results presented in a supplementary report.

This report presents the findings of the supplementary terrestrial ecology survey and assessment completed for the southern CSM water supply pipeline. The report builds upon information already provided in the environmental assessment and in particular to highlight any differences in species, communities, habitats or impacts that have become apparent as a result of these surveys.

Generally the vegetation types, habitat types and species present were the same as those recorded during the earlier surveys. However due to route modification and enhanced property access, four regional ecosystems (REs) not identified in the original route were recorded in the February 2009 surveys.

- 11.3.27c Freshwater wetlands: mixed grassland or sedgeland with areas of open water +/- aquatics
- 11.9.7 *Eucalyptus populnea*, *Eremophila mitchellii* shrubby woodland on fine-grained sedimentary rocks
- 11.9.10 *Acacia harpophylla*, *Eucalyptus populnea* open forest on fine-grained sedimentary rocks
- 11.3.19 *Callitris glaucophylla*, *Corymbia* spp. and/or *Eucalyptus melanophloia* woodland on Cainozoic alluvial plains.

One threatened species not recorded in August 2008 was recorded in the February 2009 surveys: *Gonocarpus urceolatus*. This species of plant is listed as vulnerable under the NC Regulations and was recorded at three distinct locations.

The proposed pipeline is likely to result in removal of 93 hectares of remnant vegetation, of which 1.6 hectares is listed as endangered. Other impacts and the proposed mitigation remain the same from the original technical assessment, as provided in the EIS Volume 2, Chapter 17A Terrestrial Ecology technical report TR 17A-1-V2.5.

1. Introduction

This report presents the findings of the supplementary terrestrial ecology survey and assessment completed for the southern coal seam methane (CSM) water supply pipeline associated with the Wandoan Coal Project (the Project).

1.1 Background

The Wandoan Coal Project comprises the development of thermal coal resources immediately west of Wandoan, a small rural town situated approximately 350 km northwest of Brisbane and 60 km south of Taroom. The coal reserves for the Project exist within three mining lease application areas (MLA areas 50229, 50230 and 50231) to be developed as an open cut mine with related infrastructure. The Project is being developed by the Wandoan Joint Venture (WJV), a partnership which includes Xstrata Coal Queensland Pty Ltd (XCQ), ICRA RPW Pty Ltd and Sumisho Coal Australia Pty Ltd.

1.2 Context and scope of this assessment

As part of the environmental assessment for the Project, a terrestrial ecological assessment was completed along the route of the southern CSM water supply pipeline. The Terms of Reference (ToR) for the Project indicated that seasonal surveys would need to be completed. A commitment was made in the Environmental Assessment that seasonal surveys would be completed for the southern CSM water supply pipeline and the results presented in a supplementary report.

This report presents the findings of the supplementary terrestrial ecology survey and assessment completed for the southern CSM water supply pipeline. The report is intended to build upon information already provided in the Environmental Impact Assessment and in particular to highlight any differences in species, communities, habitats or impacts that have become apparent as a result of these surveys.

1.3 Southern CSM water supply pipeline details and Study Area

For the purpose of this assessment the following definitions apply:

- **Footprint:** the extent of direct impacts of the Project. This was taken to be a 20 m corridor required for construction of the Project.
- **Study area:** the study site and any additional areas that could potentially be affected by the proposal either directly or indirectly, such as ancillary construction areas. In this case it is taken to be a 100 m wide corridor along the southern CSM water supply pipeline from the Condamine Power Station east of Miles to the Wandoan Coal Project MLA areas (see Figure 1-1).
- **Region:** a bioregion defined in a national system of bioregionalisation. For this study, this is the Brigalow Belt bioregion as defined in the Interim Biogeographic Regionalisation for Australia (Thackway & Cresswell 1995).

Two options are currently being considered for the supply of raw water to the Project for mine operations. One of these options is the use of by-product water from coal seam methane (CSM) extraction from gas fields south of Miles. For this to occur, a new pipeline is needed to transfer CSM by-product water from the Condamine Power Station, north to the MLA areas.

The proposed route commences at the Condamine Power Station and progresses in a northerly direction to an existing high voltage transmission line easement. A turn to the west is then made and the pipeline travels along the existing transmission line easement until it intersects with the Leichhardt Highway. A turn to the north is made and the proposed pipeline travels along the eastern side of the road reserve of the Leichhardt Highway, crossing the highway into the road reserve of Baileys Road and continuing north. At the intersection of Baileys and Giligulgul Roads, the proposed pipeline proceeds in a north-east direction within the road reserve. Where Giligulgul Road intersects with the Leichhardt Highway, the alignment turns into the road reserve of the Leichhardt Highway on the western side and progresses in a northerly direction until the south-eastern corner of Lot 3 FT695. At this point, the proposed alignment traverses this allotment in a northerly direction to enter the MLA areas at the south-east corner (Figure 1-1).

This route differs from the route initially assessed in Volume 2 of the EIS, particularly in the northern section between the northern end of Baileys Road to the MLA area boundary. These differences have been assessed and included in this report.

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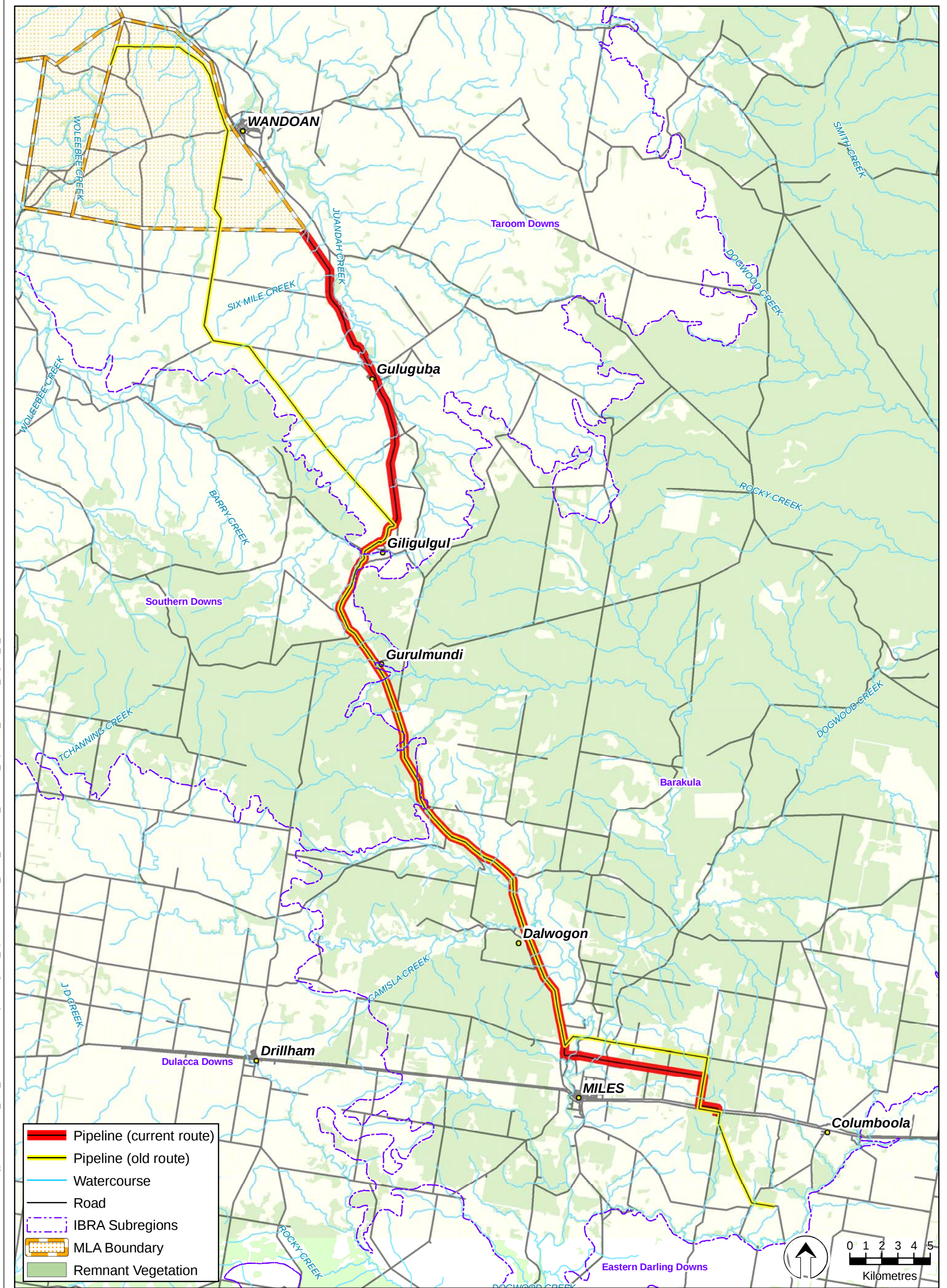


Figure 1.1 - Southern CSM water supply pipeline

2. Relevant legislation and guidelines

Generally the legislation relevant to biodiversity remains the same as in the EIS technical report. A new piece of legislation and a proposed policy are, however, relevant.

2.1 Vegetation Management (Regrowth Clearing Moratorium) Act 2009

On 7 April 2009, the Queensland Government announced a three-month moratorium on clearing high-value regrowth vegetation. The moratorium took legal effect on 8 April 2009 under the *Vegetation Management (Regrowth Clearing Moratorium) Act 2009*, and has recently been extended until 7 October 2009.

Under the moratorium all native regrowth vegetation within 50 m of a watercourse in the priority reef catchments of the Wet Tropics, Burdekin and Mackay/Whitsunday regions, and endangered regrowth vegetation in rural areas across the State on freehold and agricultural and grazing State leasehold land is protected for a period of at least three months. Remnant vegetation is dealt with in the same manner as before under the Vegetation Management Act.

Some small areas of regrowth vegetation within the study area will fall under this moratorium (refer Figures 2-1a-c). The watercourse provisions of the moratorium do not apply to this Project as it does not fall within a priority reef catchment.

2.2 Consultation draft Policy for Biodiversity offsets

A biodiversity offset is an environmental offset that addresses environmental conditions and features that are important for biodiversity. A biodiversity offset is an action undertaken to counterbalance an impact that causes a loss of biodiversity values. The Queensland Government has developed a consultation draft policy on biodiversity offsets. A final policy will be prepared following consultation from December 2008 and consideration of written submissions from individuals and organisations. At the time of writing this technical report, a final policy has not been released.

The aim of a policy on biodiversity offsets is to provide a consistent and transparent approach to the use of environmental offsets for impacts on biodiversity.

The policy applies to biodiversity values of state interest, but does not apply to biodiversity offsets for impacts to the same biodiversity values already captured under specific-issue offset policies such as the Policy for Vegetation Management Offsets.

The draft policy is not intended to replace offset programs already in place, such as those required under the Vegetation Management Act (Department of Natural Resources and Water 2007). This proposed policy is designed to sit under the existing Queensland Government Policy for Environmental Offsets, which consider a number of subpolicies including vegetation offsets and biodiversity offsets.

Offsets have been considered in Section 7.1.

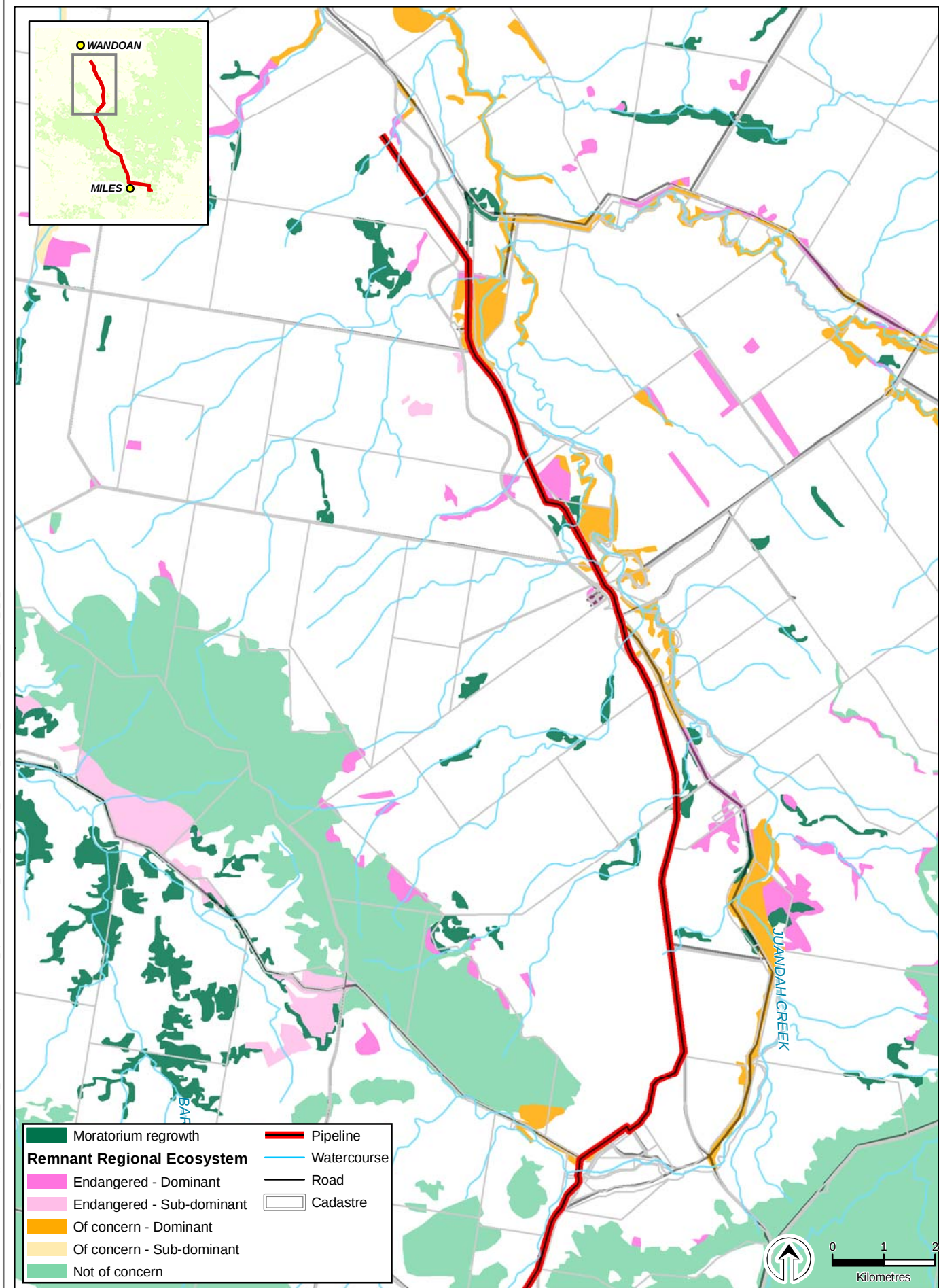


Figure 2.1(a) - Moratorium regrowth areas (northern extent of route)



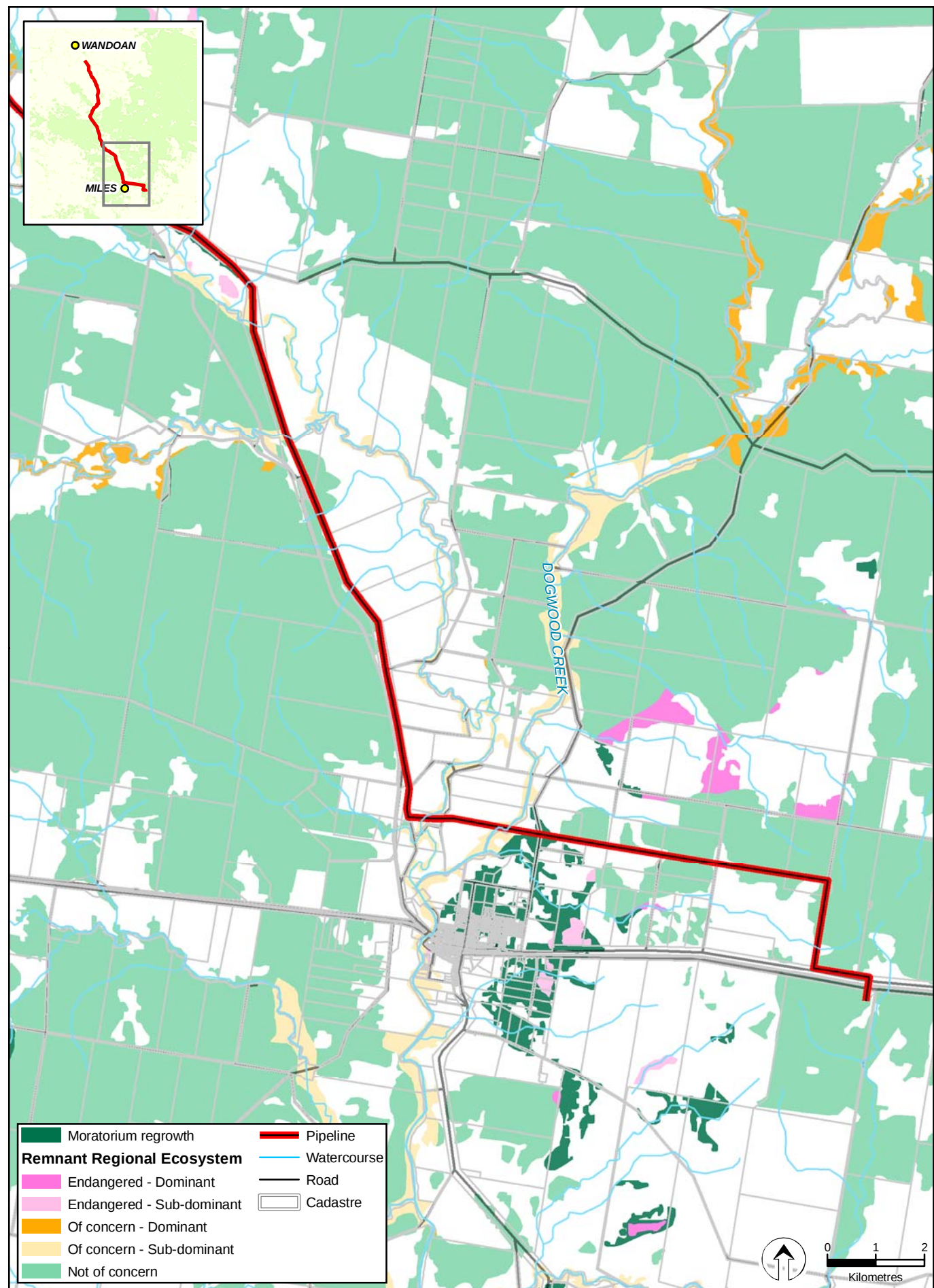


Figure 2.1(c) - Moratorium regrowth areas (southern extent of route)

3. Methods

This section outlines the methods used to gather information relating to ecologically sensitive areas and species of plants and animals that are known or likely to occur in the Study Area and surrounds. The focus of this report is on the findings of the field survey conducted as part of the Supplementary EIS.

3.1 Contributors and qualifications

The contributors to the preparation of this technical report, their qualifications and role are listed in Table 3-1.

Table 3-1 Contributors and their roles

Name	Association	Qualification	Role
Martin Predavec	PB	BSc(Hons), PhD	Ecology lead
Chris Hanson	Hansen Botanical Assessments	BMedSc, BSc (Hons)	Botanist – field surveys and reporting
Ben Lewis	Lewis Ecological Services	BAppSci(Hons)	Zoologist – field surveys and reporting
Lukas Clews	PB	BSc, Grad Cert AppSci	Botanist – field surveys
Sean Niemeijer	PB	BSc	Zoologist – field surveys
Greg Ford	Consultant Ecologist	BAppSci	Bat call analysis

All work was carried out under the necessary permits, including:

- Animal Ethics Permit from the Department of Primary Industries and Fisheries Animal Ethics Committee. Permit number CA 2007/10/223. Expires 31 October 2010
- Queensland Parks and Wildlife Service Scientific Purposes Permit issued under the Nature Conservation Regulation 1994. Permit Number WISP02443404. Expires 4 October 2009
- Department of Primary Industries and Fisheries Scientific Use Registration. Registration No: 064. Expires 13 March 2010.

3.2 Nomenclature

3.2.1 Flora

Application of scientific names in this report follows Harden et al. (2006, 2007) for rainforest plants and vines, and Bostock and Holland (2007) for all other species. In the first occurrence in the text, scientific names of plants are followed by their common name (if one exists). Common names were derived from Harden et al. (2006), Brooker and Kleinig (2004) and Auld and Medd (2002). Use of an asterisk (*) indicates the species is not native to

Queensland, e.g. **Opuntia tomentosa* (velvet prickly pear). Following the first in-text reference, floral species are referred to by scientific name only.

3.2.2 Fauna

The nomenclature for vertebrate fauna follows the Queensland Parks and Wildlife Services (QPWS) WildNet database (2008) and Census of Australian Vertebrates (CAVS) database (Department of the Environment Water Heritage and the Arts 2008).

Common names are used in this report for species of animal followed by scientific name the first time the species is mentioned. Scientific and common names are included in species lists in the relevant attachments.

3.3 Survey weather conditions

Weather conditions during the nine day survey were best described as hot with no rainfall being recorded during the survey. However, substantial rainfall events of 16-26 mm were recorded in the week leading up to the survey (Attachment A). Daily maximum temperatures consistently exceeded 30°C with overnight minimums of between 17-23°C. Survey conditions were considered optimal for most vertebrates except frogs. Weather conditions are summarised in Attachment A.

3.4 Terrestrial flora surveys

3.4.1 Objective

Seasonal floral surveys were undertaken in the period between and inclusive of 19 and 28 February 2009. The field floral survey methods were developed in order to:

- capture information about all mapped regional ecosystems and any other unusual vegetation communities identified from aerial photography interpretation, with reference to available aerial photography and regional ecosystems
- validate existing Queensland Herbarium regional ecosystem mapping
- assign a relative conservation value to all captured and described vegetation communities
- target rare and threatened flora species and communities and their habitats identified from database searches and preliminary survey efforts
- meet Queensland Department of Environment and Resource Management (DERM) minimum survey requirements.

Detailed structural information of all remnant and non-remnant vegetation communities located within the Study Area was recorded during the dry season effort and enabled the delineation of community boundaries and refinement of the current certified Regional Ecosystem (RE) mapping as determined by the DERM. The new areas of pipeline corridor within the Study Area were surveyed using secondary and tertiary level methodologies, and assessment sites were chosen to represent all DERM remnant mapped vegetation and specifically the variation of REs within these remnant areas. Additional non-remnant areas

were also surveyed in order to ensure site coverage and sampling of all potential habitat types.

During the earlier dry season survey effort (August 2008), as presented in Volume 2 terrestrial ecology technical report TR 17A-1-V2.5, detailed floral inventories were performed in secondary level assessment sites within field-validated polygons. During the current survey effort (February 2009), all previously surveyed tertiary and secondary level assessment sites were re-visited and quantitative and qualitative species composition survey within a 1,000 m² quadrat was performed (Figure 3-1). Additional species were also identified and documented within the immediate area and/or during an associated foot traverse of between 500 and 1,000 m in length.

Supplementary and/or extended targeted foot traverses were performed within marginal and core habitat of recorded and prospective threatened and regionally significant species to delineate population extent and approximate size.

3.4.2 Site Selection

Regional ecosystem mapping of the new and existing areas of the Study Area were validated at 46 sites (Figure 3-1), with multiple sites being validated within each regional ecosystem type. Data at twelve of these sites was collected in compliance with the Queensland Herbarium's secondary site assessment methodology (Neldner *et al.* 2005). Data recorded at each secondary site included:

- date and precise location (with reference to handheld Geographic Positioning System (GPS))
- soils, slope, aspect and landform observations
- ground-layer, mid-stratum and canopy species composition and abundance
- structural characteristics
- condition and disturbance of existing vegetation communities (including distribution of weed species)
- quantitative and qualitative species composition within a 1,000 m² quadrat, and documentation of ancillary species identified within the immediate area or during foot traverse
- basal area of vegetation
- photographs of the community.

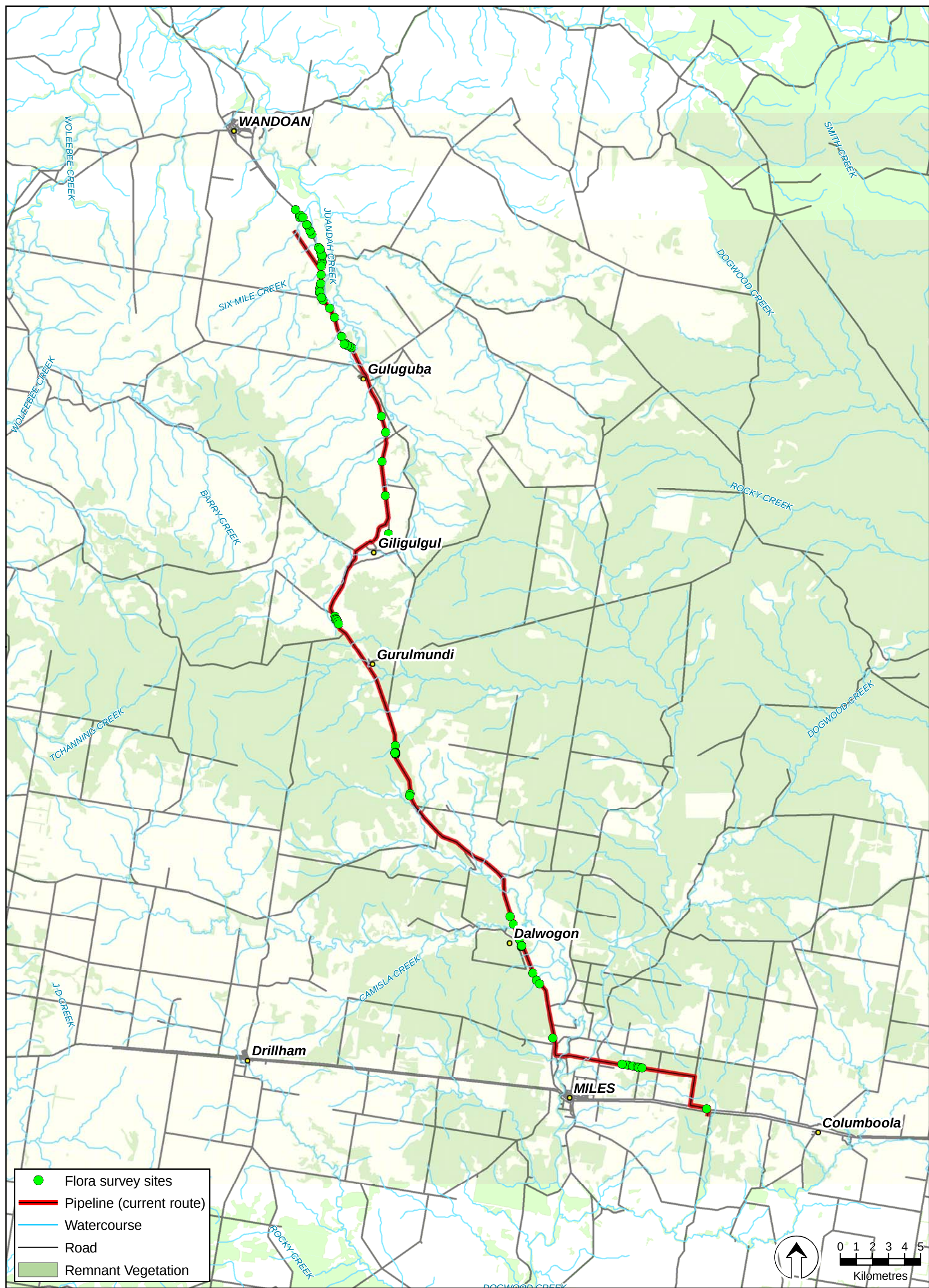


Figure 3.1 - Flora survey locations

The remaining 34 sites were performed in compliance with the Queensland Herbarium's tertiary site assessment methodology (Neldner *et al.* 2005). Data recorded at each tertiary site included:

- date and precise location (with reference to handheld GPS)
- soils, slope, aspect and landform observations
- ground-layer, mid-stratum and canopy species composition and abundance
- structural characteristics
- condition and disturbance of existing vegetation communities (including distribution of weed species)
- photographs of the community.

3.4.3 Traverses

In addition to secondary and tertiary sites, large areas of the Study Area were traversed on foot. The purpose of this type of assessment was to ensure adequate site coverage and to establish a comprehensive floral species list for the Study Area. This method is also essential for the detection of Rare and Threatened species.

3.4.4 Vegetation mapping

DERM mapped REs were validated in the field using transect data described above and the latest geology mapping (Department of Natural Resources and Mines 2005). Some boundaries were mapped in the field using a hand-held GPS as well as through aerial photograph interpretation.

3.4.5 Floral inventory and abundance

A comprehensive floral species list, including native and introduced species, was compiled for the Study Area and is presented in Attachment B. This list was reviewed and amended to include additional species recorded during the February 2009 survey effort.

Abundance of species was assessed on a site by site basis. Abundance estimates were applied to species within each stratum of the community, with particular focus paid to the ecologically dominant layer as it is by these species that the community is defined and from this, the regional ecosystem determined. Abundance assessments of canopy species are quantitative (i.e. the basal area of stems per hectare was calculated using the Bitterlich stick methodology), whilst those for other strata are relative estimates. Abundance of canopy species was recorded in field surveys as dominant, co-dominant associated and suppressed. Relative abundance of other strata was based on the Braun-Blanquet cover-abundance scale (Mueller-Dombois & Ellenberg 1974) as follows: 1 = sparse, <5%; 2 = any number, <5%; 3 = 5 – 25%; 4 = 25 – 50%; 5 = 50 – 75%; 6 = 75 – 100%.

Other field characteristics such as areas of weed infestation, habitat areas for rare and threatened species and regional connectivity were recorded and described. Photographic records were taken throughout the Study Area, capturing each community type, habitat type, potential impact areas and the broader landscape.

3.5 Terrestrial fauna

3.5.1 Faunal survey techniques

Site selection

Five main trapping sites were selected to ensure a range of habitats were sampled and where applicable preference was given to remnant vegetation within each of these habitats (Figure 3-2).

A further 25 supplementary sites were chosen to provide a more comprehensive survey of fauna assemblages and to ensure more discreet habitats such as roadside Brigalow, riparian zones and discrete depression areas were subject to at least some level of survey (Figure 3-2, Table 3-2).

Table 3-2 Faunal survey techniques and number of sites

Technique	Number of sites
Standard Trapping Site	5
Anabat	7
Active Searches - Herpetofauna	10
Harp Trapping	4
Call Broadcast	2
Spotlighting	2
Nocturnal Drive Transects	455 km

At each of the standard sites the following methods were employed:

- habitat assessment
- Elliott Traps x 10
- pitfalls x 5
- funnel traps x 3 or 4
- harp traps x 1
- spotlighting (2 people x 30 minute survey)
- ultrasonic bat detection (1 night)
- general bird surveys (~80 minutes)
- fauna features traverse (opportunistic each day)
- herpetofauna active searches (2 people x 20 minutes).

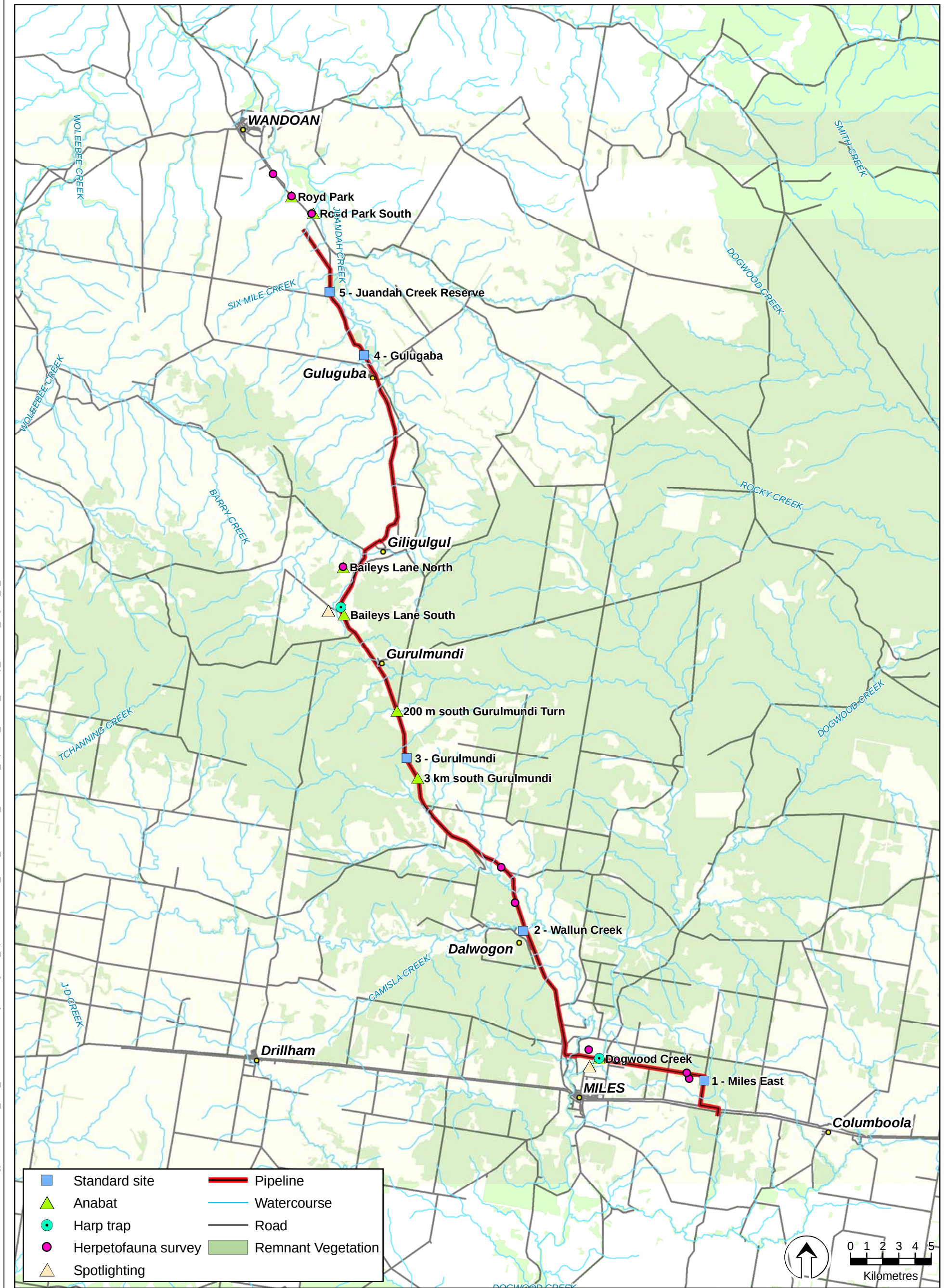


Figure 3.2 - Fauna survey locations

At each of the supplementary sites at least some of the techniques used at the standard sites were employed, and included:

- harp trapping
- ultrasonic bat detection
- herpetofauna active searches
- spotlighting
- call broadcast
- general bird surveys
- nocturnal vehicle traverses.

Details of the survey methodology employed are provided in the EIS Volume 2 terrestrial ecology report (TR 17A-1-V2.5). Survey effort in the supplementary survey is shown in Table 3-3.

Table 3-3 Faunal survey effort

Technique	No. Sites	Total survey effort
Elliott Trapping	5	200 trap nights
Pitfall Trapping	5	100 trap nights
Funnel Traps	5	80 trap nights
Harp Trapping	9	18 trap nights
Ultrasonic Bat Detection	12	120 hours
Spotlighting	7	7 hours
Call Broadcast	2	2 locations
Herpetofauna Active Searches	15	7.5 hrs
Nocturnal Drive Transects	throughout	455 km (6 nights)
Terrestrial Bird Surveys	throughout	6 days

4. Existing environment

4.1 Regional ecosystems

A Regional Ecosystem (RE) is a set of vegetation communities in a bioregion that is consistently associated with a particular combination of geology, landform and soil (Sattler & Williams 1999). During the August 2008 survey, fourteen REs were identified within the Study Area (Table 4-1). The current seasonal survey (February 2009) confirmed the existence and field-validation of these REs within the sections of the Study Area that have not been modified. These REs have not been discussed again within this report, except for Section 3.2 (Addendum to Regional Ecosystems). However, the modified route sections in the southern and northern extents of the Study Area (Figure 1-1) identified a further four REs and these have been described in detail below. A total of 18 REs have been identified in the Study Area (Table 4-1). Field verified REs are shown at a 1:10,000 scale in Attachment D.

Table 4-1 Regional ecosystems within the Study Area

RE Code	RE description (EPA 2006)	VMA status	EPA Biodiversity status	EPBC Act status
11.3.2	<i>Eucalyptus populnea</i> woodland on alluvial plains	Of concern	Of concern	Not listed
11.3.4	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. tall woodland on alluvial plains	Of concern	Of concern	Not listed
11.3.19†	<i>Callitris glaucophylla</i> , <i>Corymbia</i> spp. and/or <i>Eucalyptus melanophloia</i> woodland on Cainozoic alluvial plains	Not of concern	No concern at present	Not listed
11.3.25	<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	Not of concern	Of concern	Not listed
11.3.27c†	Freshwater wetlands: mixed grassland or sedgeland with areas of open water +/- aquatics	Not of concern	Of concern	Not listed
11.5.1	<i>Eucalyptus crebra</i> , <i>Callitris glaucophylla</i> , <i>Angophora leiocarpa</i> , <i>Allocasuarina luehmannii</i> woodland on Cainozoic sand plains/remnant surfaces	Not of concern	No concern at present	Not listed
11.5.1a	<i>Eucalyptus populnea</i> woodland with <i>Allocasuarina luehmannii</i> low tree layer Cainozoic sand plains/remnant surfaces	Not of concern	No concern at present	Not listed
11.5.4	<i>Eucalyptus crebra</i> , <i>Callitris glaucophylla</i> , <i>C. endlicheri</i> , <i>Eucalyptus chloroclada</i> , <i>Angophora leiocarpa</i> , woodland on Cainozoic sand plains/remnant surfaces(deep sands)	Not of concern	No concern at present	Not listed

RE Code	RE description (EPA 2006)	VMA status	EPA Biodiversity status	EPBC Act status
11.5.21	<i>Corymbia bloxsomei</i> +/- <i>Callitris glaucophylla</i> +/- <i>Eucalyptus crebra</i> +/- <i>Angophora leiocarpa</i> woodland on Cainozoic sand plains/remnant surfaces	Not of concern	No concern at present	Not listed
11.7.2	<i>Acacia</i> spp. woodland on lateritic duricrust. Scarp retreat zone	Not of concern	No concern at present	Not listed
11.7.4	<i>Eucalyptus decorticans</i> and/or <i>Eucalyptus</i> spp., <i>Corymbia</i> spp., <i>Acacia</i> spp., <i>Lysicarpus angustifolius</i> on laterised duricrust	Not of concern	No concern at present	Not listed
11.7.6	<i>Corymbia citriodora</i> ssp. <i>variegata</i> or <i>Eucalyptus crebra</i> woodland on lateritic duricrust	Not of concern	No concern at present	Not listed
11.7.7	<i>Eucalyptus fibrosa</i> ssp. <i>nubila</i> +/- <i>Corymbia</i> spp +/- <i>Eucalyptus</i> spp. woodland on lateritic duricrust	Not of concern	No concern at present	Not listed
11.9.5	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on fine-grained sedimentary rocks	Endangered	Endangered	Endangered
11.9.7†	<i>Eucalyptus populnea</i> , <i>Eremophila mitchellii</i> shrubby woodland on fine-grained sedimentary rocks	Of concern	Of concern	Not listed
11.9.10†	<i>Acacia harpophylla</i> , <i>Eucalyptus populnea</i> open forest on fine-grained sedimentary rocks	Of concern	Endangered	Not listed
11.10.1	<i>Corymbia citriodora</i> open forest on coarse-grained sedimentary rocks	Not of concern	No concern at present	Not listed
11.10.7	<i>Eucalyptus crebra</i> woodland on coarse-grained sedimentary rocks	Not of concern	No concern at present	Not listed

Note: † REs recorded in the new sections of the alignment during the February 2009 surveys.

The following RE descriptions are based on the composition, structure and condition of the REs (or non-remnant vegetation analogous with these REs) newly recorded in the Study Area during the February 2009 survey. Refer to the EIS Volume 2, Chapter 17A Terrestrial Ecology technical report 17A-1-V2.5, for detailed descriptions of field-validated REs identified during the August 2008 survey.

4.1.1 RE 11.3.19 *Callitris glaucophylla*, *Corymbia* spp. and/or *Eucalyptus melanophloia* woodland on Cainozoic alluvial plains

RE 11.3.19 consisted of low open forest to woodland of *Callitris glaucophylla* (White Cypress Pine) on Quaternary alluvium systems (land zone 3) and occurred as non-remnant cohorts at four locations upon the intervening floodplains located between Eleven Mile and Dogwood Creeks in the southern extent of the Study Area (Attachment D). In general, RE 11.3.19 may occur on rises associated with the levees and higher alluvial plains and

terraces of major river systems, upon deep to very deep earthy sands and associated sandy-surfaced texture contrast soils and siliceous sands. Within the Study Area, however, it occurred most frequently on broad, higher alluvial plains which have been largely cleared of extant vegetation and subjected to pasture improvement and cultivation practices. These disjunct patches represent retained woodlots and/or livestock refuge areas.

Canopy: The canopy was dominated by a sparse to mid-dense distribution of *Callitris glaucophylla* and associated *Allocasuarina leuhmanii* (Bull Oak). *Eucalyptus crebra* (Narrow-leaved Red Ironbark), *Eucalyptus populnea* (Poplar Box) and *Eucalyptus chloroclada* (Baradine Red Gum) were recorded infrequently within the canopy and emergent layers. The canopy possessed a median height of 8 m (Photo 4-1).

Mid-stratum: The very sparse to sparse tall shrub layer was dominated by *Callitris glaucophylla*, *Allocasuarina leuhmanii* and infrequent **Opuntia tomentosa* (Velvet Prickly Pear). The low shrub layer was generally absent or represented by a very sparse distribution of regenerating tall shrub layer species.

Ground layer: The sparse to very sparse ground layer was generally exclusive of exotic flora, of low diversity and dominated by *Aristida caput-metusae* (Many-headed Wiregrass), *Eriachne mucronata* (Mountain Wanderrie Grass) and *Calotis* spp. (burr daisies).

Condition: RE 11.3.19 was identified as non-remnant, regrowth vegetation that appears to have been retained as wood lots and/or refuge for livestock. No active thinning or timber harvesting was evidenced at the time of survey. Weed incursion within the ground layer was generally limited to periphery of the stands in the form of occasional tussocks of **Megathyrsus maximus* var. *maximus* (Guinea Grass). The shrub layer supported infrequent individuals of **Opuntia tomentosa*, which is listed as a Class 2 pest under the *Land Protection (Pest and Stock Route Management) Act 2002*.



Photo 4-1: RE 11.3.19 – *Callitris glaucophylla* low open forest on alluvial plains

Remnant status: All four patches of vegetation were representative of RE 11.3.19, but failed to satisfy the criteria for remnant status.

Conservation status: RE 11.3.19 is listed as 'Not of Concern' under the VM Act, and has a biodiversity status of 'No concern at present'. This RE is not consistent with a Threatened ecological community listed under the EPBC Act.

4.1.2 RE 11.3.27c Freshwater wetlands: mixed grassland or sedgeland with areas of open water +/- aquatics

RE 11.3.27c was represented by aquatic grassland and sedgeland located within a broad floodplain depression and an oxbow of Dogwood Creek (land zone 3) and occurred as potentially remnant cohorts at three locations upon the intervening floodplains located between Eleven Mile and Dogwood Creeks in the southern extent of the Study Area (Attachment D). This RE was not noted in the original surveys due to access restrictions. In general, RE 11.3.27c may occur in closed depressions on alluvial plains, as was the case within the Study Area.

Canopy: The canopy layer in the broad floodplain depression was limited to isolated mid-mature to mature *Eucalyptus tereticornis* (Queensland Blue Gum), *Angophora floribunda* (Rough-barked Apple) and/or *Eucalyptus populnea* located primarily at the peripheral edges. Infrequent juvenile specimens appear to have germinated within the depression during previous years of drought but have since failed following prolonged inundation. The oxbow distributions were fringed by woodland to open forest representative of RE 11.3.25 (dominated by *E. tereticornis* and *Angophora floribunda*).

Mid-stratum: The shrub layer was generally absent or represented by isolated juvenile species of *Eucalyptus tereticornis*.

Ground layer: The dense ground layer was the ecologically dominant layer in all three distributions. The broad floodplain depression was dominated by *Diplachne parviflora* (Small-flowered Beetle Grass) and associated *Paspalum distichum* (Water Couch), *Eleocharis plana* (Ribbed Spike Rush), *Ludwigia peploides ssp. montevidensis* (Water Primrose), *Monocharia cyanea* (Monocharia), *Pseudoraphis spinescens* (Spiny Mudgrass) and *Juncus usitatus* (Common Rush). A small open water body has been created through the excavation of soil for the creation of a narrow revetment wall which facilitates an access track along the adjacent boundary fence. *Ottelia ovalifolia* (Swamp Lily) and *Spirodela punctata* (Common Duckweed) were identified occasionally within this artificial water-body (Photograph 4-2). The oxbow supported two disconnected depressions which were dominated by a dense cover of *Paspalum distichum*, *Eleocharis plana*, *Monocharia cyanea*, *Pseudoraphis spinescens*, *Juncus usitatus*, *Cyperus difformis* (Dirty Dora), *Eleocharis sphacelata* (Bog Rush) and associated **Echinochloa colona* (Awnless Barnyard Grass), *Diplachne parviflora*, *Triglochin procera* (Water Ribbons) and *Nymphoides crenata* (Wavy Marshwort). The peripheral edges of these depressions were dominated by *Eragrostis elongata* (Clustered Lovegrass), **Phyla nodiflora var. nodiflora* (Lippia/Condamine Couch), **Conyza spp.* (Fleabane), *Bothriochloa decipiens* (Pitted Blue Grass), *Chrysopogon filipes* (Australian Vetivier) and *Diplachne parviflora* (Photo 4-3).



Photo 4-2: RE 11.3.27c – Freshwater Wetlands (broad floodplain depression)



Photo 4-3: RE 11.3.27c – Freshwater Wetlands (oxbow depression)

Condition: RE 11.3.27c was identified as potentially remnant vegetation. Weed incursion was generally limited to periphery or extent of seasonal inundation, primarily in the form of **Phyla nodiflora* and **Conyza spp.* The exotic grass, **Echinochloa colona* was infrequently encountered within the depressions. Cattle were not excluded from these areas and resultant soil compaction and trampling was evident.

Remnant status: All three patches were representative of RE 11.3.27c, and potentially satisfy the criteria for remnant status. The patches situated within the oxbows were too small to be mapped as individual polygons.

Conservation status: RE 11.3.27c is listed as 'Not of Concern' under the VM Act, and has a biodiversity status of 'Of concern'. This RE is not consistent with a Threatened ecological community listed under the EPBC Act.

4.1.3 RE 11.9.7 *Eucalyptus populnea*, *Eremophila mitchellii* shrubby woodland on fine-grained sedimentary rocks

RE 11.9.7 consisted of *Eucalyptus populnea* woodland on fine-grained sedimentary rocks (land zone 9) and occurred as non-remnant patches at six locations and as a sub-dominant and dominant remnant patch at one location (Attachment D). These areas generally occurred in association with more contiguous vegetation (RE 11.9.10) in the northern extent of the Study Area. In general, RE 11.9.7 may occur on the lower and middle slopes of gently undulated lowlands and plains formed from Cainozoic and Proterozoic consolidated fine-grained sediments, with associated soils of predominantly deep loamy red earths with sparse superficial ferruginous gravel, or deep texture-contrast soils with a thin sandy or loamy surface over strongly alkaline soils. Within the Study Area, it occurred most frequently on the lower slopes of gently undulated low rises.

Canopy: The sparse to very sparse canopy was dominated by *Eucalyptus populnea* with associated *Eucalyptus melanophloia* (Silver-leaved Ironbark) and *Casuarina cristata* (Belah) occurring at some sites. The canopy possessed a median height range of 11 to 13 m (Photograph 4-4). The sparse low tree layer was generally dominated by *Eucalyptus populnea* and associated *Casuarina cristata*, *Acacia salicina* (Sally Wattle), *Eucalyptus melanophloia* and/or *Acacia excelsa* (Ironwood). The low tree layer possessed a median height range of 5 to 9 m.



Photo 4-4: RE 11.9.7 – *Eucalyptus populnea*, *Eremophila mitchellii* shrubby woodland on fine-grained sedimentary rocks

Mid-stratum: The sparse to very sparse tall shrub layer was dominated by *Eremophila mitchellii* (Bastard Sandalwood) and/or *Geijera parviflora* (Wilga), with variously associated juvenile canopy species, *Acacia harpophylla* (Brigalow), *Eremophila deserti* (Ellengowan Poison Bush) and infrequent **Opuntia tomentosa* and *Acacia melvillei* (Yarran). The low shrub layer was similarly composed.

Ground layer: The mid-dense ground layer in both the remnant and non-remnant patches was dominated generally by exotic grasses including **Cenchrus ciliaris* (Buffel Grass), **Urochloa mosambicensis* (Sabi Grass), **Megathyrsus maximus* var. *maximus* and/or **Chloris gayana* (Rhodes Grass). Where native groundcover persisted, the general composition included *Aristida calycina* var. *praealta* (Dark Wiregrass), *Chloris divaricata* (Slender Chloris), *Enteropogon ramosus* (Twirly Windmill Grass), *Aristida jerichoensis* (Jericho's Wiregrass), *Calotis* spp. (burr daisies) and *Chloris truncata* (Comb Windmill Grass).

Condition: RE 11.9.7 was identified primarily as fragmented non-remnant, regrowth vegetation located mostly within the road reserve of the Leichhardt Highway. These areas were generally markedly degraded within the ground layer and possessed a low degree of canopy recruitment. The potentially remnant areas were associated with RE 11.9.10 and represented an absence or low percentage of *Acacia harpophylla* and/or *Casuarina cristata* within the canopy and sub-canopy layers. These areas were similarly degraded within the ground layer and supported infrequent **Opuntia tomentosa*.

Remnant status: No areas of remnant RE 11.9.7 were mapped within the Study Area (Environmental Protection Agency 2005). Potentially remnant RE 11.9.7 occurred only as a minor component of a heterogeneous polygon in which RE 11.9.10 was dominant, and as a small area downslope of a larger distribution of RE 11.9.10.

Conservation status: RE 11.9.7 is listed as 'Of concern' under the VM Act, and has a biodiversity status of 'Of concern'. This RE is not consistent with a Threatened ecological community listed under the EPBC Act.

4.1.4 RE 11.9.10 *Acacia harpophylla*, *Eucalyptus populnea* open forest on fine-grained sedimentary

RE 11.9.10 consisted of *Casuarina cristata*, *Acacia harpophylla* and *Eucalyptus populnea* woodland on fine-grained sedimentary rocks (land zone 9) and occurred as a non-remnant patch and dominant remnant patch at several locations in the northern extent of the Study Area (Attachment D). In general, RE 11.9.10 may occur on the lower parts of undulated plains formed from Cainozoic and Proterozoic consolidated fine-grained sediments often with deep texture-contrast.

Canopy: The sparse to very sparse canopy was dominated by *Casuarina cristata* and associated *Acacia harpophylla*, *Eucalyptus populnea* and *Alectryon oleifolius* ssp. *elongatus* (Scrub Boonaree), and possessed a median height range of 9 to 12 m (Photo 4-5). *Eucalyptus populnea* and *Casuarina cristata* to 16 m in height were recorded infrequently as emergents. The sparse low tree layer was generally dominated by *Casuarina cristata* and associated *Acacia harpophylla* and *Eucalyptus populneus*. The low tree layer possessed a median height range of 5 to 9 m.

Mid-stratum: The very sparse to mid-dense tall shrub layer was dominated by *Geijera parviflora*, *Acacia harpophylla* and *Casuarina cristata* with variously associated *Alectryon oleifolius*, *Alectryon diversifolius* (Boonaree), *Eremophila mitchellii*, *Eremophila desertii*, *Citrus glauca* (Wild Lime), *Santalum lanceolatum* (Sandalwood) and *Acacia salicina* occurring sporadically. The low shrub layer was similarly composed.

Ground layer: The sparse to mid-dense ground layer was dominated by variously associated *Paspalidium caespitosum* (Brigalow Grass), *Enchylaena tomentosa* (Ruby Saltbush), *Aristida calycina*, *Enteropogon ramosus*, *Aristida jerichoensis*, *Cenchrus ciliaris*, *Chloris divaricata*, *Solanum parvifolium* var. *parvifolium* (Small-leaved Nightshade), *Cheilanthes sieberi* (Mulga Fern), *Homopholis belsonii* (Belson's Panic), *Ancistrachne uncinulata* (Hooky Grass) and *Emex australis* (Goat's Head Burr).



Photo 4-5: RE 11.9.10 – *Acacia harpophylla*, *Eucalyptus populnea* open forest on fine-grained sedimentary rocks

Condition: RE 11.9.10 was identified primarily as fragmented non-remnant, regrowth vegetation located mostly within the road reserve of the Leichhardt Highway. These areas were generally markedly degraded within the ground layer and possessed a low degree of canopy recruitment. The potentially remnant areas were associated with RE 11.9.7 and represented an absence or low percentage of *Acacia harpophylla* and/or *Casuarina cristata* within the canopy and sub-canopy layers. These areas were similarly degraded within the ground layer and supported infrequent *Opuntia tomentosa*.

Remnant status: Potentially remnant RE 11.9.10 occurred as a major component of a heterogeneous polygons in which RE 11.9.7 was sub-dominant in two locations, and as a small area upslope of an even smaller distribution of RE 11.9.7. The latter is currently mapped by the DERM as remnant RE 11.9.10, while the former is mapped as non-remnant (southern distribution) and remnant RE 11.3.2/11.3.25 (northern distribution). Field validation of the latter area revealed that the vegetation was situated upon a gently undulated low rise, well removed from the extent of Quaternary alluvium.

Conservation status: RE 11.9.10 is listed as 'Of concern' under the VM Act, and has a biodiversity status of 'Endangered'. This RE is not consistent with a Threatened ecological community listed under the EPBC Act.

4.2 Addendum to Regional Ecosystems

Seasonal surveys performed during February 2009 confirmed the existence and field-validation of the fourteen REs previously described as occurring within the configuration of the Study Area that has not been modified.

The following amendments relate to the descriptions provided in the EIS terrestrial ecology technical report (EIS Volume 2, Chapter 17A Terrestrial Ecology technical report 17A-1-V2.5).

- For RE 11.7.2, 11.7.6 and 11.7.7 the recorded ground layer species of *Neurachne munroi* had been misidentified due to the poor quality of reproductive material available. *Thyridolepis mitchelliana* (no common name) should be supplemented when reading these sections.
- RE 11.9.5 was previously described as occurring in four small populations, of which only one was representative of remnant vegetation. Significant areas of regrowth RE 11.9.5 and one large patch of remnant RE 11.9.5 were identified within the northern extent of the re-aligned section of the Study Area.
- A large patch of remnant RE 11.3.2 and sub-dominant RE 11.3.25 was identified as occurring along Juandah Creek and associated floodplains in the northern extent of the re-aligned section of the Study Area.

4.3 Species of plant

Searches of relevant databases identified records of 1,082 species of plant in the Study Area and surrounding areas with 983 described as native species. The high floral diversity is indicative of the numerous REs and habitat types traversed by the Study Area. Field surveys undertaken during August 2008 identified 351 species of plant in the Study Area, of which 322 (91.7%) were native. The most diverse families included the grasses (Poaceae), daises (Asteraceae), wattles (Mimosaceae) and eucalypts (Myrtaceae).

Field surveys undertaken during February 2009 identified 437 species of plant in the Study Area, of which 390 (89.2%) were native. A total of 5 plants had been misidentified in the EIS, primarily due to the poor quality of reproductive material available during the previous survey effort. The correct identification has been incorporated into the species list presented in Attachment B.

4.4 Fauna habitats

Seven broad fauna habitat types exist within the Study Area: dry eucalypt forest, eucalypt woodlands, Acacia scrub (Lancewood and Miles Mulga), Acacia-Belah scrub (i.e. Brigalow), riparian (Queensland Blue Gum), cleared lands and wetlands (natural or artificial). These fauna habitats are as described in the earlier terrestrial ecology report (EIS Volume 2, Chapter 17A Terrestrial Ecology technical report 17A-1-V2.5). No additional broad fauna habitat types were identified in the February 2009 surveys.

4.5 Species of animal

Overall field surveys (both August 2008 and February 2009) identified 191 species in the Study Area, comprised of 10 frogs, 33 reptiles, 28 mammals and 120 species of bird (Attachment C). This included one species of national significance, the vulnerable Brigalow Scaly-foot (*Paradelma orientalis*) and two other species of state significance, the rare Little-pied Bat (*Chalinolobus picatus*) and Golden-tailed Gecko (*Strophurus taenicauda*). The vulnerable Glossy Black-cockatoo (*Calyptorhynchus lathamii*) was also tentatively recorded. Several other species of prominent conservation value were recorded including the Great Egret (*Ardea alba*) listed under the migratory provision of the EPBC Act and 14 species considered priority taxa by the Southern Brigalow Belt Expert Fauna Panel (Environmental Protection Agency 2002c). An additional species (Little Forest Bat *Vespadelus vulturnus*) has also been considered significant given it reaches its northern distributional limit in the Study Area.

February 2009 field surveys identified 161 species in the Study Area and comprised 27 mammals, 109 birds, 7 frogs and 18 reptile species (Attachment C). February 2009 field surveys identified 142 species comprising 24 mammals, 82 birds, 9 frogs and 27 reptile species (Attachment C). This later survey recorded substantially more herpetofauna than the earlier winter survey though markedly less birds of which both results are probably more an artefact of the warmer weather conditions and in the case of the birds, fewer flowering eucalypts and Acacia's.

5. Threatened biodiversity and other significant matters

This section presents information on threatened biodiversity. It should be read in conjunction with the information presented in the EIS technical report (EIS Volume 2, Chapter 17A Terrestrial Ecology technical report 17A-1-V2.5) and does not repeat information contained in the earlier report unless noted.

5.1 Matters of National Environmental Significance

5.1.1 Vegetation communities

Brigalow (*Acacia harpophylla* dominant and co-dominant)

'Brigalow (*Acacia harpophylla* dominant and co-dominant)' was found to occur at two locations in the Study Area (Attachment D). This community is determined to be represented by a number of REs as described under the Queensland *Vegetation Management Act 1999*, including RE 11.9.5. Vegetation consistent with RE 11.9.5 occurred in the northern extent of the Study Area. One of these two patches is currently and correctly mapped by the DERM as it possessed the characteristic properties of this community type in terms of height, structure, species composition, and location (underlying geology and landscape distribution). The other patch is currently mapped as 11.3.2/11.3.25. A considerable proportion of the polygon is representative of these vegetation types, but the south-western extent of the polygon was found to be representative of *Acacia harpophylla* woodland to open forests and possessed the height, structure, species composition, and location (underlying geology and landscape distribution) necessary to be described as remnant RE 11.9.5. Considerable areas of fragmented, non-remnant, regrowth *Acacia harpophylla* was also encountered within the northern extent of the Study Area. These areas ranged from fragmented shrubland with a ground layer dominated by exotic pastoral grasses to moderately intact tall shrubland to low woodland with a groundlayer dominated by dense leaf litter and scattered native grasses including the Commonwealth listed grass, *Homopholis belsonii*. Historical aerial photography would be required to ascertain whether this vegetation was representative of regrowth Brigalow of greater than 15 years of age.

One other vegetation type which supported a dominant or co-dominant distribution of *Acacia harpophylla* was identified within the Study Area, and was represented by RE 11.9.10. This vegetation type has been excluded from the listing advice for the endangered ecological community described as 'Brigalow (*Acacia harpophylla* dominant and co-dominant)'.

Based on the above, the mapped 'Brigalow' shown as RE 11.9.5 is considered part of the endangered ecological community listed under the *Environment Protection and Biodiversity Conservation Act 1999*, and is therefore a matter of national environmental significance.

5.1.2 Species of plant

Homopholis belsonii (Belson's Panic) was identified throughout the northern extent of the re-aligned section of the Study Area in two different vegetation types (Attachment D). *Homopholis belsonii* was identified as a relatively common to infrequent component of the ground layer within remnant and non-remnant RE 11.9.5 and RE 11.9.10 (see Attachment D). Detailed foot traverses of all regrowth distributions of these vegetation types within the road reserves of the Leichhardt Highway identified that a minimum canopy cover and exclusion of **Cenchrus ciliaris* corresponded with the existence of this species. A slender, weakly stonoliferous grass, *Homopholis belsonii* is afforded a conservation status of 'vulnerable' under the EPBC Act and 'endangered' under the Nature Conservation (Wildlife) Regulation 2006.

Population estimates were not established due to the frequency and dominance of the grass within a number of the sampled vegetation communities. However, it is estimated that in excess of 3,000 individual specimens exist within the aforementioned areas.

5.1.3 Species of animal

No additional threatened faunal species of National significance were recorded during the February 2009 surveys and based on the habitats present no additional species are considered likely to occur. The migratory Rainbow Bee-eater was recorded during the summer surveys. Those species listed under the EPBC Act recorded in the surveys are described below (both August 2008 and February 2009 surveys).

Brigalow Scaly-foot (*Paradelma orientalis*)

Brigalow Scaly-foot is currently listed as Vulnerable pursuant to the EPBC Act and NC Regulation. It was recorded at four locations in the Study Area from just south of Gurulmundi, and north to almost Wandoan (Attachment D). They included:

- one adult captured at Site W1 sheltering beneath refuse in a homogenous tract of Dry Sclerophyll Forest
- one adult captured from Site S3 around 4 km south of Gurulmundi
- two adults captured about 1 km apart from roadside Brigalow and Poplar Box Woodland habitats between Gulugaba and Wandoan.

The two sites to the south of Gurulmundi were dominated by Spotted Gum and Smooth-barked Apple with some occasional Narrow-leaved Ironbark growing on a flat sand plain derived from deeply weathered sandstone. Abundant cover in the form of deep litter (5-20 cm), logs (15%) and an old refuse site were noted at the capture site on the eastern side of Baileys Road whilst abundant rock (10%), log (12%) and deep litter were described as amicable habitat attributes present at the Gurulmundi south site.

The records described above are among the first for this species in the local area. Despite this, the Brigalow Scaly-foot is likely to occur sporadically throughout the area where microhabitat features including but not limited to deep litter, abundant log cover and/or surrogate habitat features occur. Within the Study Area this includes most of those habitats that border the Leichhardt Highway.

Great Egret (*Ardea modesta*)

Great Egret is listed as a migratory (CAMBA and JAMBA) under the migratory provision of the EPBC Act. This species was recorded on two occasions from dams located near Nine Mile Creek and at a Poplar Box-Queensland Blue Gum depression north of Kowguran. No nests consistent with this species were recorded during the survey. This species was not recorded in the Study Area during summer field surveys with this temporal variation consistent with its nomadic habits. Seasonally, the Great Egret would be expected to occur along Dogwood Creek where birds are likely to occasionally congregate, however, it is unlikely that any of the habitat within or immediately adjacent to the construction footprint represents important habitat as defined under the Principal Significant Impact Guidelines (Department of the Environment and Heritage 2006).

Rainbow Bee-eater (*Merops ornatus*)

Rainbow Bee-eater is currently listed as a migratory species (JAMBA) under the migratory provision of the EPBC Act. This species was recorded at 10 locations during the summer survey with records extending from east of Miles to almost Wandoan encompassing virtually all habitat types present in the Study Area (Attachment D). Flock sizes were typically small with most observations comprising less than 10 birds.

The Rainbow Bee-eater inhabits a wide range of vegetation communities from open woodlands, riparian and riverine forest, shrublands, grasslands and dry sclerophyll forests (Higgins 1999). Its generalist and migratory habits suggest much of the Study Area represent either known or potential habitat for this species. Given the Study Area is geographically located within the known breeding range for Rainbow Bee-eater, communal breeding probably takes place between October and January where pairs generally select sandy soil types often located in the banks of creeks, rivers, dams, road and rail cuttings. Although these sites may be breeding sites they would not support an ecologically significant proportion of the population and therefore would not be considered important habitat as defined under the Principal Significant Impact Guidelines (Department of the Environment and Heritage 2006).

5.2 Matters of state significance

5.2.1 Flora

No threatened species of plant were recorded in the Study Area during the August 2008 survey. However the February 2009 surveys identified two state-listed threatened species within the Study Area in addition to *Homopholis belsonii*.

Gonocarpus urceolatus (Raspweed) was identified in three disjunct locations in three different vegetation types. All populations were identified in shallow depressions within RE 11.5.1, RE 11.5.4 and RE 11.7.4. Detailed foot traverses within these vegetation types failed to locate any other specimens. A slender herb, *Gonocarpus urceolatus* has a conservation status of 'vulnerable' under the NC Regulation.

Desmodium macrocarpum (no common name) was found at one location within RE 11.5.1 (Attachment D). Detailed population estimations revealed that the distribution declined exponentially away from a core population which was identified in close proximity to the road reserve. Given the adhesive nature of the fruiting bodies of this species, the population may have arisen from the establishment of an individual seed or few seeds that may have

been introduced to the site via mechanical or anthropogenic vectors (e.g. a grader used in routine road maintenance). Detailed foot traverses within this vegetation type failed to locate any other specimens. An herbaceous perennial, *Desmodium macrocarpum* has a conservation status of 'rare' under the NC Regulation.

5.2.2 Fauna

No additional faunal species of state significance were recorded during the February 2009 surveys. The following information is presented on all species recorded (August 2008 and February 2009).

Golden-tailed Gecko (*Strophurus taenicauda*)

The Golden-tailed Gecko is currently listed as a rare species pursuant under the NC Regulation. This species was recorded at five locations distributed from Silver-leaved Ironbark and Lancewood habitats east of Miles (i.e. Gearys Lane and Warrego Highway) north through Blue-leaved Ironbark, Buloke and White Cypress associations to Brigalow habitat within the Baileys Lane road reserve (Attachment D). This species was also recorded from Spotted Gum and Smooth Barked Apple forest with a dense Acacia understorey near Gurulmundi. The presence of Golden-tailed Gecko within a broad range of habitats suggest it is widely distributed in the Study Area and elsewhere in the Wandoan and Spring Gully areas as supported by previous surveys (refer Volumes 1, 2 and 3 of the EIS) and records obtained during database searches. The fact that Golden-tailed Gecko was not detected during the February 2009 surveys suggest this species probably displays differing patterns in habitat use between winter and summer months with the warmer months, probably supporting more arboreal habits.

Little-pied Bat (*Chalinolobus picatus*)

The Little-pied Bat is currently listed as a rare species under the NC Regulation. This species was recorded at eight sites widely distributed across the Study Area (Attachment D). One male was captured in a harp trap at Wallun Creek, characterised with Queensland Blue Gum and adjacent areas of Blue-leaved Ironbark and White Cypress. A male was similarly captured from Lancewood community to the east of Miles and along Baileys Lane between Gurulmundi and Giligulgul (Attachment D). Calls consistent with this species were recorded from Brigalow vegetation from Peakes Road, Queensland Blue and Poplar Box depression bordering the Leichhardt Highway near Gurulmundi and Acacia scrub near Miles (Attachment D).

The records described above reflect a species that is widely distributed in the Study Area which is consistent with the findings from previous surveys of the MLA areas and lands further to the west near Spring Gully (refer EIS Volumes 1, 2 and 3).

Glossy Black-cockatoo (*Calyptorhynchus lathami*)

The Glossy Black-cockatoo is currently listed under the vulnerable schedule of the NC Regulation. The listing refers to the species as a whole, but does not refer to the subspecies *Calyptorhynchus lathami halmanturinus*, which is found on Kangaroo Island in South Australia, and which is listed as Endangered under the EPBC Act. A tentative record was made from chewed cones from a patch of Belah at the northern end of the proposed pipeline route bordering the Leichhardt Highway. This species has been recorded previously from the Wandoan area along Wandoan Creek within the MLA50231 (refer Volume 1 Terrestrial Ecology Report).

The preferred habitat for Glossy Black-cockatoo in the Southern Brigalow Belt tends to be Belah woodlands and stands of *Allocasuarina* spp. Belah dominated communities occur in the northern portion of the Study Area. Based on the apparent infrequent use by Glossy Black-cockatoo, these habitats could be best described as 'sub optimal' or 'transitional' used during broader movements. For example, they may be used during post breeding dispersal of young or changes in habitat use following stochastic events such as wildfire and land clearing of more preferred habitats in the region.

5.3 Matters of regional significance

Under the Biodiversity Assessment and Mapping Methodology (Environmental Protection Agency 2002a), expert panels are convened to review and refine the results of initial determination of significance of the Biodiversity Planning Assessment framework (Environmental Protection Agency and Environmental Planning Southwest Queensland 2002a, 2002b) at a Bioregional scale. These panels provide recommendations in relation to habitat for threatened species (EVR Taxa) and Essential habitat for priority taxa.

5.3.1 Flora

Five priority taxa species of plant for the Brigalow Belt South bioregion (Environmental Protection Agency 2002b) were recorded in the Study Area: *Acacia melvillei* (Yarran), *Acacia shirleyi* (Lancewood) *Acacia omalophylla* (Yarran), *Acacia aprepta* (Miles Mulga) and *Dodonaea macrossanii* (no common name). *Acacia melvillei* was recorded at several locations in RE 11.3.2, RE 11.9.5, RE 11.9.7 and 11.9.10. *Acacia omalophylla* was recorded in RE 11.7.2, RE 11.7.4 and RE 11.10.7. *Acacia aprepta* was recorded at several locations only in RE 11.7.4. *Dodonaea macrossanii* was recorded at one location only in RE 11.7.7. *Acacia shirleyi* was relatively common in RE 11.7.2 and also recorded in RE 11.7.7. Specimens of *Acacia triptera* (Spur-leaf Wattle), which had been downgraded from a conservation status of 'rare' under the NC Regulation were also encountered within RE 11.5.1.

5.3.2 Fauna

Fifteen species recorded during the survey are currently considered priority taxa as defined by the Expert Fauna Panel for the Southern Brigalow Belt (Environmental Protection Agency 2002b). Four of these have been presented in the aforementioned sections under matters related to national and state significance (Brigalow Scaly Foot, Golden-tailed Gecko; Little Pied Bat and Glossy Black-cockatoo) with the remaining 11 species discussed below.

Common Brush-tail Possum (*Trichosurus vulpecula*)

The Common Brush-tail Possum was recorded at 26 locations broadly distributed throughout the Study Area and has been subsequently assigned an 'abundant' rating (Attachment D). This species was detected at most of the surveyed riparian zones that featured Poplar Box, Queensland Blue Gum or other box and ironbark associations found in the Study Area. It was also widely distributed in Dry Sclerophyll Forest and occasionally within more discrete habitats including Acacia Scrub and Buloke Woodland. Most of the records were based on the identification of scats, although some direct observations of individuals were recorded following spotlight surveys of sites W2, W4, W5, S2, S3 and S5.

Greater Glider (*Petauroides volans*)

The Greater Glider was recorded on five occasions during the survey and has been assigned an uncommon status (Attachment D). Gliders were observed at sites W2, W4, S3, S4 and along Dogwood Creek during spotlight traverses. These sites are comprised largely of senescent dry sclerophyll forest dominated by Smooth-barked Apple, Spotted Gum and to a lesser extent Baradine Red Gum or riparian areas dominated by Queensland Blue Gum, Rough-barked Apple or Poplar Box. The spotlight results indicate gliders typically occur at densities of less than two individuals per hectare except at Dogwood Creek where densities of around six per hectare were recorded.

Greater Gliders generally occupy eucalypt or Corymbia dominated forests or woodlands occupying home ranges of up to about 2.5 ha in Queensland (Comport *et al.* 1996; Menkhorst & Knight 2004). Within its home range a family group may browse on just one to two species, however tree species selection varies markedly across its range (McKay 2008). Denning (i.e. roosting) takes place in large tree hollows and this ecological demanding requirement lends this species to often being used as an indicator of condition within upper strata of remnant forest or woodland.

Black-striped Wallaby (*Macropus dorsalis*)

Black-striped Wallaby was recorded on one occasion during the August 2008 survey. Several individuals were regularly observed adjacent to Brigalow and cleared lands along Baileys Lane (Attachment D). Based on this single record and its apparent absence from the MLA areas (refer Volume 1 terrestrial ecology technical report), this species has been assigned a 'rare' status in the Study Area.

Rufous Bettong (*Aepyprymnus rufescens*)

A single Rufous Bettong was recorded on one occasion north of Guluguba near site S4 (Attachment D). This species is likely to be more common than records from this study indicate. Diggings similar to those made by Rufous Bettong were noted at several locations between Gurulmundi and Dalwogon, however, they could not be confidently distinguished from Red-necked Wallaby and Swamp Wallaby which occasionally excavate the ground during dry periods.

Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)

An Eastern Bent-wing Bat was recorded on one occasion during anabat surveys in Poplar Box woodland bordering Eleven Mile Creek. The Eastern Bent-wing Bat is an obligate cave dwelling species and may use suitable artificial surrogates such as dwellings, culverts and bridge structures. This species is likely to have a sparse but widespread distribution throughout the Study Area, a fact partly supported by previous surveys of the MLA areas and peripheral landscape (see EIS Volumes 1, 2 and 3, Chapter 17A Terrestrial Ecology technical reports)

Little Forest Bat (*Vespadelus vulturnus*)

Little Forest Bat was recorded on six occasions from near Gurulmundi south to about Wallan Creek (Attachment D). Two individuals were captured in harp traps with calls fitting this species recorded from two other locations. It has been assigned a 'rare' status in the Study Area and is consistent with findings from earlier surveys in the MLA areas and lands further to the west.

Grey-crowned Babbler (*Pomatostomus temporalis temporalis*)

Grey-crowned Babbler was recorded on six occasions and considered uncommon in the Study Area (Attachment D). This species was recorded from remnant Brigalow along Peakes Road and from Buloke Woodland in the southern Study Area between Dalwogon and Miles and to the east of Miles.

Speckled Warbler (*Chthonicola sagittata*)

Speckled Warbler was recorded on one occasion to the east of Miles (Attachment D). Two individuals were observed foraging within the low shrub layer of Ironbark Woodland with *Acacia* understorey adjacent to Geary Lane.

Salmon-sided Frog (*Limnodynastes salmani*)

Salmon-sided Frog was recorded on one occasion in the northern portion of the Study Area where one individual was captured during herpetofauna surveys of remnant Brigalow bordering Peakes Road (Attachment D). Although considered rare on the basis of the results of the current survey, investigations within the MLA areas suggest it is common and relatively widespread.

Squirrel Glider (*Petaurus norfolcensis*)

The Squirrel Glider was recorded on one occasion in the southern portion of the Study Area at Dogwood Creek (Attachment D). One individual was observed within a stand of Queensland Blue Gum immediately adjacent to the proposed route.

Although considered rare on the basis of the results of the current survey, this species is likely to be patchily distributed along major riparian drainages in the Study Area including Wallun Creek in the central portion of the Study Area and Juandah Creek further to the north.

Pale-headed Snake (*Hoplocephalus bitorquatus*)

A Pale-headed Snake was recorded on one occasion in the northern portion of the Study Area between Gulugaba and Wandoan (Attachment D). A single adult was recorded as road kill during a drive transect in the summer survey. Habitat in this area is essentially senescent Poplar Box woodland bordering Brigalow between the Leichardt Highway and Juandah Creek.

This species has been considered rare in the Study Area although it is likely to occur along most of the drainage lines and associated forests and woodlands that support senescent trees. In this instance Dogwood Creek, Wallun Creek, eleven Mile Creek and those larger tracts of senescent forest which border these areas are most likely to support populations of Pale-headed Snake.

6. Potential impacts

Impacts associated with the pipeline are the same as those described in the EIS Volume 2, Chapter 17A Terrestrial Ecology chapter and technical report. However due to the realignment of the pipeline in sections and new information on the regional ecosystems and habitats present, the extent of clearing for the new alignment is presented in Table 6-1. Other potential impacts are described in the EIS technical report (EIS Volume 2, Chapter 17A Terrestrial Ecology technical report 17A-1-V2.5).

The proposed southern CSM water supply pipeline would remove approximately 157 hectares of vegetation, including 93 hectares of remnant vegetation and 64 hectares of non remnant vegetation. Of this total 1.6 hectares is remnant endangered and 7.0 hectares is remnant Of Concern. This total compares with the 85.7 hectares (55.8 remnant, 30.0 non remnant) in the earlier assessment, prior to the route realignment.

Table 6-1 Likely extent of vegetation clearing

RE Code	RE description (EPA 2006)	VMA status	EPA Biodiversity status	EPBC Act status	Extent of clearing (ha)			Extent remaining in subregions in 2005 (ha)*	Extent reserved in subregions in 2005 (ha)*
					Remnant	Non remnant	Total		
11.10.1	<i>Corymbia citriodora</i> open forest on coarse-grained sedimentary rocks	Not of concern	No concern at present	Not listed	1.1	0.6	1.7	98,978	233
11.10.7	<i>Eucalyptus crebra</i> woodland on coarse-grained sedimentary rocks	Not of concern	No concern at present	Not listed	6.8	0	6.8	70,514	4,819
11.3.2	<i>Eucalyptus populnea</i> woodland on alluvial plains	Of concern	Of concern	Not listed	4.2	7.4	11.6	139,033	1,190
11.3.19	<i>Callitris glaucophylla</i> , <i>Corymbia</i> spp. and/or <i>Eucalyptus melanophloia</i> woodland on Cainozoic alluvial plains	Not of concern	No concern at present	Not listed	0	0.8	0.8	28,800	0
11.3.25	<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	Not of concern	Of concern	Not listed	1.9	0	1.9	72,279	35
11.3.27c	Freshwater wetlands	Not of concern	Of concern	Not listed	0.3	0	0.3	1,222	0
11.3.4	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. tall woodland on alluvial plains	Of concern	Of concern	Not listed	2.8	2.3	5.1	6,116	3

RE Code	RE description (EPA 2006)	VMA status	EPA Biodiversity status	EPBC Act status	Extent of clearing (ha)			Extent remaining in subregions in 2005 (ha)*	Extent reserved in subregions in 2005 (ha)*
					Remnant	Non remnant	Total		
11.5.1	<i>Eucalyptus crebra</i> , <i>Callitris glaucophylla</i> , <i>Angophora leiocarpa</i> , <i>Allocasuarina luehmannii</i> woodland on Cainozoic sand plains/remnant surfaces	Not of concern	No concern at present	Not listed	19.7	13.4	33.1	174,991	40
11.5.1a	<i>Eucalyptus populnea</i> woodland with <i>Allocasuarina luehmannii</i> low tree layer Cainozoic sand plains/remnant surfaces	Not of concern	No concern at present	Not listed	4.8	14.6	19.4	—	-
11.5.21	<i>Corymbia bloxsomei</i> +/- <i>Callitris glaucophylla</i> +/- <i>Eucalyptus crebra</i> +/- <i>Angophora leiocarpa</i> woodland on Cainozoic sand plains/remnant surfaces	Not of concern	No concern at present	Not listed	10.2	0.6	10.8	72,024	0
11.5.4	<i>Eucalyptus crebra</i> , <i>Callitris glaucophylla</i> , <i>C. endlicheri</i> , <i>Eucalyptus chloroclada</i> , <i>Angophora leiocarpa</i> , woodland on Cainozoic sand plains/remnant surfaces(deep sands)	Not of concern	No concern at present	Not listed	4	0.5	4.5	23,171	0
11.7.2	<i>Acacia spp.</i> woodland on lateritic duricrust. Scarp retreat zone	Not of concern	No concern at present	Not listed	3.5	0	3.5	34,391	1

RE Code	RE description (EPA 2006)	VMA status	EPA Biodiversity status	EPBC Act status	Extent of clearing (ha)			Extent remaining in subregions in 2005 (ha)*	Extent reserved in subregions in 2005 (ha)*
					Remnant	Non remnant	Total		
11.7.4	<i>Eucalyptus decorticans</i> and/or <i>Eucalyptus</i> spp., <i>Corymbia</i> spp., <i>Acacia</i> spp., <i>Lysicarpus angustifolius</i> on laterised duricrust	Not of concern	No concern at present	Not listed	4.0	5.3	9.3	78,839	60
11.7.6	<i>Corymbia citriodora</i> ssp. <i>variegata</i> or <i>Eucalyptus crebra</i> woodland on lateritic duricrust	Not of concern	No concern at present	Not listed	21.5	0	21.5	168,824	554
11.7.7	<i>Eucalyptus fibrosa</i> ssp. <i>nubila</i> +/- <i>Corymbia</i> spp +/- <i>Eucalyptus</i> spp. woodland on lateritic duricrust	Not of concern	No concern at present	Not listed	6.6	8.9	15.5	52,278	100
11.9.5	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on fine-grained sedimentary rocks	Endangered	Endangered	Endangered	1.6	3.0	4.6	69,654	1,059
11.9.7	<i>Eucalyptus populnea</i> , <i>Eremophila mitchellii</i> shrubby woodland on fine-grained sedimentary rocks	Of concern	Of concern	Not listed	0.0	5.6	5.6	50,340	0
11.9.10	<i>Acacia harpophylla</i> , <i>Eucalyptus populnea</i> open forest on fine-grained sedimentary rocks	Of concern	Endangered	Not listed	0.0	1.0	1.0	49,649	2,419
TOTAL					93	64	157	1,191,103	10,513

* based on three subregions (Taroom, Barakula and Southern Downs). Data from Accad et al (2008)

6.1 Regional Vegetation Management Code

Clearing of native vegetation for the purpose of a significant project under the *State Development and Public Works Act 1971* (section 26) is allowable provided that the clearing follows the performance requirements outlined in the Regional Vegetation Management Code. In the case of the southern CSM water supply pipeline, the code is that for the Brigalow Belt and New England Tablelands bioregions (Department of Natural Resources and Water 2006) and the specific performance requirements for significant projects (Part S) are discussed below. Where an acceptable solution includes different solutions depending on the bioregion or the subregion, only those relevant to the project area are mentioned.

For performance requirements that include maintaining the current extent of assessable vegetation, offsets are an acceptable solution (see Section 7).

6.1.1 PR S.1: Limits to clearing

Performance requirement

To regulate the clearing of vegetation in a way that conserves remnant regional ecosystems, does not cause land degradation, prevents the loss of biodiversity and maintains ecological processes – subject to the limitations required to meet PR S.2 to PR S.10 – clearing is limited to the extent that is necessary for the project, any associated ancillary works, and the operation of works that comprise a project declared to be a significant project under the *State Development and Public Works Organisation Act 1971*, section 26.

Project response

The clearing values presented in this report are based on the extent necessary to construct and operate the southern CSM water supply pipeline.

6.1.2 PR S.2: Wetlands

Performance requirement

To regulate the clearing of vegetation in a way that prevents the loss of biodiversity and maintains ecological processes—maintain the current extent of assessable vegetation associated with any natural significant wetland and/or natural wetland to provide:

- a) Water quality by filtering sediments, nutrients and other pollutants; and
- b) Aquatic habitat; and
- c) Terrestrial habitat.

Acceptable solution

Clearing does not occur:

- a) In any natural wetland; and
- b) Within 100 metres from any natural wetland; and
- c) In any natural significant wetland; and
- d) Within 200 metres from any natural significant wetland.

Project response

No significant wetlands occur within the project area, although the project does cross into RE11-3-27c (Freshwater wetlands). RE 11.3.27c was represented by aquatic grassland and sedgeland located within a broad floodplain depression and an oxbow of Dogwood Creek (land zone 3) and occurred as potentially remnant cohorts at three locations upon the intervening floodplains located between Eleven Mile and Dogwood Creeks in the southern extent of the Study Area (Attachment D). No other remnant vegetation occurs within 100 metres of the occurrences of this regional ecosystem.

Approximately 0.3 hectares of this ecosystem would be affected by the proposed pipeline. While the final design will aim to reduce impacts on this RE, offsets may be used to meet the performance requirement.

6.1.3 PR S.3: Watercourses

Performance requirement

To regulate the clearing of vegetation in a way that does not cause land degradation, prevents the loss of biodiversity and maintains ecological processes – maintain the current extent of assessable vegetation associated with any watercourse to provide:

- a) Bank stability by protecting against bank erosion; and
- b) Water quality by filtering sediments, nutrients and other pollutants; and
- c) Aquatic habitat; and
- d) Terrestrial habitat.

Acceptable solution

Clearing does not occur:

- a) In any watercourse; and
- b) Within the relevant distance stipulated in Table 2 of the code, of each high bank of each watercourse.

Project response

Creeks within the proposed pipeline area are all first or second order streams and therefore Table 2 of the Vegetation Management Code indicates that a distance of 50 metres from each high bank should be protected. A total of 10 hectares of remnant vegetation lies within the 20 m corridor within 50 m of each mapped watercourse (Table 6-2). While the final design will aim to reduce impacts on these ecosystems and on watercourses, offsets may be used to meet the performance requirement

Table 6-2 Remnant regional ecosystems that may be cleared within 50 m of each mapped watercourse

Regional ecosystem	Potential clearing within 50 m of a mapped watercourse (ha)
11.3.2	1.5
11.3.25	1.7
11.3.4	2.1
11.5.1	1.6
11.5.21	0.5
11.5.4	2.6
Total	10.0

6.1.4 PR S.4: Connectivity

Performance requirement

To regulate the clearing of vegetation in a way that prevents the loss of biodiversity and maintains ecological processes – areas of remnant vegetation are:

- a) Of sufficient size and configured in a way to maintain ecosystem functioning; and
- b) Of sufficient size and configured in a way to remain in the landscape in spite of any threatening processes; and
- c) Located on the lot(s) that are the subject of the application to maintain connectivity to remnant vegetation on adjacent properties.

Acceptable solution

Where clearing is less than:

- a) 25 metres wide in the non-coastal subregions of the Brigalow Belt and the New England Tableland Bioregion; or
- b) Is less than 5 hectares in the non-coastal subregions of the Brigalow Belt and the New England Tableland Bioregion:

clearing does not:

 - i) reduce the width of remnant vegetation to less than 200 metres; and
 - ii) occur where the width of remnant vegetation is less than 200 metres.

OR

Clearing does not:

- a) Reduce areas of contiguous remnant vegetation to less than 50 hectares, in the non-coastal subregions of the Brigalow Belt and the New England Tableland Bioregion
- b) Occur in areas of contiguous remnant vegetation that are less than 50 hectares, in the non-coastal subregions of the Brigalow Belt and the New England Tableland Bioregion

- c) Reduce the width of remnant vegetation to less than 200 metres
- d) Occur where the width of remnant vegetation is less than 200 metres
- e) Reduce the total extent of remnant vegetation to less than 30%
- f) Occur where the total extent of remnant vegetation is less than 30%.

Project response

The proposed clearing width for the pipeline is 20 metres and therefore the project will meet this requirement provided that it does not reduce the width of vegetation to less than 200 metres or occurs where the width of a remnant is less than 200 metres. The majority of the remnant vegetation that will be affected occurs in large patches, much greater than 200 metres in width. Areas where the width of vegetation is small occur generally adjacent to creeks or in some cases in the road reserve (Table 6-3).

Table 6-3 Areas of remnant vegetation with a reduced width along the pipeline corridor

Location	Width of remnant vegetation (m)	Comment
Dogwood Creek	400 m	This area is greater than 200 m
Eleven Mile Creek	280 m	This area is greater than 200 m
Wallan Creek	300 m	This area is greater than 200 m
Unnamed creek to the north of Wallan Creek	75 m	Although mapped as remnant vegetation, this area does not have remnant characteristics
Oberina Road, south of Myall Street	190 m	The final design will need to avoid impacts in this area
Oakdean Road, north of Oakey Street	233 m	This area is greater than 200 m
Corner Gilgulgul Road and Baileys Road	130 m	The final design will need to avoid impacts in this area (e.g. by trenching in the road surface)

Two areas have remnant vegetation less than 200 metres in width (Table 6-3). In both these areas the final design will need to be modified to avoid impacts on this vegetation.

6.1.5 PR S.5: Soil erosion

Performance requirement

To regulate the clearing of vegetation in a way that does not cause land degradation and maintains ecological processes—the effect of clearing does not result in:

- a) Mass movement, gully erosion, rill erosion, sheet erosion, tunnel erosion, stream bank erosion, wind erosion, or scalding.
- b) Any associated loss of chemical, physical or biological fertility – including, but not limited to water holding capacity, soil structure, organic matter, soil biology, and nutrients, within and/or outside the lot(s) that are the subject of the application.

Acceptable solution

Mechanical clearing only occurs on:

- a) Very stable soils on a slope less than 15%
- b) Stable soils on a slope less than 12%
- c) Unstable soils on a slope less than 8%
- d) Very unstable soils on a slope less than 5%.

Project response

Soils within the proposed pipeline area are considered unstable as per Table 15 of the Vegetation Management Code. In this case mechanical clearing would only take place where the slope is less than 8%.

6.1.6 PR S.6: Salinity

Performance requirement

To regulate the clearing of vegetation in a way that does not cause land degradation and maintains ecological processes – clearing does not contribute to:

- a) waterlogging; or
- b) the salinisation of groundwater, surface water or soil.

Acceptable solution

Where clearing is less than:

- a) 5 hectares; or
- b) 50 metres wide:
 - clearing does not occur:
 - i) in any discharge area
 - ii) within 200 metres of any discharge area.

Project response

Clearing for the proposed pipeline is proposed to be 20 metres wide and therefore clearing should not occur in or within 200 metres of any discharge area. There are no known discharge areas within the proposed pipeline area.

6.1.7 PR S.7: Conserving remnant *endangered* regional ecosystems and *of concern* regional ecosystems

Performance requirement

To regulate the clearing of vegetation in a way that conserves remnant endangered regional ecosystems and remnant of concern regional ecosystems – maintain the current extent of endangered regional ecosystems and of concern regional ecosystems.

Acceptable solution

Clearing only occurs in endangered regional ecosystems or of concern regional ecosystems that are not listed in Table 4 (of the Vegetation Management Code) and where the clearing within those regional ecosystems is less than:

- a) 10 metres wide; or
- b) 0.5 hectares.

Project response

Five of the regional ecosystems within the study area are listed as endangered or of concern (Table 6-2). None of these REs are listed in Table 4 of the Vegetation Management Code (ref) and two will not be affected by the proposed pipeline. Three of the REs will be affected and clearing would be greater than 0.5 hectares (Table 6-2). While the final design will aim to reduce impacts on these REs, offsets may be used to meet the performance requirement.

Table 6-4 Endangered and Of Concern regional ecosystems

Regional ecosystems	Status	In Table 4*	Extent of remnant clearing (hectares)
11.3.2 <i>Eucalyptus populnea</i> woodland on alluvial plains	Of concern	No	4.2
11.3.4 <i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus spp.</i> tall woodland on alluvial plains	Of concern	No	2.8
11.9.5 <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on fine-grained sedimentary rocks	Endangered	No	1.6
11.9.7 <i>Eucalyptus populnea</i> , <i>Eremophila mitchellii</i> shrubby woodland on fine-grained sedimentary rocks	Of concern	No	0
11.9.10 <i>Acacia harpophylla</i> , <i>Eucalyptus populnea</i> open forest on fine-grained sedimentary rocks	Of concern	No	0

* Table 4 of the Vegetation Management Code lists dense regional ecosystems and mid-dense wet sclerophyll, melaleuca, mangrove and wetland regional ecosystems

6.1.8 PR S.8: Essential habitat

Performance requirement

To regulate the clearing of vegetation in a way that prevents the loss of biodiversity – maintain the current extent of essential habitat.

Acceptable solution

Clearing does not occur in an area shown as essential habitat on the essential habitat map.

Project response

No essential habitat has been mapped in the proposed pipeline area.

6.1.9 PR S.9: Conservation status thresholds

To regulate the clearing of vegetation in a way that prevents the loss of biodiversity and conserves remnant regional ecosystems – maintain the current extent of regional ecosystems listed in Table 5 (of the Vegetation Management Code).

Acceptable solution

Clearing in a regional ecosystem listed in Table 5 (of the Vegetation Management Code) does not occur unless the clearing is less than:

- a) 10 metres wide; or
- b) 2 hectares.

Project response

Table 5 of the Vegetation Management Code includes regional ecosystems that are at risk of the remnant extent falling below 30% of its pre-clearing extent, or having a remnant extent of less than 10,000 hectares. None of the REs within the study area are listed within Table 5 of the Vegetation Management Code.

6.1.10 PR S.10: Acid sulfate soils

This performance requirement relates to the coastal areas of the Brigalow Belt bioregion and therefore does not apply to the proposed pipeline area.

6.1.11 Summary of the regional vegetation management codes

The southern CSM water supply pipeline will meet the performance requirements of the regional vegetation management codes, provided the design is modified to avoid remnant vegetation in the two areas where the remnant vegetation is less than 200 metres in width (see Section 6.1.4) and with the provision of suitable offsets to maintain the current extent of vegetation (see Section 7).

7. Mitigation measures and offsets

Mitigation measures are the same as those described in the EIS Volume 2 Chapter 17A Terrestrial Ecology chapter and technical report. The realignment of the pipeline in sections has not modified the measures required.

The southern CSM water supply pipeline route falls outside of the MLA areas and as such is not exempt from meeting the requirements of the regional vegetation management codes (Department of Natural Resources and Water 2006) and subsequent offsets (Department of Natural Resources and Water 2007).

7.1 Offsets

Biodiversity offsets for the proposed pipeline are considered below under the Policy for Vegetation Management Offsets (Department of Natural Resources and Water 2007), the draft policy for Biodiversity Offsets (Queensland Government 2009) and the Draft Policy Statement: Use of environmental offsets under the *Environment Protection and Biodiversity Conservation Act 1999* (Department of Environment and Water Resources 2007).

7.1.1 Vegetation Management Act 1999

Offsets are an acceptable mechanism to meet the performance requirement of the Regional Vegetation Management Code (Department of Natural Resources and Water 2006) where the performance requirement includes maintaining the current extent of assessable vegetation. Offsets provided to meet the performance requirements should follow the Policy for Vegetation Management Offsets (Department of Natural Resources and Water 2007). Three of the performance requirements (see Section 6) require offsets (Table 7-1).

Table 7-1 Proposed clearing requiring offsets to meet the performance requirements

Performance requirement	Regional ecosystem(s)	Listed in Table 3*	Extent of clearing (ha)
PRS.2 Wetlands	11.3.27	No	0.3
PRS.3 Watercourses	11.3.2 11.3.25 11.3.4 11.5.1 11.5.21 11.5.4	No	10.0
PRS.7 Conserving remnant endangered (e) regional ecosystems and of concern (oc) regional ecosystems	11.3.2 (oc) 11.3.4 (oc) 11.9.5 (e)	No	4.2 2.8 1.6

* Table 3 of the Policy for Vegetation Management Offsets lists regional ecosystems that have a remnant extent below 5% of their preclearing extent and that are less than 500 hectares in total extent, or that have a remnant extent less than 200 hectares, or that are at risk of the remnant extent falling below 200 hectares. Different offsetting requirements apply to ecosystems listed in Table 3.

Clearing of remnant regional ecosystems as detailed in Table 7-1 would require offsets that meet the following criteria:

- limitations on offset vegetation
- selection and location of appropriate regional ecosystem
- remnant mapping
- obtaining ecological equivalence
- ensuring ongoing management
- ensuring the offset is legally secured
- Other requirements including ownership of land and financial contributions (Department of Natural Resources and Water 2007).

Details of the criteria are presented in the Policy for Vegetation Management Offsets (Department of Natural Resources and Water 2007). The minimum area of clearing to offset ratio will need to be determined following Table 2 of the Policy for Vegetation Management Offsets (Department of Natural Resources and Water 2007), up to a ratio of 1:4 depending on the location, habitat quality and ecosystem type of the offsets. Each performance requirement will need to be addressed completely, but a single offset may address more than one performance requirement.

7.1.2 Draft Queensland Government Policy on Biodiversity Offsets

As noted in Section 2.2, the Queensland Government has released a draft Policy for Biodiversity Offsets. Under this draft policy, the Coordinator-General, in consultation with DERM, may consider the appropriate offset requirements for 'significant projects', which may comprise an offset package and/or financial contribution. The draft policy considers offsets for endangered, vulnerable and rare species; endangered and of concern regional ecosystems; and remnant vegetation in subregions with less than 30% of remnant vegetation remaining. It is understood that this policy is currently being revised following consultation and submissions.

7.1.3 Offsets under the EPBC Act

Offsets under the EPBC Act may be required for impacts to matters of national environmental significance, including endangered ecological communities (Brigalow (*Acacia harpophylla* dominant and co-dominant)) and threatened species (e.g. *Homopholis belsonii* and Brigalow Scaly-foot). The offsets should follow the principles outlined in the Draft Policy Statement: Use of environmental offsets under the *Environment Protection and Biodiversity Conservation Act 1999* (Department of Environment and Water Resources 2007), namely:

1. Environmental offsets should be targeted to the matter protected by the EPBC Act that is being impacted.
2. A flexible approach should be taken to the design and use of environmental offsets to achieve long-term and certain conservation outcomes which are cost effective for proponents.

3. Environmental offsets should deliver a real conservation outcome.
4. Environmental offsets should be developed as a package of actions - which may include both direct and indirect offsets.
5. Environmental offsets should, as a minimum, be commensurate with the magnitude of the impacts of the development and ideally deliver outcomes that are 'like for like'.
6. Environmental offsets should be located within the same general area as the development activity.
7. Environmental offsets should be delivered in a timely manner and be long lasting.
8. Environmental offsets should be enforceable, monitored and audited.

Offsets required under the EPBC Act can generally overlap with those required to address state policies (i.e. the one offset site may address multiple offsetting requirements).

7.1.4 WJV's Biodiversity Offset Strategy

As part of its Biodiversity Offset Strategy, the WJV commits to ensuring a biodiversity offset to meet a 3:1 ratio for Project-related disturbance of remnant endangered regional ecosystem vegetation (using biodiversity status), endangered ecosystems listed under the EPBC Act and vegetation covered under the vegetation management code. For the CSM water supply pipeline areas, these unavoidable impacts include no more than the clearing of 18.9 ha of vegetation, resulting in a biodiversity offset of approximately 56.7 ha. These figures will be refined as part of the Biodiversity Offset Strategy during the detailed design phase.

8. Significance of impacts

A number of Threatened REs, communities, species of plant and species of animal have been recorded in the Study Area or are considered likely to occur (moderate or high likelihood), and may be affected by the proposed pipeline.

Impacts on Threatened species and communities listed under the EPBC Act are required to be assessed following the *Principal Significant Impact Guidelines*. An assessment of the significance of the impact to State-listed REs and Threatened species was also undertaken.

For the majority of species and communities, the results of the February 2009 surveys did not significantly change the Significance assessments for these communities and species as detailed in Volume 2 terrestrial ecology technical report TR17A-1-V2.5.

One vulnerable species, *Gonocarpus urceolatus*, was recorded in the February 2009 surveys but was not listed or assessed as part of the earlier EIS studies.

Gonocarpus urceolatus (Raspweed) was identified in three disjunct locations in three different vegetation types, with recorded numbers of 20, 10 and 35. All populations were identified in shallow depressions within RE 11.5.1, RE 11.5.4 and RE 11.7.4. Detailed foot traverses within these vegetation types failed to locate any other specimens.

The assessment of state-listed threatened species was against the following five criteria:

- will areas of high conservation value for the species or community be affected?
- do individual animals and/or plants and/or subpopulations that are likely to be affected by the Project play an important role in maintaining the long-term viability of the species, population or ecological community?
- do habitat features that are likely to be affected by the Project play an important role in maintaining the long-term viability of the species, population or ecological community?
- are the duration of impacts for the species or community long-term?
- are the impacts for the species or community permanent and irreversible?

The proposed pipeline has the potential to remove 65 individual *Gonocarpus urceolatus* spread across three populations. These three populations were found in three distinct REs (11.5.1, 11.5.4 and 11.7.4) totalling 27.5 hectares (remnant) within the Study Area. A total of 277,000 hectares of similar REs are mapped within the three subregions that the Study Area crossed (see Table 6-1) and 100 hectares occurs in reserves. Threats to this species include unsuitable fire regimes, weed invasion and loss of habitat. The first two threats are likely to be currently occurring given the location of the three populations near to the highway.

9. Conclusions

The February 2009 ecological surveys aimed to address the TOR for the Project by completing seasonal surveys. It also provided an opportunity to address route changes since the first (August 2008) surveys.

Generally the vegetation types, habitat types and species present were the same as those recorded during the earlier surveys. However due to the route modification, four REs not identified in the original route were recorded in the February 2009 surveys. One threatened species not recorded in August 2008 was recorded in the February 2009 surveys: *Gonocarpus urceolatus*. This species of plant is listed as vulnerable under the NC Regulations and was recorded at three distinct locations.

The proposed pipeline is likely to result in removal of 93 hectares of remnant vegetation, of which 1.6 hectares is listed as endangered. Other impacts and the proposed mitigation remain the same from the original technical assessment.

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Attachment A

Weather conditions during field
surveys

Attachment A: Weather conditions during field surveys

Weather variables recorded throughout the survey. Weather conditions recorded at collected from Miles Post office Weather Station at Constance Street [station 042112] (Bureau of Metrology 2008).

Shaded lines represent the period of survey.

Date	Minimum temperature (°C)	Maximum temperature (°C)	Rainfall (mm)	3 pm relative humidity (%)	3 pm wind direction	3 pm wind speed (km/h)	3 pm MSL pressure (hPa)
1/02/2009	20	31.4	0	43	ESE	15	1010.1
2/02/2009	22.8	30.8	0	49	NE	11	1008.6
3/02/2009	20.4	33.6	0	40	ESE	9	1005.3
4/02/2009	20.2	33.5	11	39	E	11	1004.7
5/02/2009	18.6	35.4	0	25	ESE	13	1004.3
6/02/2009	20.1	35.9	0	21	E	15	1006.9
7/02/2009	19.8	33.9	0	25	E	15	1009.1
8/02/2009	18.4	36	0	16	SSE	9	1007.5
9/02/2009	20.1	39.8	0	16	W	7	1005.3
10/02/2009	24.6	30.7	0	66	NNE	20	1007
11/02/2009	19.8	35.5	0.8	27	W	9	1003.8
12/02/2009	19.4	34	0	33	NNE	11	1006.3
13/02/2009	21.9	28.3	0	75	ENE	17	1010.1
14/02/2009	17.9	30.4	26.6	53	NNE	11	1005.3
15/02/2009	19.5	28.5	0.2	47	SW	13	1005.9
16/02/2009	17	31.1	0.2	47	ENE	15	1005.3
17/02/2009	20.7	28.6	2.8	62	SE	19	1005.1
18/02/2009	19.9	31.8	16.6	45	NE	7	1003.2
19/02/2009	21.4	34.3	0	35	WNW	7	1005.2
20/02/2009	22.5	34.7	1.4	46	N	7	1007
21/02/2009	21	31.7	3.6	49	WNW	6	1007.7
22/02/2009	22.2	32.6	0	37	ESE	13	1009.9
23/02/2009	19.3	33.3	0	30	E	13	1012.1
24/02/2009	17.9	32.9	0	27	E	9	1012.3
25/02/2009	19.8	28.8	0	40	E	11	1012.8
26/02/2009	17	32.9	0	32	SE	13	1011
27/02/2009	18	32.8	0	28	SSW	13	1010.5
28/02/2009	18.1	33.4	0	26	SSW	13	1009.2
1/03/2009	17.2	38	0	23	SSE	7	1008.4
2/03/2009	21.1	38.8	0	10	SW	13	1009.5
3/03/2009	22.8	37.5	0	23	ENE	6	1011.5

Attachment B

Flora survey results

Attachment B – Flora survey results

FAMILY	Scientific name	Common name	Native	Brigalow belt south significant	Surveyed regional ecosystems																
					11.3.2	11.3.19	11.3.25	11.3.27c	11.5.1	11.5.1a	11.5.4	11.5.21	11.7.2	11.7.4	11.7.6	11.7.7	11.9.5	11.9.7	11.9.10	11.10.7	Cleared areas
ACANTHACEAE	<i>Brunoniella australis</i>	Blue Trumpet	Y		1		2			3			1		2	1	2	3			1
	<i>Hypoestes floribunda</i>		Y														1				
ADIANTACEAE	<i>Cheilanthes distans</i>		Y								2	2								1	
	<i>Cheilanthes sieberi</i> var. <i>sieberi</i>	Mulga Fern	Y						2	3	2	2	2	3	1	1	1			2	1
AIZOACEAE	<i>Tetragonia tetragonoides</i>	Warrigal Greens	Y														1				2
	<i>Trianthema triquetra</i>	Red Spinach	Y														1	2			
AMARANTHACEAE	<i>Achyranthes aspera</i>	Chaff Flower	Y								1										
	<i>Alternanthera denticulata</i>	Lesser Joyweed	Y																		
	<i>Alternanthera nana</i>		Y		2		1														
	<i>Alternanthera nodiflora</i>	Joyweed	N																		
	<i>Gomphrena celosioides</i>	Gomphrena Weed	N		2		1			1											
	<i>Ptilotus exaltatus semilanatus</i>	Lamb's Tail	Y						1											1	
APIACEAE	<i>Cyclospermum leptophyllum</i>	Slender Celery	Y				1														1
	<i>Dichondra repens</i>	Kidney Weed	Y				1														
	<i>Hydrocotyle laxiflora</i>	Pennyweed	Y				2														
	<i>Trachymene incisa</i>	Wild Parsnip	Y										2	2							
APOCYNACEAE	<i>Alstonia constricta</i>	Bitter Bark	Y													1	2				
	<i>Carissa ovata</i>	Kunkerberry	Y													1	1				
	<i>Parsonsia eucalyptophylla</i>	Gnarloo	Y														2				
	<i>Parsonsia lanceolata</i>		Y														1		1		
ASCLEPIADACEAE	<i>Marsdenia viridiflora</i> ssp. <i>viridiflora</i>	Native Pear	Y														1	1			
	<i>Tylophora grandiflora</i>	Small-leaved Tylophora	Y														1				

FAMILY	Scientific name	Common name	Native	Brigalow belt south significant	Surveyed regional ecosystems																	
					11.3.2	11.3.19	11.3.25	11.3.27c	11.5.1	11.5.1a	11.5.4	11.5.21	11.7.2	11.7.4	11.7.6	11.7.7	11.9.5	11.9.7	11.9.10	11.10.7	Cleared areas	
ASTERACEAE	<i>Argemone ochroleuca</i>	Mexican Poppy	N																		1	
	<i>Calotis lappulacea</i>	Yellow Burr Daisy	Y													2		1		1	2	
	<i>Calotis cuneifolia</i>	Purple Burr Daisy	Y		2		2							1	2		1	1	2		2	2
ASTERACEAE	<i>Calotis scabiosifolia</i> var. <i>scabiosifolia</i>	Rough Burr Daisy	Y		2		1										1		1			1
	<i>Calotis tenuissima</i>		Y							1							1	1				
	<i>Camptacra barbata</i>		Y														1					
	<i>Centipeda minima</i>		Y				2															
	<i>Chrysocephalum apiculatum</i>	Yellow Buttons	Y		2		1		2	1	1				2		2				2	
	<i>Cirsium vulgare</i>	Scotch Thistle	N				1															1
	<i>Emex australis</i>	Spiny Emex	Y							1					1			2	1			
	<i>Emilia sonchifolia</i>	Milk Thistle	Y								1				2							
	<i>Epaltes australis</i>		Y																			1
	<i>Glossocardia bidens</i>	Native Cobblers Pegs	Y																		1	
	<i>Gnaphalium pensylvanicum</i>	Cudweed	N																			1
	<i>Helichrysum collinum</i>		Y							1						2	1					
	<i>Ozothamnus diosmifolius</i>	Sago Flower	Y													2						
	<i>Ozothamnus diotophyllus</i>		Y							1							2					
	<i>Peripleura hispidula</i>		Y										1	2		2	1					
	<i>Podolepis longipedata</i>		Y				1			1												1
	<i>Rhodanthe polyphylla</i>		Y							1							1					
	<i>Senecio lautus</i> s. str		Y					1										1				1
	<i>Senecio tuberculatus</i>		Y																			
	<i>Sigesbeckia orientalis</i>	Indian Head	N					2				1										
	<i>Soliva anthemifolia</i>	Soft Bindy-eye	N															1				
	<i>Sonchus oleraceus</i>	Milk Thistle	N					2														1
	<i>Verbena encelioides</i>	Crownbeard	Y															1				1

FAMILY	Scientific name	Common name	Native	Brigalow belt south significant	Surveyed regional ecosystems																
					11.3.2	11.3.19	11.3.25	11.3.27c	11.5.1	11.5.1a	11.5.4	11.5.21	11.7.2	11.7.4	11.7.6	11.7.7	11.9.5	11.9.7	11.9.10	11.10.7	Cleared areas
ASTERACEAE	<i>Vittadinia cuneata</i>		Y							1							2	1			
	<i>Vittadinia dissecta</i>		Y		2		2			1			2			2					2
	<i>Vittadinia pustulata</i>		Y		2		1			1						1					
	<i>Vittadinia sulcata</i>		Y			1			1		1			1						1	
AZOLLACEAE	<i>Zygophyllum apiculatum</i>	Gall Weed	Y														2				1 to 3
	<i>Azolla pinnata</i>	Azolla Fern	Y																		2(da m)
BORAGINACEAE	<i>Heliotropium amplexicaule</i>	Blue Heliotrope	N							2											
	<i>Cardamine paucijuga</i>		Y														2				
	<i>Lepidium bonariense</i>		N		1		2														1
	<i>Sisymbrium irio</i>	London Rocket	N														1				
CACTACEAE	<i>Opuntia stricta</i>	Common Prickly Pear	N(2)				2			2							1				
	<i>Opuntia tomentosa</i>	Velvet Prickly Pear	N(2)		2		1		1	1	2		1			1	2	1		1	1
CAESALPINIACEAE	<i>Senna artemisioides ssp. coriacea</i>		Y										2				2				1
	<i>Senna coronilloides</i>		Y														1				
	<i>Senna sophera sp. 'Forty Mile Scrub'</i>		Y														1				
CALLITRICHACEAE	<i>Callitriche muelleri</i>		Y																		
CAMPANULACEAE	<i>Wahlenbergia communis</i>		Y																		
	<i>Wahlenbergia gracilis</i>		Y															1		1	
CAPPARACEAE	<i>Apophyllum anomalum</i>	Warrior Bush	Y														2				
	<i>Capparis canescens</i>	Wild Orange	Y						1			1			1	1				1	
	<i>Capparis lasiantha</i>	Nipan	Y		2		1										2	2			1 to 2
	<i>Capparis loranthifolia</i>	Narrow-leaved Bumble Tree	Y														2				

FAMILY	Scientific name	Common name	Native	Brigalow belt south significant	Surveyed regional ecosystems																	
					11.3.2	11.3.19	11.3.25	11.3.27c	11.5.1	11.5.1a	11.5.4	11.5.21	11.7.2	11.7.4	11.7.6	11.7.7	11.9.5	11.9.7	11.9.10	11.10.7	Cleared areas	
CARYOPHYLLACEAE	<i>Capparis mitchellii</i>	Native Orange	Y														2					
	<i>Polycarpa corymbosa</i> var. <i>minor</i>		Y											1								
CASUARINACEAE	<i>Allocasuarina inophloia</i>	Thready-barked She-Oak	Y											2								
CASUARINACEAE	<i>Allocasuarina luehmannii</i>	Bull Oak	Y		2		1		4			3			2	1		2		2	2	
	<i>Casuarina cristata</i>	Belah	Y						2								4				1	
CELASTRACEAE	<i>Elaeodendron australe</i> var. <i>integrifolium</i>	Narrow-leaved Red Olive Plum	Y		2		1										1				1	
	<i>Maytenus cunninghamii</i>		Y										2							2		
	<i>Maytenus disperma</i>		Y														1					
CHENOPODIACEAE	<i>Atriplex muelleri</i>	Mueller's Saltbush	Y																		3	
	<i>Atriplex semibaccatum</i>	Creeping Saltbush	Y														1				1	
	<i>Chenopodium carinatum</i>	Small Crumbweed	N													2	1				1	
	<i>Chenopodium desertorum</i>	Desert Goosefoot	N				2						2									
	<i>Chenopodium melanocarpum</i>		Y																			
	<i>Chenopodium pumilo</i>		N										1				1					
	<i>Dysphania microcephala</i>		Y																			
	<i>Einadia hastata</i>	Saloop	Y		1		1						2				2				1	
	<i>Einadia nutans</i>	Climbing Saltbush	Y		1		2			1	2						2				1	
	<i>Enchylaena tomentosa</i>	Ruby Saltbush	Y							2							1	1			2	
	<i>Maireana decalvans</i>	Black Cottonbush	Y														1					
	<i>Maireana microphylla</i>	Small-leaved Cottonbush	Y						2				2					1			1	
	<i>Rhagodia gaudichaudiana</i>		Y														1					
	<i>Rhagodia parabolica</i>		Y														2					
	<i>Salsola kali</i>	Soft Roly Poly	Y		1		2			1			2				2	1			2	
	<i>Sclerolaena bicornis</i> var.	Goathead Burr	Y		2		1															

FAMILY	Scientific name	Common name	Native	Brigalow belt south significant	Surveyed regional ecosystems																	
					11.3.2	11.3.19	11.3.25	11.3.27c	11.5.1	11.5.1a	11.5.4	11.5.21	11.7.2	11.7.4	11.7.6	11.7.7	11.9.5	11.9.7	11.9.10	11.10.7	Cleared areas	
	<i>horrida</i>																					
	<i>Sclerolaena birchii</i>	Galvanised Burr	Y				2										2				1	
	<i>Sclerolaena muricatus</i>	Black Roly Poly	Y														1				2	
	<i>Sclerolaena tetracuspis</i>	Brigalow Burr	Y																			
	<i>Sclerolaena tricuspis</i>		Y																			
COMMELINACEAE	<i>Commelina ensifolia</i>		Y					1														
	<i>Murdannia graminea</i>		Y		1			1		1		1		1								
CONVOLVULACEAE	<i>Cuscuta campestris</i>	Dodder Laurel	N				1										1				1	
	<i>Evolvulus alsinoides</i>	Tropical Speedwell	Y		1		2							1								
CLUSIACEAE	<i>Hypericum gramineum</i>	Native St. John's Wort	Y					1														
CRASSULACEAE	<i>Bryophyllum delagoense</i>	Mother-of-Millions	N(2)								4											
	<i>Calandrinia ptychosperma</i>		Y					1									2					
	<i>Crassula sieberiana</i>		Y					1						2			1					
CUPRESSACEAE	<i>Callitris glaucophylla</i>	White Cypress Pine	Y		2		1		6	1	5 to 6	5		3	4	3	1	3		4	1	
	<i>Callitris endlicheri</i>	Black Cypress Pine	Y											1								
CYPERACEAE	<i>Carex inversa</i>		Y		2		1															
	<i>Cyperus betchei</i>		Y		2		1															
	<i>Cyperus cyperoides</i>		Y				1				1	1										
	<i>Cyperus difformis</i>	Dirty Dora	Y																			
	<i>Cyperus exaltatus</i>	Tall Sedge	Y				2															
	<i>Cyperus gracilis</i>	Whisker Grass	Y		2		1							2			2			1		
	<i>Cyperus gilesii</i>		Y				1					1										
	<i>Eleocharis philippensis</i>		Y					3														
	<i>Eleocharis plana</i>	Ribbed Spike Rush	Y				1	4														
	<i>Eleocharis sphacelata</i>		Y				1	1														
	<i>Fimbristylis dichotoma</i>		Y						1		1	1			2					2	1	

FAMILY	Scientific name	Common name	Native	Brigalow belt south significant	Surveyed regional ecosystems																	
					11.3.2	11.3.19	11.3.25	11.3.27c	11.5.1	11.5.1a	11.5.4	11.5.21	11.7.2	11.7.4	11.7.6	11.7.7	11.9.5	11.9.7	11.9.10	11.10.7	Cleared areas	
	<i>Gahnia aspera</i>	Saw Sedge	Y						2		1				2	3	2	1				
	<i>Schoenus kennyi</i>		Y						1					2		1	1					
	<i>Scleria mackaviensis</i>		N		1		2							2			2					1
DILLENACEAE	<i>Hibbertia cistoidea</i>		Y						2													
DROSERACEAE	<i>Drosera peltata</i>	Pale Sundew	Y												2							
EBENACEAE	<i>Diospyros humilis</i>	Small-leaved Ebony	Y															1				
EHRETIACEAE	<i>Ehretia membranifolia</i>	Peach Bush	Y											2				1				
EPACRIDACEAE	<i>Leucopogon biflorus</i>		Y														1					
	<i>Leucopogon pleiospermus</i>		Y						2							5		1				
EUPHORBIACEAE	<i>Acalypha eremorum</i>	Soft Acalypha	Y															2				
	<i>Breynia oblongifolia</i>	Coffee Bush	Y														2		1			
	<i>Bridelia leichhardtii</i>	Small-leaved Scrub Ironbark	Y														1		1			
	<i>Chamaesyce drummondii</i>	Caustic Weed	Y																1			1
	<i>Euphorbia tannensis</i> ssp. <i>eremophila</i>		Y											2			1				1	
	<i>Petalostigma pubescens</i>	Quinine Bush	Y								1	4				1	2					
	<i>Phyllanthus gunnii</i>		Y						1			1										
	<i>Phyllanthus maderaspatensis</i>		Y											2								
	<i>Phyllanthus virgatus</i>		Y											2		2						
FABACEAE	<i>Daviesia ulicifolia</i>	Native Gorse	Y									1										
	<i>Desmodium brachypodium</i>		Y							1											1	
	<i>Desmodium macrocarpum</i>		R							1												
	<i>Desmodium rhytidophyllum</i>	Hairy Tre-foil	Y												1							
	<i>Desmodium varians</i>	Variable Tre-foil	Y															2				
	<i>Glycine microphylla</i>		Y								1											

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	<i>Glycine tabacina</i>	Glycine Pea	Y																			
	<i>Glycine tomentella</i>	Hairy Glycine	Y										1									
	<i>Hovea ramularis</i>		Y																			
	<i>Jacksonia scoparia</i>	Dogwood	Y										2									1
	<i>Medicago polymorpha</i>	Burr Medic	N			2											1					2
	<i>Mirbelia pungens</i>		Y					1														
FABACEAE	<i>Stylosanthes humilis</i>	Shrubby Stylo	N																			
	<i>Zornia dyctiocarpa</i> var. <i>dyctiocarpa</i>		Y										1									
GERANIACEAE	<i>Erodium crinitum</i>	Crowsfoot	Y																			
GOODENIACEAE	<i>Dampiera adpressa</i>		Y					2									1					
	<i>Goodenia fascicularis</i>	Silky Goodenia	Y													2	1		2			
	<i>Goodenia glabra</i>	Smooth Goodenia	Y								1						1					
	<i>Goodenia grandiflora</i>		Y												1							
	<i>Goodenia rotundifolia</i>		Y											2								
	<i>Scaevola spinescens</i>	Prickly Fan Flower	Y						1													
HALORAGACEAE	<i>Gonocarpus micranthus</i> ssp. <i>ramosissimus</i>		Y												2							
	<i>Gonocarpus urceolatus</i>	Raspweed	V					1		1					1							
HEMEROCALLIDACE AE	<i>Dianella caerulea</i>	Blue Flax Lily	Y													2						
	<i>Dianella longifolia</i>	Smooth Flax Lily	Y					1														
	<i>Dianella revoluta</i> var. <i>revoluta</i>	Spreading Flax Lily	Y										2			2	1					
JOHNSONIACEAE	<i>Tricoryne elatior</i>		Y													1						
JUNCACEAE	<i>Juncus aridicola</i>		Y																			
	<i>Juncus psammophilus</i>		Y			1																
	<i>Juncus remotiflorus</i>		Y																			
	<i>Juncus subsecundus</i>		Y		2		1				1											
	<i>Juncus usitatus</i>		Y								1											

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					11.3.2	11.3.19	11.3.25	11.3.27c	11.5.1	11.5.1a	11.5.4	11.5.21	11.7.2	11.7.4	11.7.6	11.7.7	11.9.5	11.9.7	11.9.10	11.10.7		
LAMIACEAE	<i>Prostanthera</i> sp. Baking Board (Vh Hando135)		Y												2							
LAXMANNIACEAE	<i>Laxmannia gracilis</i>	Wire Lily	Y						2				1				1					
	<i>Lomandra confertifolia</i> ssp. <i>pallida</i>		Y						1			2	2			2		2				
LAXMANNIACEAE	<i>Lomandra filiformis</i>		Y												2		2					
	<i>Lomandra leucocephala</i> var. <i>leucocephala</i>	Woolly-headed Mat Rush	Y						2				2	2	1		1					
	<i>Lomandra longifolia</i>	Spiny-headed Mat Rush	Y			1		2		1			2	2		2						
	<i>Lomandra multiflora</i>	Many-flowered Mat Rush	Y			1		2		1				2		1	2	2				
LILIACEAE	<i>Bulbine barbata</i>		Y															1				
	<i>Crinum flaccidum</i>	Murray Lily	Y												1							
LOGANIACEAE	<i>Mitrasacme paludosa</i>		Y													1						
LORANTHACEAE	<i>Amyema bifurcata</i>	Bloodwood Mistletoe	Y													1						
	<i>Amyema congener</i> ssp. <i>congener</i>	Variable Mistletoe	Y																		1	
	<i>Amyema linophylla</i> ssp. <i>orientalis</i>	Bull Oak Mistletoe	Y											3								
	<i>Amyema maidenii</i> ssp. <i>angustifolia</i>		Y															2				
	<i>Amyema miquelii</i>	Box Mistletoe	Y			1		1														
	<i>Amyema quandang</i> var. <i>bancroftii</i>	Grey Mistletoe	Y												2	2		2	1			1
	<i>Amyema quandang</i> var. <i>quandang</i>	Grey Mistletoe	Y															2				1
	<i>Lysiana exocarpi</i> ssp. <i>tenuis</i>	Harlequin Mistletoe	Y							2												
	<i>Lysiana subfalcata</i>	Yellow Mistletoe	Y																			1
LYRATHACEAE	<i>Ammannia multiflora</i>		Y				1	1				1										
MALVACEAE	<i>Abutilon malvifolium</i>	Bastard Marshmallow	Y								1						1	2				

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	<i>Abutilon oxycarpum</i> var. <i>oxycarpum</i>	Flannel Weed	Y														1				
	<i>Hibiscus sturtii</i>	Hill Hibiscus	Y										3	1		1					
	<i>Malvastrum americanum</i>	Spiked Malvastrum	N		2		1										1				2
MALVACEAE	<i>Melhania oblongifolia</i>	Melhania	Y					1						1	1						
	<i>Modiola carolinae</i>	Red-fruited Mallow	N			2															1
	<i>Sida cordifolia</i>	Flannel Weed	Y												1						
	<i>Sida corrugata</i>	Corrugated Sida	Y																		
	<i>Sida cunninghamii</i>	Ridge Sida	Y									2					2				
	<i>Sida fibulifera</i>	Pin Sida	Y						1												
	<i>Sida filiformis</i>	Fine Sida	Y										1	1							
	<i>Sida rhombifolia</i>	Paddy's Lucerne	N			1															1
	<i>Sida rohlenae</i>	Shrub Sida	Y										1	1	1	2		2		2	1
	<i>Sida subspicata</i>	Spiked Sida	Y		3		1														1
	<i>Sida trichopoda</i>	High Sida	Y					1									1				
	MELIACEAE	<i>Owenia acidula</i>	Emu Apple	Y										2				1	2		1 to 2
MENYANTHACEAE	<i>Nymphoides crenata</i>	Wavy Marshwort	Y				2														
MIMOSACEAE	<i>Acacia aprepta</i>	Miles Mulga	Y	Yes										3							1
	<i>Acacia blakei</i> ssp. <i>blakei</i>	Blake's Wattle	Y			2						1		2	2	3					3
	<i>Acacia burrowii</i>	Currawong	Y										2	1							
	<i>Acacia buxifolia</i>	Box-lef Wattle	Y													1					
	<i>Acacia caroleae</i>	Carole's Wattle	Y					2													
	<i>Acacia conferta</i>	Crowded-leaf Wattle	Y									4		2		1					1
	<i>Acacia crassa</i> ssp. <i>crassa</i>	Black Wattle	Y								4				2					2 to 3	1
	<i>Acacia debilis</i>		Y																		
	<i>Acacia decora</i>	Pretty Wattle	Y															1		3	2
	<i>Acacia excelsa</i>	Ironwood	Y		3		2				1						1	2			2

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MIMOSACEAE	<i>Acacia harpophylla</i>	Brigalow	Y														5				2 to 4
	<i>Acacia ixiophylla</i>	Umbrella Wattle	Y					2 to 4		1											2 to 4
	<i>Acacia julifera</i> ssp. <i>julifera</i>		Y			2					1										1
	<i>Acacia juncifolia</i> ssp. <i>juncifolia</i>	Rush-leaf Wattle	Y											1							
	<i>Acacia leiocalyx</i> ssp. <i>leiocalyx</i>	Black Wattle	Y					2						2					1		1
	<i>Acacia longispicata</i> ssp. <i>velutina</i>		Y																		
	<i>Acacia loroloba</i>		Y										2								1
	<i>Acacia macradenia</i>	Zig-zag Wattle	Y																		1
	<i>Acacia melvillei</i>	Yaran	Y	Yes	1												1	2	1		2
	<i>Acacia neriifolia</i>		Y																		
	<i>Acacia omalophylla</i>	Yarran	Y	Yes									1	2						1	
	<i>Acacia salicina</i>	Sally Wattle	Y		2		1										2				1
	<i>Acacia semilunata</i>		Y			2		1					2		1						2
	<i>Acacia semirigida</i>	Stony-Ridge Wattle	Y					1		2					2						1
	<i>Acacia shirleyi</i>	Lancewood	Y	Yes									6			1					2 to 4
	<i>Acacia sparsiflora</i>		Y											2							
	<i>Acacia spectabilis</i>	Glory Wattle	Y					1			2		1		2						2
	<i>Acacia triptera</i>	Spur-wing Wattle	Y					1													1
MYOPORACEAE	<i>Eremophila debile</i>	Winter Apple	Y		2		1											1			
	<i>Eremophila deserti</i>	Ellangowan Poison Bush	Y											2	1	2					1
	<i>Eremophila mitchellii</i>	False Sandalwood	Y		2		2		3							2	2				2
	<i>Myoporum acuminatum</i>	Mountain Boobialla	Y		2		1														

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MYRTACEAE	<i>Angophora floribunda</i>	Rough-barked Apple	Y				2				3											1
	<i>Angophora leiocarpa</i>	Smooth-bark Apple	Y						2			5				2						1
	<i>Corymbia citriodora</i> ssp. <i>variegata</i>	Spotted Gum	Y												6							1
	<i>Corymbia clarksoniana</i>	Long-fruited Bloodwood	Y									2									1	
MYRTACEAE	<i>Corymbia tessellaris</i>	Carbeen	Y				1				1							1				
	<i>Corymbia trachyphloia</i> ssp. <i>trachyphloia</i>	Brown Bloodwood	Y											1								
	<i>Eucalyptus chloroclada</i>	Baradine Red Gum	Y						1		4	2				1						
	<i>Eucalyptus crebra</i>	Narrow-leaved Red Ironbark	Y						5		1		1	1		1	2				6	1
	<i>Eucalyptus exserta</i>	Queensland Peppermint	Y						1					4		1						
	<i>Eucalyptus fibrosa</i> ssp. <i>nubila</i>	Blue-leaved Ironbark	Y											2			5					1
	<i>Eucalyptus longirostrata</i>	Grey Gum	Y								5											
	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark	Y		2		1															
	<i>Eucalyptus pilligaensis</i>	Narrow-leaved Grey Box	Y											1								1
	<i>Eucalyptus populnea</i>	Poplar Box	Y		6		4		2	6			2					1	6		2	1
	<i>Eucalyptus tenuipes</i>	Narrow-leaved White Mahogany	Y												2		1					
	<i>Eucalyptus tereticornis</i>	Queensland Blue Gum	Y				3															
	<i>Leptospermum polygalifolium</i>	Wild May	Y												2							
	<i>Lysicarpus angustifolius</i>	Budgeroo	Y												1		1					
	<i>Melaleuca viminalis</i>	Weeping Bottlebrush	Y																			
	OLEACEAE	<i>Jasminum didymum</i> ssp. <i>racemosum</i>		Y		1		2			1								1			
<i>Jasminum lineare</i>		Desert Jasmine	Y				1											1				

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ORCHIDACEAE	<i>Jasminum volubile</i>		Y															1				
	<i>Notelaea microcarpa</i> var. <i>microcarpa</i>	Narrow-leaved Mock Olive	Y											1				1				
	<i>Cyanicula caerulea</i> var. <i>caerulea</i>		Y						1						1							
OXALIDACEAE	<i>Oxalis corniculata</i> ssp. <i>corniculata</i>	Creeping Oxalis	N		2		1															2
	<i>Oxalis exilis</i>		Y														1					
	<i>Oxalis perennans</i>		Y												1			1				
	<i>Oxalis</i> sp. (n-r)		Y		2		1				1			2	3		2	2				
PITTOSPORACEAE	<i>Auranticarpa rhombifolia</i>	Diamond-leaved Pittosporum	Y															2				
	<i>Pittosporum angustifolium</i>	Weeping Pittosporum	Y		1		2			2						2			1		1	
	<i>Pittosporum spinescens</i>	Wallaby Apple	Y															1				
PLANTAGINACEAE	<i>Plantago cunninghamii</i>		Y															1				
POACEAE	<i>Alloteropsis semialata</i>	Cockatoo Grass	Y								1	1										1
	<i>Ancistrachne uncinulata</i>	Hooky Grass	Y											2		2		1				
	<i>Aristida calycina</i> var. <i>praealta</i>	Dark Wiregrass	Y							2	1				1				2			2
	<i>Aristida caput-medusae</i>	Many-headed Wiregrass	Y		1		2				2	3	4	3	3	4					2	3
	<i>Aristida curvula</i>	African Lovegrass	N																			2
	<i>Aristida echinata</i>		Y													2						
	<i>Aristida holathera</i> var. <i>holathera</i>	Erect Kerosene Grass	Y													2	1					1
	<i>Aristida jerichoensis</i> var. <i>jerichoensis</i>	Jericho Wiregrass	Y		1		2		1						1	1		1				2
	<i>Aristida latifolia</i>	Feathertop Wiregrass	Y															1			2	1
	<i>Aristida leichhardtiana</i>		Y											1	1							
	<i>Aristida leptopoda</i>	White Wiregrass	Y																	1		2

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	<i>Aristida personata</i>		Y												1							
	<i>Aristida ramosa</i>	Purple Wiregrass	Y					5						2	1	2	1				3	
	<i>Arundinella nepalensis</i>	Reedgrass	Y							2				2								
	<i>Austrostipa ramosissimum</i>	Stout Bamboo Grass	Y			2											1					
	<i>Austrostipa scaber</i>	Rough Speargrass	Y														1					
	<i>Austrostipa verticillata</i>	Slender Bamboo Grass	Y														1					
	<i>Bothriochloa decipiens</i> var. <i>decipiens</i>	Pitted Bluegrass	Y															1			1	
	<i>Calypochloa gracillima</i>		Y					1		2			1	1								
	<i>Capillipedium spicigerum</i>	Scented Top	Y			3	1			1	2											
	<i>Cenchrus ciliaris</i>	Buffel Grass	Y						2								2	1		1	4	
	<i>Cenchrus echinatus</i>	Mossman River Grass	N		1	1															1	
	<i>Chionachne cyathophora</i>	River Grass	Y			2																
	<i>Chloris divaricata</i>	Slender Chloris	Y		2		2										4	2			1	
	<i>Chloris gayana</i>	Rhodes Grass	N			2														1	2	
	<i>Chloris truncata</i>	Windmill Grass	Y		1		2			4	1						1	2		2		
	<i>Chloris ventricosa</i>	Tall Chloris	Y		1													1	1	1	1	
	<i>Chrysopogon fallax</i>	Golden Beard Grass	Y					1		2					1					2		
	<i>Chrysopogon filipes</i>	Australian Vetivier	Y			2	3															
	<i>Cleistochloa subjuncea</i>		Y					1	1	2		4	2	3	2							
	<i>Cymbopogon obtectus</i>	Silky Heads	Y							1												
	<i>Cymbopogon refractus</i>	Barbed Wire Grass	Y		1		2			1	2	1			2			1		2		
	<i>Cynodon dactylon</i>	Couch	N		2		1			2												
	<i>Dichanthium sericeum</i>	Queensland Blue Grass	Y		1		2			1	1							3		2	2	
	<i>Dichelachne crinita</i>	Shorthair Plume Grass	Y						1													

FAMILY	Scientific name	Common name	Native	Brigalow belt south significant	Surveyed regional ecosystems																
					11.3.2	11.3.19	11.3.25	11.3.27c	11.5.1	11.5.1a	11.5.4	11.5.21	11.7.2	11.7.4	11.7.6	11.7.7	11.9.5	11.9.7	11.9.10	11.10.7	Cleared areas
	<i>Digitaria ammitophilus</i>		Y																		1
	<i>Digitaria bicornis</i>		Y									1									1
	<i>Digitaria breviglumis</i>		Y											1							
	<i>Digitaria divaricatissima</i>		Y										2	2		2				1	1
	<i>Digitaria nematostachya</i>		Y												2						
	<i>Digitaria orbata</i>		Y						1		1		1								
	<i>Digitaria ramularis</i>		Y												1						
	<i>Diplachne parviflora</i>	Small-leaved Beetle Grass	Y				1	3 to 6													
	<i>Echinochloa colona</i>	Awnless Barnyard Grass	N				2														
	<i>Echinochloa crus-galli</i>	Barnyard Grass	N				1										1				
	<i>Echinopogon ovatus</i>	Hedgehog Grass	Y																		
	<i>Eleusine indica</i>	Crow's Foot Grass	N														1				1
	<i>Elymus scabrus</i>	Common Wheat Grass	Y		2		1														
	<i>Enneapogon gracilis</i>	Nine Awn Grass	Y															1		2	
	<i>Enneapogon intermedius</i>		Y									1			1						
	<i>Enneapogon nigricans</i>	Niggerheads	Y								1										
	<i>Enneapogon robustissimus</i>		Y						2	1	1				1	2					
	<i>Enteropogon acicularis</i>	Curly Widmill Grass	Y															1			
	<i>Enteropogon ramosus</i>	Twirly Windmill Grass	Y		1					2							3	2	1	1	
	<i>Entolasia stricta</i>	Wiry Panic	Y						2				1		3	2					
	<i>Eragrostis cilianensis</i>	Stink Grass	N																		1 to 3
	<i>Eragrostis curvula</i>	African Love Grass	N				1														1 to 4
	<i>Eragrostis elongatus</i>	Clustered Lovegrass	Y		2		1		2		3				2	2					1
	<i>Eragrostis lacunaria</i>	Purple Lovegrass	Y						1						2		2	1			

FAMILY	Scientific name	Common name	Native	Brigalow belt south significant	Surveyed regional ecosystems																
					11.3.2	11.3.19	11.3.25	11.3.27c	11.5.1	11.5.1a	11.5.4	11.5.21	11.7.2	11.7.4	11.7.6	11.7.7	11.9.5	11.9.7	11.9.10	11.10.7	Cleared areas
	<i>Eragrostis leptocarpa</i>		Y				1														1
	<i>Eragrostis leptostachya</i>	Paddock Lovegrass	Y		2		1				2		2								
	<i>Eragrostis longipedicellata</i>		Y										2								
	<i>Eragrostis megalosperma</i>		Y				1	2		2			2			1	1				
	<i>Eragrostis spartinoides</i>		Y						2												
	<i>Eragrostis sororia</i>	Woodland Lovegrass	Y							3		1	2							2	
	<i>Eragrostis tenellula</i>		Y		2		1				1										1
	<i>Eriachne mucronata</i>	Mountain Wanderrie Grass	Y						4					1		2					
	<i>Eriochloa crebra</i>	Early Spring Cup Grass	Y		2		2	1										1		1	1
	<i>Eulalia fulva</i>	Silky Brown Top	Y				1				1	2									
	<i>Heteropogon contortus</i>	Bunched Speargrass	Y		3		1			1	2							2		4	
	<i>Homopholis belsonii</i>	Belson's Panic	Y	EV													1 to 4		2		
	<i>Hyparrhenia rufa</i>	Thatch Grass	Y																		
	<i>Imperata cylindrica</i>	Blady Grass	Y																		
	<i>Leptochloa decipiens</i> ssp. <i>decipiens</i>		Y								1				1						
	<i>Leptochloa decipiens</i> ssp. <i>peacockii</i>		Y										2				2				
	<i>Leptochloa digitata</i>	Umbrella Canegrass	Y				2														
	<i>Megathyrsus maximus</i> var. <i>maximus</i>	Guinea Grass	N		2		3			2	4					2	2				1 to 4
	<i>Microlaena stipoides</i>	Weeping Meadow Grass	Y										2								
	<i>Panicum buncei</i>		Y									1			1					1	1
	<i>Panicum decompositum</i>	Native Millet	Y															2		1	1
	<i>Panicum effusum</i>	Hairy Panic	Y						1		2				2	2		1		1	

FAMILY	Scientific name	Common name	Native	Brigalow belt south significant	Surveyed regional ecosystems																	
					11.3.2	11.3.19	11.3.25	11.3.27c	11.5.1	11.5.1a	11.5.4	11.5.21	11.7.2	11.7.4	11.7.6	11.7.7	11.9.5	11.9.7	11.9.10	11.10.7	Cleared areas	
	<i>Panicum queenslandicum</i> var. <i>queenslandicum</i>	Yabilla Grass	Y				1															
	<i>Panicum simile</i>	Two-coloured Panic	Y																	1		
	<i>Paspalidium caespitosum</i>	Brigalow Grass	Y														1					
	<i>Paspalidium constrictum</i>		Y											1				2	2			
	<i>Paspalidium distans</i>	Shot Grass	Y					1		2						2		2				
	<i>Paspalidium</i> sp. (n-r)		Y							2				2		2						
	<i>Paspalidium jubiflorum</i>		Y			2	1															
	<i>Paspalum dilatatum</i>	Paspalum	N			1																
	<i>Paspalum distichum</i>	Water Couch	Y																			
	<i>Paspalum scrobiculatum</i>	Scrobic	Y									1										1
	<i>Pennisetum setaceum</i>	Fountain Grass	N												1							
	<i>Perotis rara</i>	Comet Grass	Y					1	1						1							
	<i>Phragmites australis</i>	Common Reed	Y			2																
	<i>Pseudoraphis spinescens</i>	Spiny Mudgrass	Y				3															
	<i>Rhynchelytrum repens</i>	Red Natal Grass	Y							2	3						2				1 2	1
	<i>Setaria parviflora</i>		N					1														
	<i>Setaria paspalidioides</i>		Y					1														
	<i>Setaria surgens</i>	Annual Pigeon Grass	Y											1	1							1
	<i>Sporobolus actinocladius</i>		Y								2								1			
	<i>Sporobolus caroli</i>	Fairy Grass	Y		1		2			2								2	1			1
	<i>Sporobolus contiguus</i>		Y			1													6			
	<i>Sporobolus coromandelianus</i>		N																			2
	<i>Sporobolus creber</i>	Slender Rat's Tail Grass	Y		1		2															
	<i>Sporobolus elongatus</i>	Slender Rat's Tail Grass	Y								2									1		

FAMILY	Scientific name	Common name	Native	Brigalow belt south significant	Surveyed regional ecosystems																	
					11.3.2	11.3.19	11.3.25	11.3.27c	11.5.1	11.5.1a	11.5.4	11.5.21	11.7.2	11.7.4	11.7.6	11.7.7	11.9.5	11.9.7	11.9.10	11.10.7	Cleared areas	
	<i>Themeda avenacea</i>		Y				2															
	<i>Themeda triandra</i>	Kangaroo Grass	Y							1						2						
	<i>Thyridolepis mitchelliana</i>		Y										3	2	3	1						
	<i>Tragus australianus</i>	Small Burrgrass	Y		2		1															
	<i>Urochloa mosambicensis</i>	Sabi Grass	N													1						
	<i>Vulpia myuros</i>		Y				1															
	POLYGONACEAE	<i>Rumex brownii</i>	Swamp Dock	Y				2														
PONTEDDERIACEAE	<i>Monochoria cyanea</i>	Monocharia	Y					2														
PORTULACACEAE	<i>Portulaca filiformis</i>		Y															1				
	<i>Portulaca pilosa</i>	Hairy Pigweed	N																			1
PROTEACEAE	<i>Grevillea striata</i>	Beefwood	Y															1				
	<i>Hakea fraseri</i>	Corkwood Oak	Y										2					1				
	<i>Hakea purpurea</i>	Needlewood	Y						1													
RANUNCULACEAE	<i>Ranunculus pentandrus</i> var. <i>platycarpus</i>	(a) Buttercup	Y																			
RHAMNACEAE	<i>Alphitonia excelsa</i>	Red Ash	Y							1						1	1					1
	<i>Cryptandra armata</i>		Y											2	1	1						
	<i>Pomaderris queenslandica</i>		Y								1											
RUBIACEAE	<i>Asperula conferta</i> ssp. <i>conferta</i>	Common Woodruff	Y																1			
	<i>Asperula geminifolia</i>	Twin-leaf Bedstraw	Y											2			1					
	<i>Pomax umbellata</i>	Pomax	Y																			
	<i>Psydrax johnsonii</i>	Brigalow Canthium	Y															2				
	<i>Psydrax odorata</i> var. <i>buxifolia</i>	Shiny Canthium	Y																			
	<i>Psydrax odorata</i> var. <i>odorata</i>	Stiff Canthium	Y													1						
	<i>Psydrax oleifolium</i>		Y							3	1			1		2			1		1	
	<i>Richardia brasiliensis</i>	White Eye	N																			

FAMILY	Scientific name	Common name	Native	Brigalow belt south significant	Surveyed regional ecosystems																	
					11.3.2	11.3.19	11.3.25	11.3.27c	11.5.1	11.5.1a	11.5.4	11.5.21	11.7.2	11.7.4	11.7.6	11.7.7	11.9.5	11.9.7	11.9.10	11.10.7	Cleared areas	
RUTACEAE	<i>Boronia bipinnata</i>	Rock Boronia	Y					2								1						
	<i>Boronia glabrata</i>	Sandstone Boronia	Y												2	2						
	<i>Boronia repanda</i>		Y					2						1								
	<i>Citrus glauca</i>	Wild Lime	Y														1					
	<i>Flindersia collina</i>	Leopard Wood	Y														1					
	<i>Geijera parviflora</i>	Narrow-leaved Wilga	Y		2		1		3				1		1		3	2				2
SANTALACEAE	<i>Santalum lanceolatum</i>	Sandalwood	Y					1								1	2					1 to 3
SAPINDACEAE	<i>Alectryon diversifolius</i>	Scrub Boonaree	Y		2		1										2					
	<i>Alectryon oleifolius</i>	Western Rosewood	Y		2		2										2					
	<i>Atalaya hemiglauca</i>	Whitewood	Y						1								2	1				1 to 3
	<i>Dodonaea biloba</i>		Y											1								
	<i>Dodonaea macrossanii</i>		Y	Yes												1						
	<i>Dodonaea peduncularis</i>		Y												1							
	<i>Dodonaea triangularis</i>		Y												1	2						
	<i>Dodonaea truncatiales</i>		Y																			
	<i>Dodonaea vestita</i>		Y					1														
	<i>Dodonaea viscosa</i> var. <i>spatulata</i>	Sticky Hop Bush	Y																		2	
SOLANCEAE	<i>Solanum ellipticum</i>	Potato Bush	Y				2					1		1		2						1
	<i>Solanum esuriale</i>	Potato Weed	Y										1								1	1
	<i>Solanum mitchellianum</i>	Western Prickly Nightshade	Y		2		1										2					
	<i>Solanum nemophilum</i>		Y						1				3	1	2	2		1				1
	<i>Solanum parvifolium</i> ssp. <i>parvifolium</i>	Small-leaved Nightshade	Y											2	2		2					
STACKHOUSIACEAE	<i>Stackhousia muriculata</i>		Y												1							
STERCULIACEAE	<i>Brachychiton australis</i>	Broad-leaved Bottle Tree	Y														1					

FAMILY	Scientific name	Common name	Native	Brigalow belt south significant	Surveyed regional ecosystems																	
					11.3.2	11.3.19	11.3.25	11.3.27c	11.5.1	11.5.1a	11.5.4	11.5.21	11.7.2	11.7.4	11.7.6	11.7.7	11.9.5	11.9.7	11.9.10	11.10.7	Cleared areas	
	<i>Brachychiton populneus</i>	Kurrajong	Y															1				
	<i>Brachychiton rupestris</i>	Queensland Bottle Tree	Y														1				1	
	<i>Seringia corollata</i> var. <i>corollata</i>		Y												2							
	STYLIDIACEAE	<i>Stylidium eglandulosum</i>	a trigger plant	Y									1									
THYMELAEACEAE	<i>Pimelea microcephala</i> var. <i>microcephala</i>	Poison Pimelea	Y						1								1				1	
VERBENACEAE	<i>Clerodendrum floribundum</i>	Lolly Bush	Y																			
	<i>Phyla nodiflora</i>	Condamine Couch	N																			
	<i>Verbena aristigera</i>	Mayne's Pest	Y		3		3			2	2					2	1	1		1	1 to 4	
	<i>Verbena bonariensis</i>	Purple-top	Y				2															
VISICACEAE	<i>Viscum whitei</i> ssp. <i>whitei</i>		Y																			
VITACEAE	<i>Cayratia clematidea</i>	Slender Grape	Y														1					
XANTHORRHOEACEAE	<i>Xanthorrhoea johnsonii</i>	Grass Tree	Y												1		1					
ZYGOPHYLLACEAE	<i>Tribulus terrestris</i>	Caltrop	Y																		2	
	<i>Zygophyllum glaucum</i>	Pale Twinleaf	Y														1					

Attachment C

Fauna survey results

Attachment C: Fauna survey results

Vertebrate fauna recorded during both the winter and summer surveys.

Vertebrate fauna species recorded during the field survey of proposed Southern CSM Water Supply Pipeline. • = indicates the species was recorded during fauna survey.

CONSERVATION STATUS: Species in bold denotes a species of state or federal significance. NCR: E = Endangered, V = Vulnerable or R = Rare as listed under the Queensland *Nature Conservation (Wildlife)* Regulation 2006; EPBC: E = Endangered, V = Vulnerable, M = Migratory under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* I = Introduced species. RSF= Regionally Significant Fauna, NRL = Northern Range Limit. SigSBB = significant in the southern Briglow Belt.

DETECTION METHOD: O = Observed, W = Heard, H = Harp Trap, E = Elliott Trap, P = Pitfall, A = Anabat detection, S = Spotlight, HS = Herpetofauna Survey, S = Spotlight, Re = Remains, D = Diggings, Sc = Scats, Tk = Tracks.

SUPPLEMENTARY SITES & OPPORTUNISTIC RECORDS (Supp Site/Opp): Sites were not standard survey sights but involved a targeted survey technique such as a bird survey, anabat, harp trap, active search or waterbird survey. Opportunistic was casual observation.

Abundance Rating (ABUN): R = Rare fauna <5 site records, U = Uncommon fauna 5-10 site records, C = Common fauna 11-20 site records, A = Abundant fauna >20 site records.

HABITATS: B = Brigalow (*Acacia harp* +- *Casuarina cristata*), DSF = Dry Sclerophyll Forest (*Corymbia citriodora ssp. variegata* + *Angophora leiocarpa*) Occasionally Redgum (*Eucalyptus chloroclada*), bloodwood (*Corymbia clarksoniana*) and or Grey Gum, BuW = Buloke (*Allocasuarina leuhmanii*) Woodland, IW = Ironbark (*Eucalyptus fibrosa ssp. nubila* or *E. crebra*) +- *Callitris glaucophylla* and or Lancewood *Acacia shirleyi* Woodland, BW = Poplar Box (*Eucalyptus populnea*) Woodland, R = Riparian (*E. tereticornis* dominated), AS = Acacia Scrub (Miles Mulga *Acacia aprepta*), C = Predominantly Cleared, W = Wetland/Dam.

Scientific name	Common name	Conservation status			Abun	Winter survey	Summer survey	Winter 2008 survey							Summer 2009 survey					Supp	Habitat type associations								
		NCR	EPBC	RSF				Detection method	Standard sites					Supp	Standard sites						DSF	BuW	IW	PB	R	AS	C	W	
									1	2	3	4	5		1	2	3	4	5										
<i>Bufo marinus</i>	Cane Toad	I	-	-	C	1	1	HS, Re						1		1	1	1	1	1		1	1	1	1	1	1	1	1
<i>Limnodynastes ornatus</i>	Ornate Burrowing Frog	C	-	-	C		1	P,S,DT							1	1	1	1	1	1		1	1	1	1	1	1	1	1
<i>Limnodynastes salmini</i>	Salmon Sided Frog	C	-	SigSBB	R	1		HS						1															
<i>Limnodynastes tasmaniensis</i>	Spotted Grassfrog	C	-	-	R	1	1	HS				1		1				1		1				1	1		1	1	1
<i>Litoria caerulea</i>	Common Green Tree Frog	C	-	-	C	1	1	HS						1	1	1		1	1	1		1	1	1	1	1	1	1	1
<i>Litoria fallax</i>	Eastern Dwarf Frog	C	-	-	R		1											1		1				1	1			1	
<i>Litoria latopalmata</i>	Broad Palmed Rocket Frog	C	-	-	U	1	1	HS, S				1		1				1		1		1	1	1	1		1	1	1
<i>Litoria peronii</i>	Peron's Tree Frog	C	-	-	U		1									1		1	1	1		1		1	1	1	1	1	1
<i>Litoria rubella</i>	Desert Tree Frog	C	-	-	C	1	1	HS						1	1	1	1	1	1	1		1	1	1	1	1	1	1	1
<i>Uperoleia rugosa</i>	Dusky Toadlet	C	-	-		1	1	HS						1			1	1		1		1	1	1		1	1	1	1
		Site Totals							0	0	0	2	0	7	3	5	4	9	5	9		7	6	7	8	8	6	8	9
<i>Amphibolurus burnsi</i>	Burn's Dragon	C	-	-	R	1		HS						1									1	1					
<i>Anomalopus leuckartii</i>	A legless skink	C	-	-	R		1									1							1						
<i>Antaresia maculosa</i>	Spotted Python	C	-	-	U	1	1	HS			1							1	1								1		
<i>Boiga irregularis</i>	Brown Tree Snake	C	-	-	R		1												1		1				1				
<i>Carlia foliorum</i>	Rainbow Skink	C	-	-	C	1	1	HS, O, P, FT	1	1	1		1	1		1		1	1	1		1		1	1	1			
<i>Carlia pectoralis pectoralis</i>	Rainbow Skink	C	-	-	U	1	1	HS, O, P	1		1		1	1			1		1		1		1		1	1			
<i>Carlia vivax</i>	Lined Rainbow Skink	C	-	-	R		1												1		1			1					
<i>Chelodina longicollis</i>	Eastern Snake-necked Turtle	C	-	-	R	1		Re						1													1	1	
<i>Cryptoblepharus carnabyi</i>	Tree Skink	C	-	-	R	1		HS						1										1					
<i>Cryptoblepharus virgatus</i>	Wall Skink	C	-	-	A	1	1	HS	1	1	1	1	1	1		1	1	1	1	1		1	1	1	1	1			
<i>Cryptophis nigrescens</i>	Eastern Small-eyed Snake	C	-	-	R	1	1	HS					1			1							1		1				
<i>Ctenotus robusta</i>	Eastern Striped Skink	C	-	-	R	1	1	HS						1						1			1		1		1		
<i>Ctenotus taeniolatus</i>	Fire-tail Skink	C	-	-	R	1		HS																1					

Scientific name	Common name	Conservation status			Abun	Winter survey	Summer survey	Winter 2008 survey							Summer 2009 survey					Supp	Habitat type associations									
		NCR	EPBC	RSF				Detection method	Standard sites					Supp	Standard sites						DSF	BuW	IW	PB	R	AS	C	W		
									1	2	3	4	5		1	2	3	4	5											
<i>Diplodactylus steindachneri</i>	Box-patterned Gecko	C	-	-	U		1							1		1			1	1		1			1					
<i>Diplodactylus vittatus</i>	Wood Gecko	C	-	-	R		1									1		1		1										
<i>Egernia striolata</i>	Tree Skink	C	-	-	R		1											1	1			1								
<i>Furina diadema</i>	Red-naped Snake	C	-	-	R		1												1				1							
<i>Gehyra dubia</i>	Tree Dtella	C	-	-	A	1	1	HA			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					
<i>Heteronotia binoei</i>	Bynoe's Gecko	C	-	-	A	1	1	HS, P, FT	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1					
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	C	-	SigSBB	R		1												1				1	1						
<i>Lerista fragilis</i>	Sand Sliding Skink	C	-	-	A	1	1	HS	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					
<i>Lerista punctatovittata</i>	Sand Sliding Skink	C	-	-	R		1								1				1					1						
<i>Mentia greyii</i>	Greys Skink	C	-	-	R		1												1					1						
<i>Morelia spilota</i>	Carpet Python	C	-	-	R		1																	1						
<i>Morethia boulengeri</i>	A skink	C	-	-	C	1	1	HS, P		1	1		1	1	1	1	1	1	1	1	1	1	1	1	1					
<i>Oedura robusta</i>	Robust Velvet Gecko	C	-	-	R		1												1				1							
<i>Paradelma orientalis</i>	Brigalow Scaly-foot	V	V	SigSBB	R	1	1	HS	1							1			1	1			1							
<i>Pogona barbata</i>	Bearded Dragon	C	-	-	C	1	1	HS, O			1			1		1	1		1	1	1	1	1	1	1					
<i>Pygopus schraderi</i>	Eastern Hooded Scaly-foot	C	-	-	R		1										1			1										
<i>Strophurus taenicauda</i>	Golden-tailed Gecko	R	-	SigSBB	U	1		HS			1			1						1	1	1								
<i>Underwoodisaurus milii</i>	Barking Gecko	C	-	-	R		1									1							1							
<i>Varanus panoptes</i>	Yellow-spotted Monitor	C	-	-	R		1												1	1		1								
<i>Varanus tristis</i>	Freckled Monitor	C	-	-	R	1		HS						1										1						
		Site Totals			6							5	10	3	8	14	6	10	11	3	10	21	16	8	19	12	13	13	6	1
<i>Isodon or Perameles</i>	Bandicoot (Probably Long-nosed)	C	-	SigSBB	R	1	1	Tk						1			1		1	1			1							
<i>Macropus dorsalis</i>	Black-striped Wallaby	C	-	SigSBB	R	1		O, S			1			1													1			
<i>Lepus capensis</i>	Brown Hare	I	-	-	U	1	1	O, S			1			1				1	1	1		1		1		1				
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	C	-	SigSBB	A	1	1	S, Sc	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				

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		NCR	EPBC	RSF				Detection method	Standard sites					Supp	Standard sites						DSF	BuW	IW	PB	R	AS	C	W
									1	2	3	4	5		1	2	3	4	5									
<i>Sminthopsis murina</i>	Common Dunnart	C	-	-	R	1		T	1																			
<i>Canis lupus dingo</i>	Dingo/Wild Dog	I	-	-	U	1	1	Sc											1	1	1				1	1		
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bent-wing Bat	C	-	SigSBB	R	1		A																				
<i>Macropus giganteus</i>	Eastern Grey Kangaroo	C	-	-	C	1	1	O, Re			1	1		1	1			1	1	1	1		1		1	1	1	
<i>Mormopterus</i> species 2/3	Eastern/Inland Free-tail Bat	C	-	-	R	1	1	A	1	1		1		1							1	1		1	1		1	
<i>Felis catus</i>	Feral Cat	I	-	-	R	1	1	Tk						1				1		1			1		1			
<i>Sus scrofa</i>	Feral Pig	I	-	-	U	1	1	Tk, O, D						1					1				1	1		1	1	
<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat	C	-	-	U	1	1	H				1			1	1						1	1	1	1	1		
<i>Chalinolobus gouldii</i>	Goulds Wattled Bat	C	-	-	U	1	1	A		1		1		1	1					1	1	1	1	1				
<i>Petauroides volans</i>	Greater Glider	C	-	SigSBB	R	1	1	S, Sc		1		1		1			1	1		1	1	1	1	1				
<i>Mus musculus</i>	House Mouse	I	-	-	C	1	1	T, O, HS	1	1	1			1	1	1			1	1	1	1	1	1	1	1	1	
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	C	-	-	U	1	1	H					1	1	1	1				1	1	1	1	1		1		
<i>Scotorepens greyii</i>	Little Broad-nosed Bat	C	-	-	C	1	1	A				1		1	1	1				1	1	1	1	1		1		
<i>Vespadelus vulturnus</i>	Little Forest Bat	C	-	NRL	R	1	1	A, H				1		1		1				1			1	1	1		1	
<i>Chalinolobus picatus</i>	Little Pied Bat	R	-	SigSBB	U	1	1	A, H				1	1	1	1							1	1	1	1	1	1	
<i>Oryctolagus cuniculus</i>	Rabbit	I	-	-	U	1	1	Sc, O, S				1	1		1	1			1	1	1	1	1	1		1		
<i>Vulpes vulpes</i>	Red Fox	I	-	-	U	1	1	Sc		1				1					1	1	1	1		1		1		
<i>Macropus rufogriseus</i>	Red-necked Wallaby	C	-	-	U	1	1	O			1		1	1		1	1	1	1	1	1	1	1	1	1	1	1	
<i>Aepyprymnus rufescens</i>	Rufous Bettong	C	-	SigSBB	R	1		O													1			1		1		
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna	C	-	-	A	1	1	HS, Sc, O, Re	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
<i>Petaurus norfolcensis</i>	Squirrel Glider	C	-	SigSBB	R		1												1					1				
<i>Wallabia bicolor</i>	Swamp Wallaby	C	-	-	U	1	1	O, Re, S			1	1	1	1	1				1	1	1	1	1	1	1	1	1	
<i>Tadarida australis</i>	White-striped Freetail Bat	C	-	-	R	1	1	W			1							1	1	1	1				1			
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail Bat	c	-	-	C		1								1	1	1	1	1	1	1	1	1	1	1	1	1	
		Site Totals							5	7	10	12	6	19	13	9	6	9	9	21	20	13	19	19	19	13	15	5

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									1	2	3	4	5		1	2	3	4										5
<i>Struthidea cinerea</i>	Apostlebird	C	-	-	A	1	1	O		1	1			1	1		1		1	1	1	1	1		1			
<i>Ardeotis australis</i>	Australian Bustard	C	-	-	R	1	1	O						1											1			
<i>Falco longipennis</i>	Australian Hobby	C	-	-	R	1		O		1				1											1			
<i>Alisterus scapularis</i>	Australian King Parrot	C	-	-	R	1	1	O				1		1		1				1	1		1	1		1		
<i>Gymnorhina tibicen</i>	Australian Magpie	C	-	-	C	1	1	O			1	1	1	1	1	1		1	1	1			1	1	1	1		
<i>Aegotheles cristatus</i>	Australian Owlet Nightjar	C	-	-	R	1	1	W			1				1	1	1	1		1		1	1	1				
<i>Pelecanus conspicillatus</i>	Australian Pelican	C	-	-	R	1		O																		1		
<i>Corvus coronoides</i>	Australian Raven	C	-	-	R	1		W	1					1								1			1			
<i>Threskiornis spinicollis</i>	Australian White Ibis	C	-	-	R	1		O						1										1	1	1		
<i>Chenonetta jubata</i>	Australian Wood Duck	C	-	-	R	1	1	O											1							1		
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe		-	-	R			O																		1		
<i>Tyto alba</i>	Barn Owl	C	-	-	U	1	1	Re									1		1	1	1			1				
<i>Geopelia humeralis</i>	Bar-shouldered Dove		-	-	R			O,W								1		1	1					1				
<i>Milvus migrans</i>	Black Kite	C	-	-	R	1		O											1						1			
<i>Elanus axillaris</i>	Black Shouldered Kite	C	-	-	R	1	1	O											1						1			
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo Shrike	C	-	-	C	1	1	O			1	1		1	1	1	1	1	1	1	1	1	1	1	1	1		
<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater	C	-	-	C	1	1	O			1	1		1		1		1		1		1	1		1			
<i>Grus rubicundus</i>	Brolga	C	-	-	R	1	1	O											1						1			
<i>Falco berigora</i>	Brown Falcon	C	-	-	R	1	1	O			1		1	1					1					1	1			
<i>Accipiter fasciatus</i>	Brown Goshawk	C	-	-	R	1		O		1										1	1	1						
<i>Lichmera indistincta</i>	Brown Honeyeater	C	-	-	C	1	1	O		1	1	1	1	1	1					1	1	1	1	1				
<i>Coturnix ypsilophora</i>	Brown Quail	C	-	-	C	1	1	O							1		1	1	1			1	1	1	1			
<i>Cincloramphus cruralis</i>	Brown Songlark	C	-	-	R	1		O											1						1			
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater	C	-	-	R	1	1	O		1				1					1		1	1	1					
<i>Acanthiza reguloides</i>	Buff-rumped Thornbill	C	-	-	R	1		O		1				1							1	1						

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									1	2	3	4	5		1	2	3	4										5
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill	C	-	-	C	1	1	O		1	1	1	1	1			1			1	1	1			1			
<i>Nymphicus hollandicus</i>	Cockatiel	C	-	-	U	1	1	O						1				1	1	1					1			
<i>Phaps chalcoptera</i>	Common Bronzewing	C	-	-	R	1	1	O						1		1				1	1	1						
<i>Sturnus vulgaris</i>	Common Starling	I	-	-	R	1	1	O												1					1			
<i>Ocyphaps lophotes</i>	Crested Pigeon	C	-	-	A	1	1	O			1	1		1				1	1	1			1	1	1	1		
<i>Eurystomus orientalis</i>	Dollarbird		-	-	C			O,W							1	1	1	1	1	1	1	1	1	1	1	1		
<i>Taeniopygia bichenovii</i>	Double Barred Finch	C	-	-	C	1	1	O			1	1		1				1		1	1	1	1	1	1			
<i>Artamus</i>	Dusky Woodswallow	C	-	-	R	1		O						1									1	1				
<i>Eopsaltria australis</i>	Eastern Yellow Robin	C	-	-	R	1	1	O		1							1			1	1							
<i>Dromaius novaehollandiae</i>	Emu	C	-	-	R	1		O																	1			
<i>Cacatua roseicapilla</i>	Galah	C	-	-	C	1	1	O			1		1	1	1	1	1	1	1	1			1	1	1			
<i>Pachycephala pectoralis</i>	Golden Whistler	C	-	-	R	1		O		1				1							1	1	1		1			
<i>Ardea modesta</i>	Great Egret	C	M	-	R	1		O															1			1		
<i>Cracticus torquatus</i>	Grey Butcherbird	C	-	-	U	1	1	O	1	1				1	1	1	1	1	1	1	1	1						
<i>Rhipidura fuliginosa</i>	Grey Fantail	C	-	-	A	1	1	O	1	1		1	1	1						1	1	1	1	1	1			
<i>Colluricincla harmonica</i>	Grey Shrike Thrush	C	-	-	U	1	1	O	1	1		1	1	1	1	1	1			1	1	1	1	1	1			
<i>Anas gracilis</i>	Grey Teal	C	-	-	R	1	1	O												1						1		
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler	C	-	SigSBB	U	1	1	O							1	1	1			1	1	1	1					
<i>Aythya australis</i>	Hardhead	C	-	-	R	1		O																		1		
<i>Passer domesticus</i>	House Sparrow	I	-	-	R	1		O																	1			
<i>Acanthiza apicalis</i>	Inland Thornbill	C	-	-	R	1		O		1											1	1						
<i>Microeca flavigaster</i>	Jacky Winter	C	-	-	U	1		O				1		1								1	1		1			
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	C	-	-	U	1	1	O	1			1	1	1	1	1	1	1	1		1		1	1	1			
<i>Myiagra rubecula</i>	Leaden Flycatcher		-	-	R			O														1		1				
<i>Cacatua sanguinea</i>	Little Corella	C	-	-	R	1	1	O											1				1					

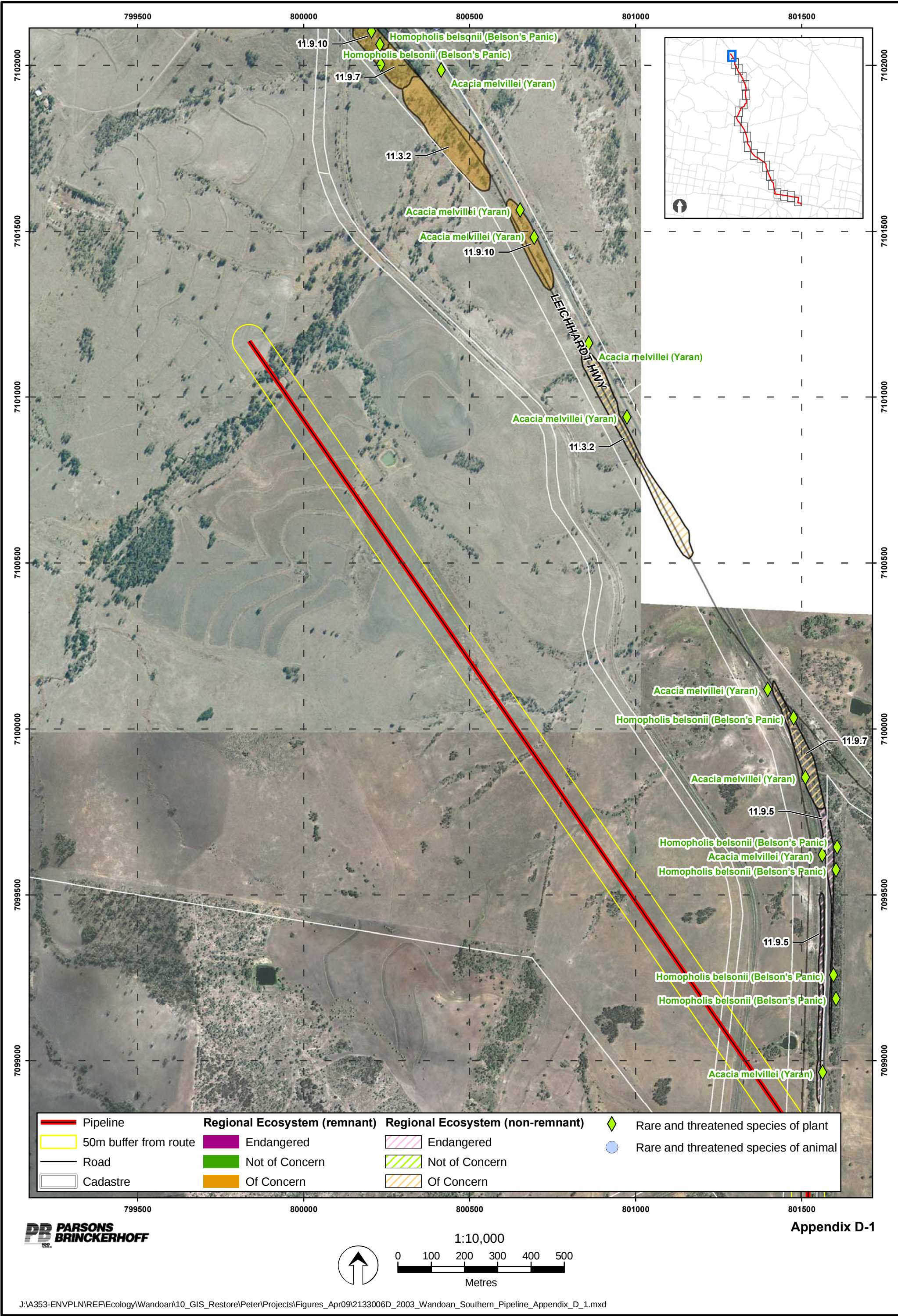
Scientific name	Common name	Conservation status			Abun	Winter survey	Summer survey	Winter 2008 survey						Summer 2009 survey					Supp	Habitat type associations								
		NCR	EPBC	RSF				Detection method	Standard sites					Supp	Standard sites					DSF	BuW	IW	PB	R	AS	C	W	
									1	2	3	4	5		1	2	3	4										5
<i>Philemon citreogularis</i>	Little Friarbird	C	-	-	A	1	1	O	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
<i>Glossopsitta pusilla</i>	Little Lorikeet	C	-	-	C	1	1	O	1			1		1		1	1	1		1	1		1	1				
<i>Grallina cyanoleuca</i>	Magpielark	C	-	-	C	1	1	O				1	1		1				1	1	1				1	1		
<i>Vanellus miles miles</i>	Masked Lapwing	C	-	-	U	1	1	O											1		1				1	1		
<i>Dicaeum hirundinaceum</i>	Mistletoebird	C	-	-	A	1	1	O, W	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
<i>Falco cenchroides</i>	Nankeen Kestrel	C	-	-	U	1	1	O					1	1						1					1			
<i>Philemon corniculatus</i>	Noisy Friarbird	C	-	-	R	1	1	O		1	1				1					1	1	1		1				
<i>Manorina melanocephala</i>	Noisy Miner	C	-	-	C	1	1	O	1	1		1	1	1						1	1	1	1	1	1	1		
<i>Oriolus sagittatus</i>	Olive-backed Oriole		-	-	U			O,W							1	1	1		1	1			1					
<i>Anas superciliosa</i>	Pacific Black Duck	C	-	-	R	1	1	O												1						1		
<i>Platycercus adscitus paliceps</i>	Pale-headed Rosella	C	-	-	A	1	1	O		1	1	1	1	1	1	1		1	1	1	1	1	1	1				
<i>Geopelia striata</i>	Peaceful Dove	C	-	-	U	1	1	O				1		1				1	1	1	1	1	1	1				
<i>Centropus phasianinus</i>	Pheasant Coucal	C	-	-	U	1	1	O			1							1					1		1			
<i>Cracticus nigrogularis</i>	Pied Butcherbird	C	-	-	A	1	1	O		1	1	1	1	1	1	1			1	1	1	1	1	1	1	1		
<i>Strepera graculina graculina</i>	Pied Currawong	C	-	-	U	1	1	O				1	1	1		1				1	1			1	1	1		
<i>Dendrocygna eytoni</i>	Plumed Whistling Duck	C	-	-	R			O,W												1								
<i>Merops ornatus</i>	Rainbow Bee-eater	C	M	-	U			O							1	1	1	1	1	1	1	1	1	1	1	1		
<i>Trichoglossus haematodus haematodus</i>	Rainbow Lorikeet	C	-	-	U	1	1	O							1		1	1		1	1		1	1	1	1		
<i>Psephotus haematonotus</i>	Red Rumped Parrot	C	-	-	U	1	1	O											1	1				1		1		
<i>Aprosmictus erythropterus</i>	Red Winged Parrot	C	-	-	A	1	1	O	1		1	1	1	1		1		1	1	1	1	1	1		1			
<i>Malurus leucopterus</i>	Red-backed Wren	C	-	-	R	1	1	O						1				1		1			1		1			
<i>Petroica goodenovii</i>	Red-capped Robin	C	-	-	R	1	1	O					1							1				1				
<i>Myiagra inquieta</i>	Restless Flycatcher	C	-	-	R	1	1	O						1						1				1				
<i>Anthus novaeseelandiae</i>	Richards Pipit	C	-	-	C	1	1	O												1					1			
<i>Columba livia</i>	Rock Dove	I	-	-	R	1	1	O												1				1				

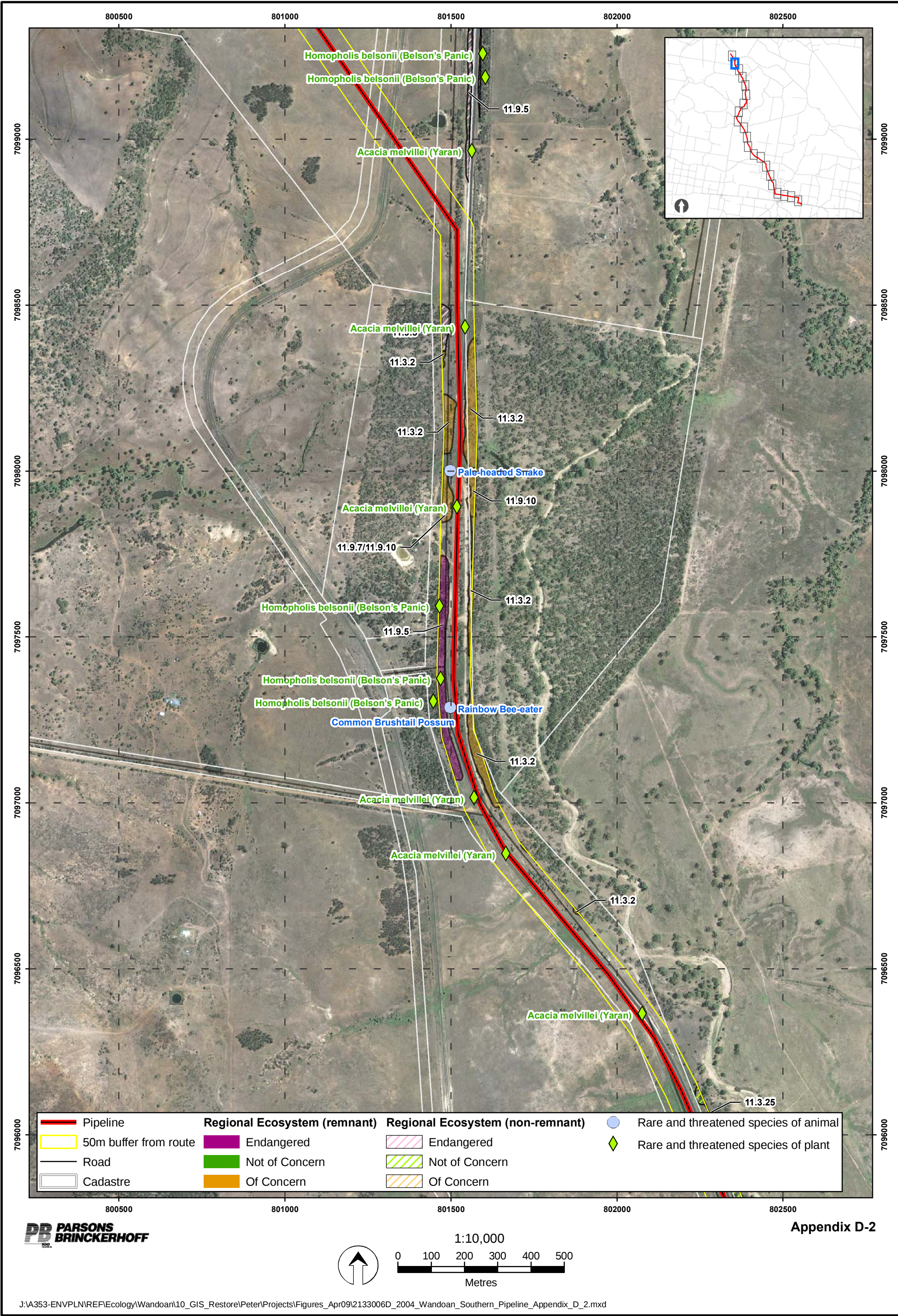
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									1	2	3	4	5		1	2	3	4										5	
<i>Platalea regia</i>	Royal Spoonbill	C	-	-	R	1		O																					1
<i>Cincloramphus mathewsi</i>	Rufous Songlark	C	-	-	R	1	1	O												1								1	
<i>Pachycephala rufiventris</i>	Rufous Whistler	C	-	-	U	1	1	O	1	1	1	1	1	1	1	1		1		1	1	1	1	1	1				
<i>Todiramphus sanctus</i>	Sacred Kingfisher	C	-	-	R			O							1					1	1		1		1				
<i>Trichoglossus chlorolepidotus</i>	Scaly-breasted Lorikeet	C	-	-	A	1	1	O	1	1	1	1	1	1				1		1	1	1	1	1	1				
<i>Myzomela sanguinolenta</i>	Scarlet Honeyeater	C	-	-	C	1	1	O	1			1		1	1					1	1		1	1	1	1			
<i>Chrysococcyx lucidus</i>	Shining Bronze Cuckoo	C	-	-	R	1		O					1													1			
<i>Mirafra javanica</i>	Singing Bushlark	C	-	-	R			O												1							1		
<i>Lichenostomus virescens</i>	Singing Honeyeater	C	-	-	R	1		O				1																	
<i>Ninox novaeseelandiae</i>	Southern Boobook	C	-	-	U	1	1	O	1	1	1		1		1	1	1	1	1	1	1	1	1	1	1				
<i>Dicrurus bracteatus</i>	Spangled Drongo	C	-	-	U	1	1	O						1	1	1	1	1	1	1	1	1	1	1	1				
<i>Chthonicola sagittata</i>	Speckled Warbler	C	-	SigSBB	R	1		O						1										1					
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	C	-	-	C	1	1	O		1	1				1		1		1	1	1	1	1	1					
<i>Chlamydera maculata</i>	Spotted Bowerbird	C	-	-	U	1	1	O											1	1									
<i>Circus assimilis</i>	Spotted Harrier	C	-	-	R	1		O																			1		
<i>Streptopelia chinensis</i>	Spotted Turtle Dove	I	-	-	R	1	1	O												1					1		1		
<i>Threskiornis spinicollis</i>	Straw-necked Ibis	C	-	-	R	1		O																					
<i>Pardalotus striatus</i>	Striated Pardalote	C	-	-	A	1	1	O, W	1		1	1	1	1	1	1		1	1	1	1	1	1	1	1				
<i>Plectorhyncha lanceolata</i>	Striped Honeyeater	C	-	-	A	1	1	O	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1				
<i>Coturnix pectoralis</i>	Stubble Quail	C	-	-	R	1		O					1												1	1			
<i>Cacatua galerita</i>	Sulphur Crested Cockatoo	C	-	-	C	1	1	O				1	1			1		1		1				1	1	1	1		
<i>Malurus cyaneus</i>	Superb Fairywren	C	-	-	U	1	1	O	1		1		1	1				1	1	1	1	1	1	1	1	1	1		
<i>Podargus strigoides</i>	Tawny Frogmouth	C	-	-	C	1	1	O, W	1		1				1	1	1	1	1	1	1	1	1	1	1	1			
<i>Corvus orru</i>	Torresian Crow	C	-	-	A	1	1	O, W	1	1	1	1	1	1	1					1	1	1	1	1	1	1	1	1	
<i>Daphoenositta chrysoptera</i>	Varied Sittella	C	-	-	U	1	1	O	1	1		1				1	1	1		1	1	1	1	1	1				

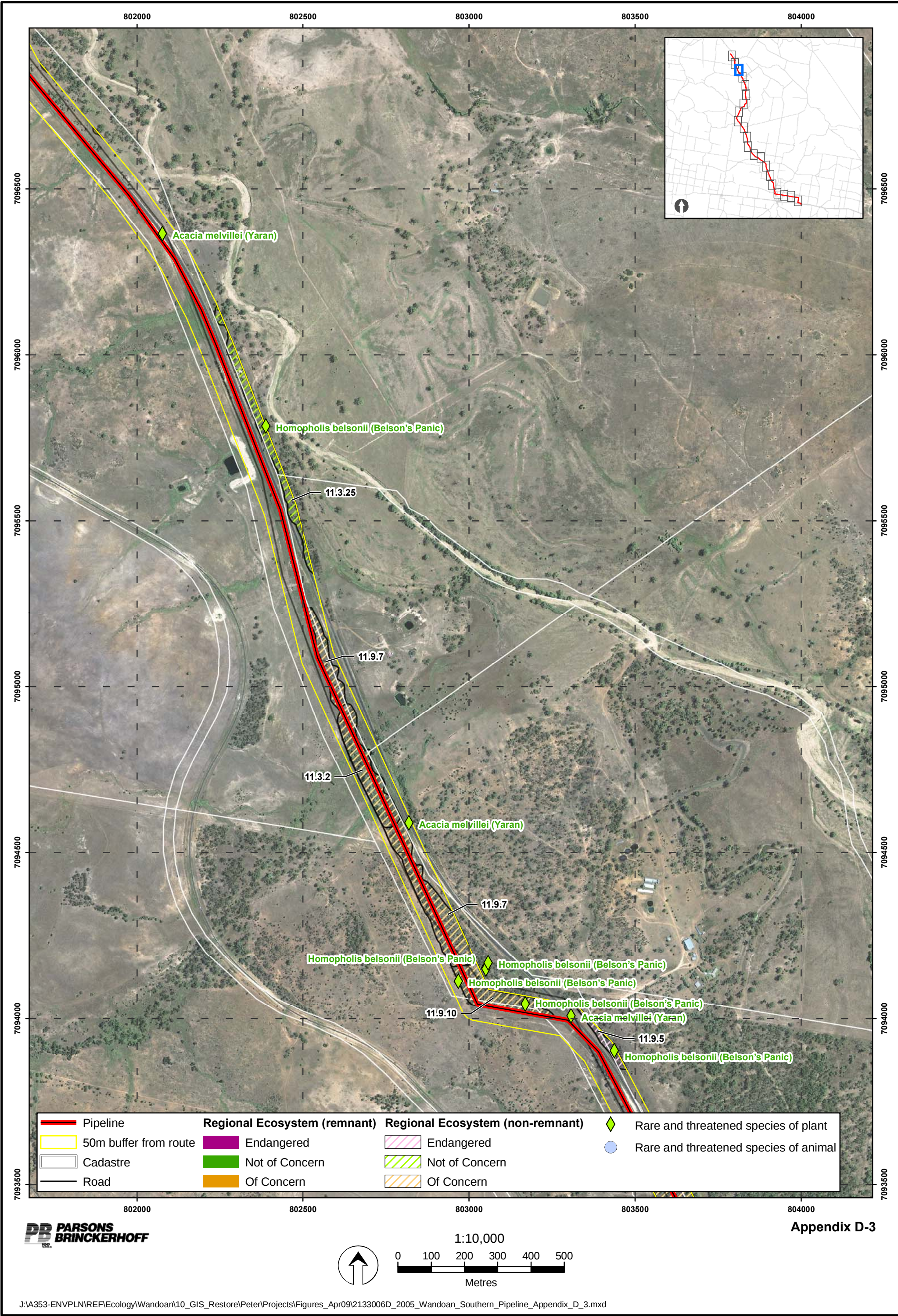
Scientific name	Common name	Conservation status			Abun	Winter survey	Summer survey	Winter 2008 survey							Summer 2009 survey					Supp	Habitat type associations							
		NCR	EPBC	RSF				Detection method	Standard sites					Supp	Standard sites						DSF	BuW	IW	PB	R	AS	C	W
									1	2	3	4	5		1	2	3	4	5									
<i>Malurus lamberti</i>	Variegated Fairy Wren	C	-	-	R	1		O						1														1
<i>Aquila audax</i>	Wedge-tailed Eagle	C	-	-	A	1	1	O		1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	
<i>Smicromis brevirostris</i>	Weebill	C	-	-	A	1	1	O, W	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
<i>Hirundo neoxena</i>	Welcome Swallow	C	-	-	U	1	1	O						1						1				1	1		1	1
<i>Haliastur sphenurus</i>	Whistling Kite	C	-	-	R	1		O																			1	
<i>Coracina papuensis</i>	White-bellied Cuckoo Shrike	C	-	-	R	1	1	W								1				1				1				
<i>Artamus leucorhynchus</i>	White-breasted Woodswallow	C	-	-	R			o												1			1					
<i>Lichenostomus leucotis</i>	White-eared Honeyeater	C	-	-	C	1	1	O, W					1	1	1	1	1	1		1	1	1			1			
<i>Egretta novaehollandiae</i>	White-faced Heron	C	-	-	U	1	1	O						1						1				1	1		1	1
<i>Ardea pacifica</i>	White-necked Heron	C	-	-	R	1		O																				1
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater	C	-	-	R	1		O																1				
<i>Gerygone olivacea</i>	White-throated Gerygone	C	-	-	C	1	1	O								1				1			1	1	1			
<i>Eurostopodus mystacalis</i>	White-throated Nightjar	C	-	-	R			w												1			1					
<i>Corcorax melanorhamphos</i>	White-winged Chough	C	-	-	R	1	1	O		1				1				1				1	1	1		1		
<i>Rhipidura leucophrys</i>	Willie Wagtail	C	-	-	C	1	1	O		1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1
<i>Acanthiza nana</i>	Yellow Thornbill	C	-	-	R	1	1	O						1									1					
<i>Manorina melanotis</i>	Yellow- throated Miner	C	-	-	A	1	1	O										1	1	1		1	1	1	1	1		
<i>Platalea flavipes</i>	Yellow-billed Spoonbill	C	-	-	R	1		O																				1
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater	C	-	-	U	1	1	O, W	1	1	1	1	1	1	1	1	1	1				1	1	1	1	1		
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	C	-	-	A	1	1	O		1	1			1	1			1	1	1					1	1	1	
Total															34	35	29	41	34	84	59	40	68	55	66	44	57	19

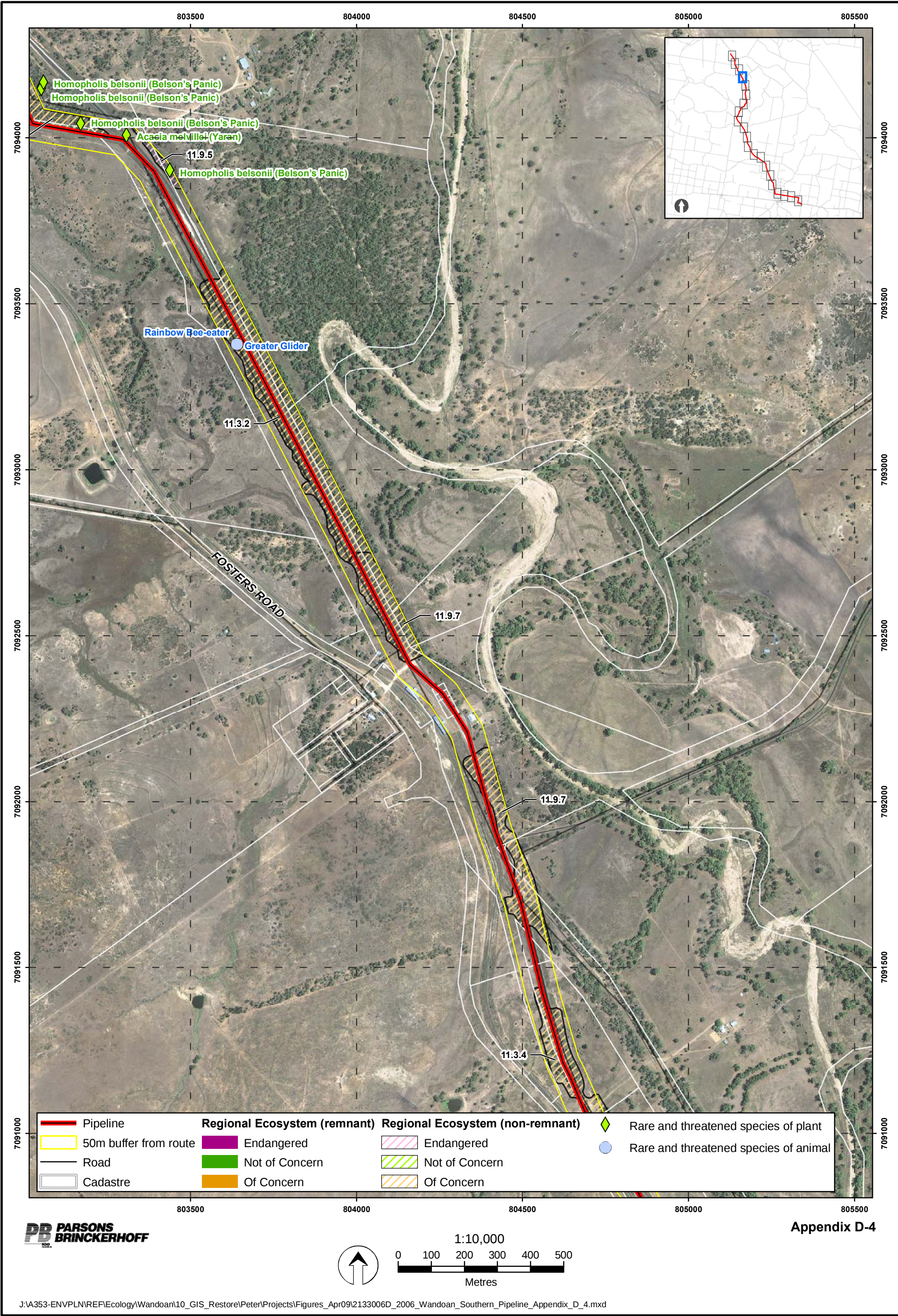
Attachment D

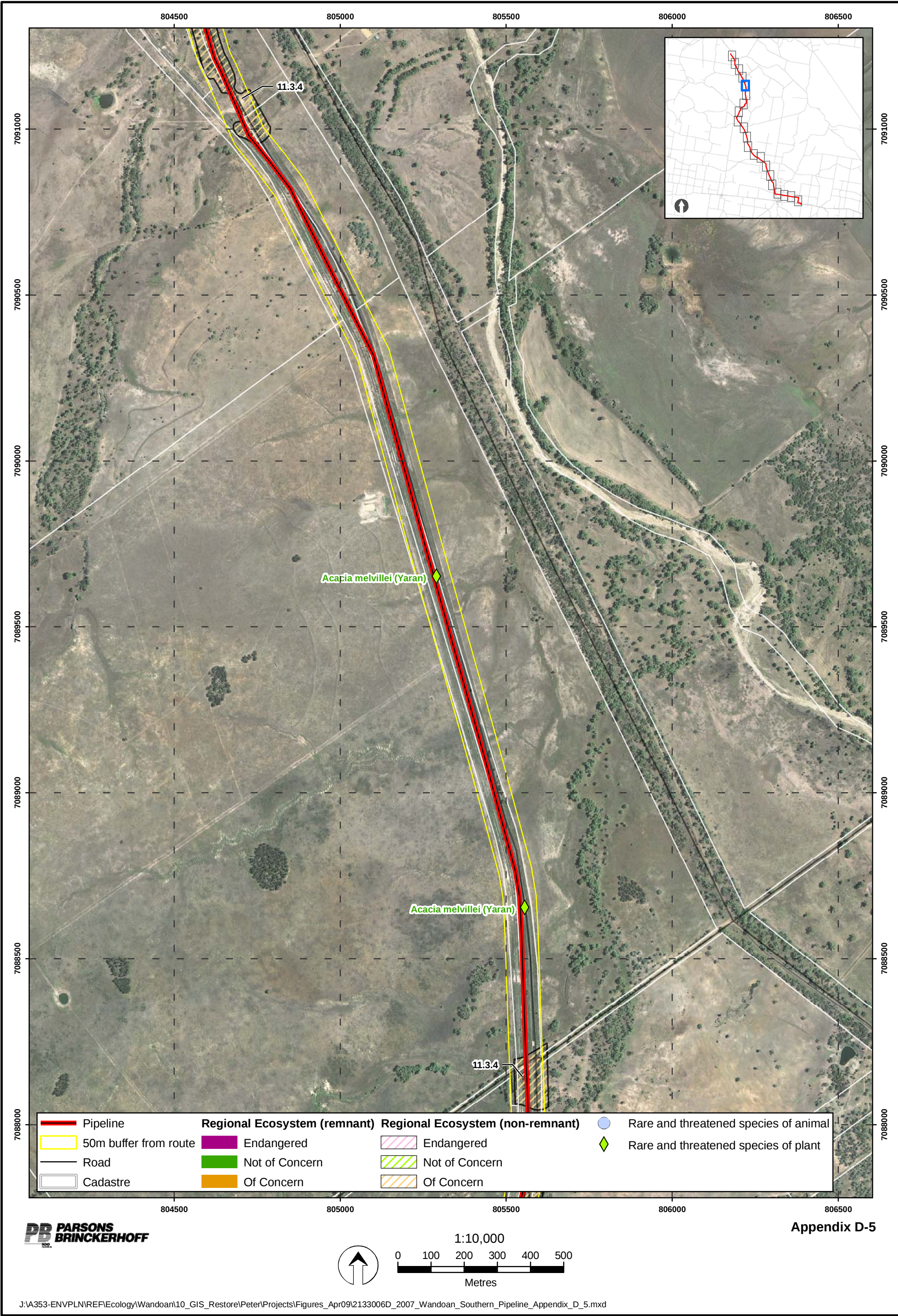
RE mapping and rare and
threatened species

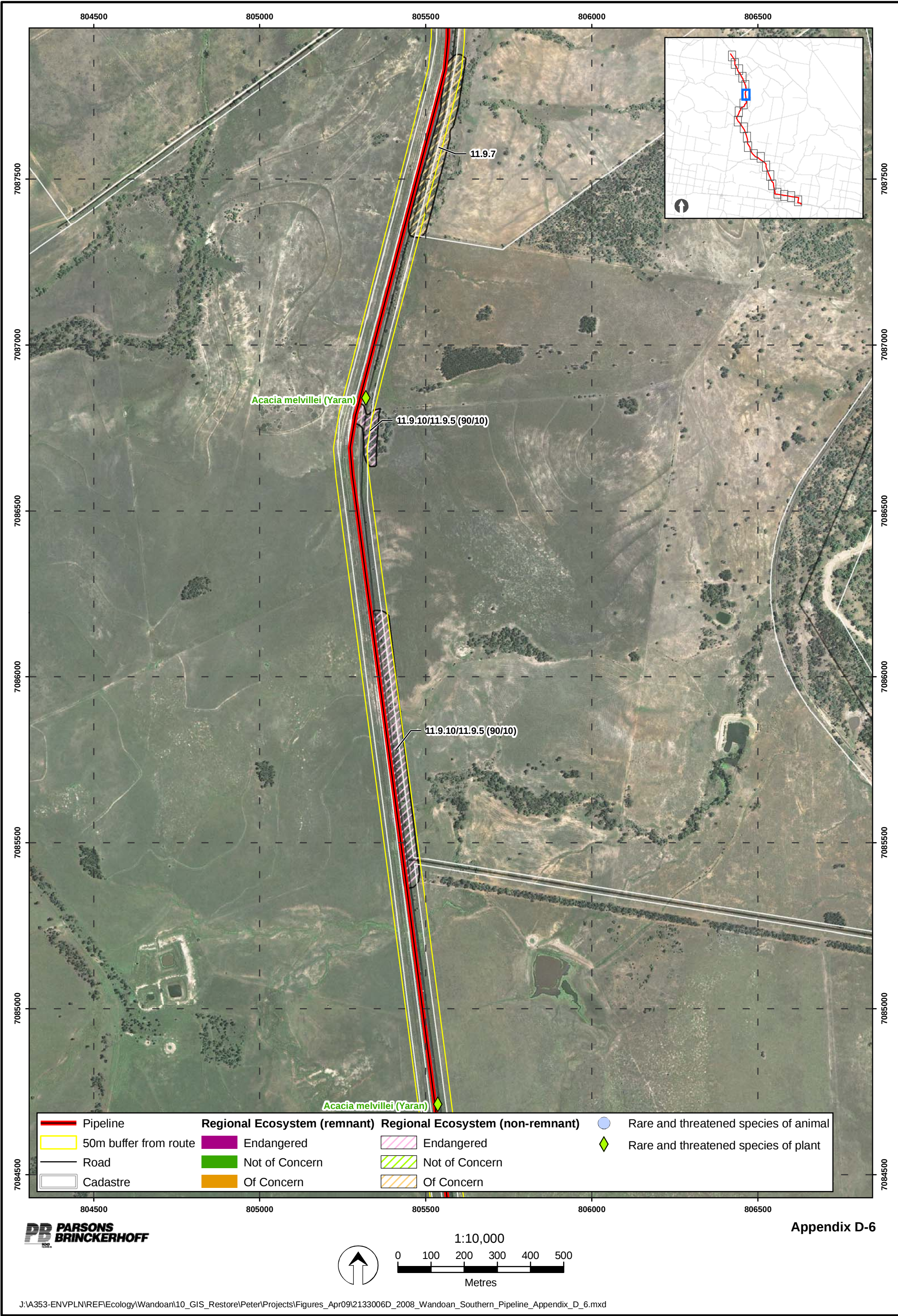


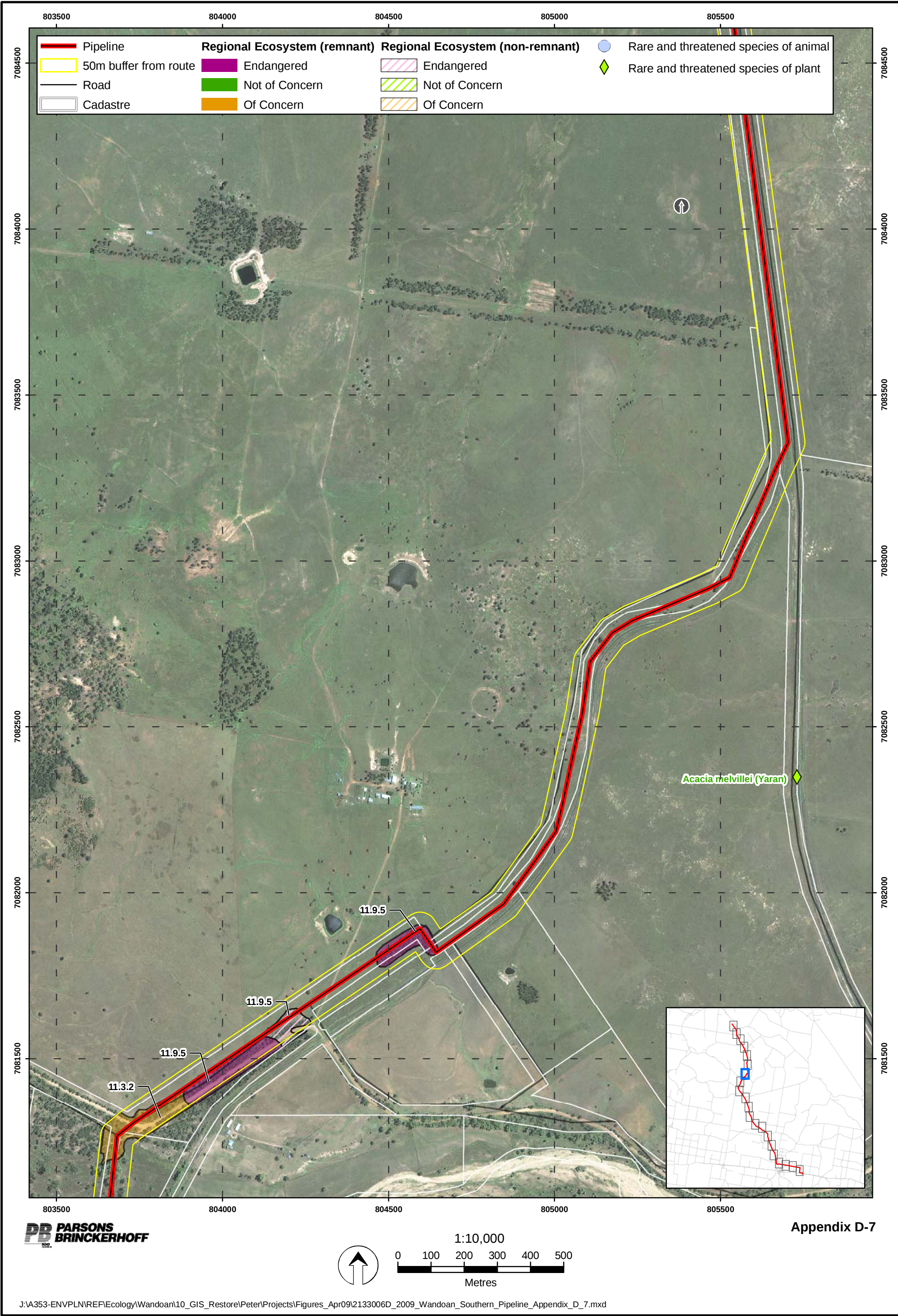


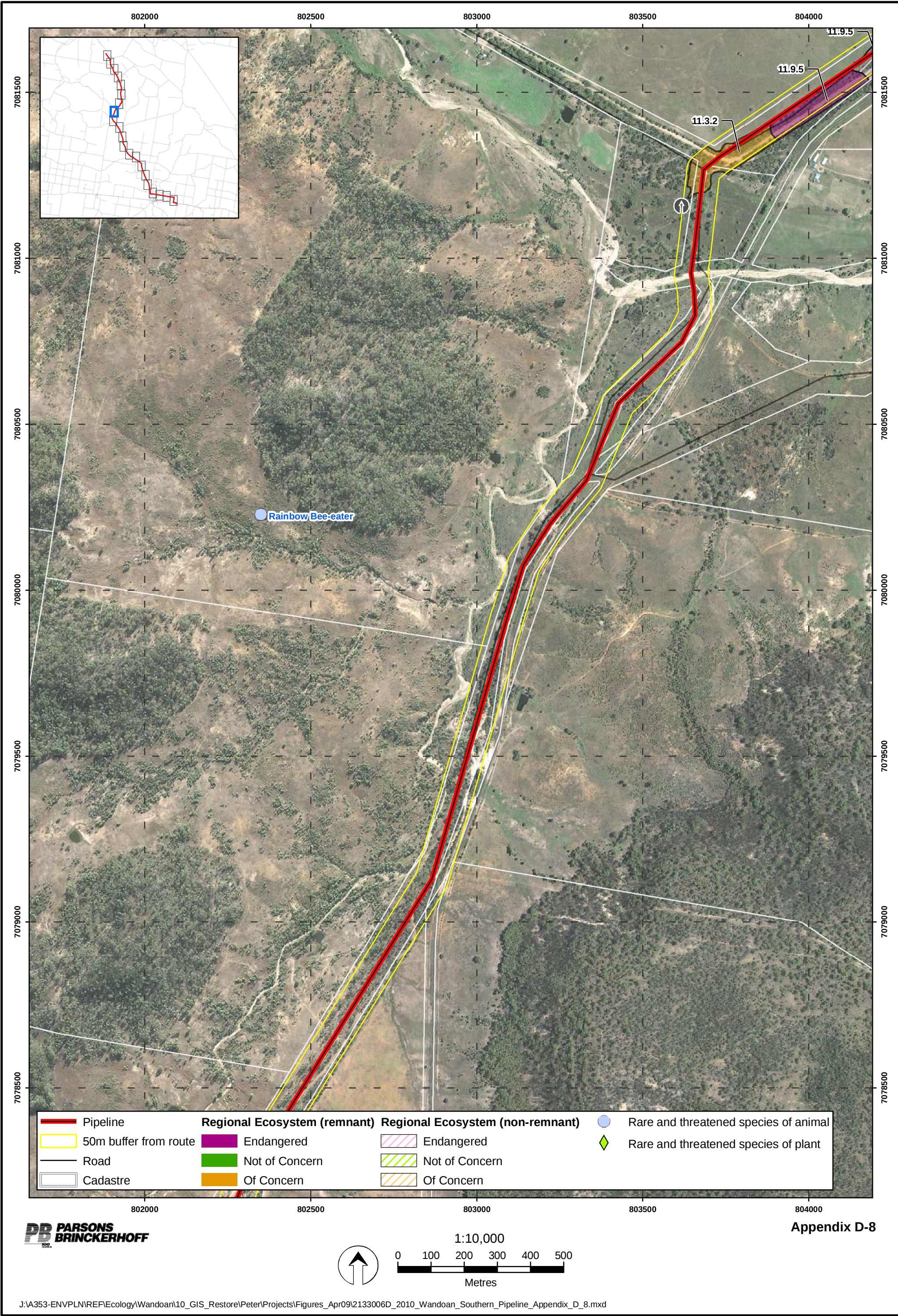


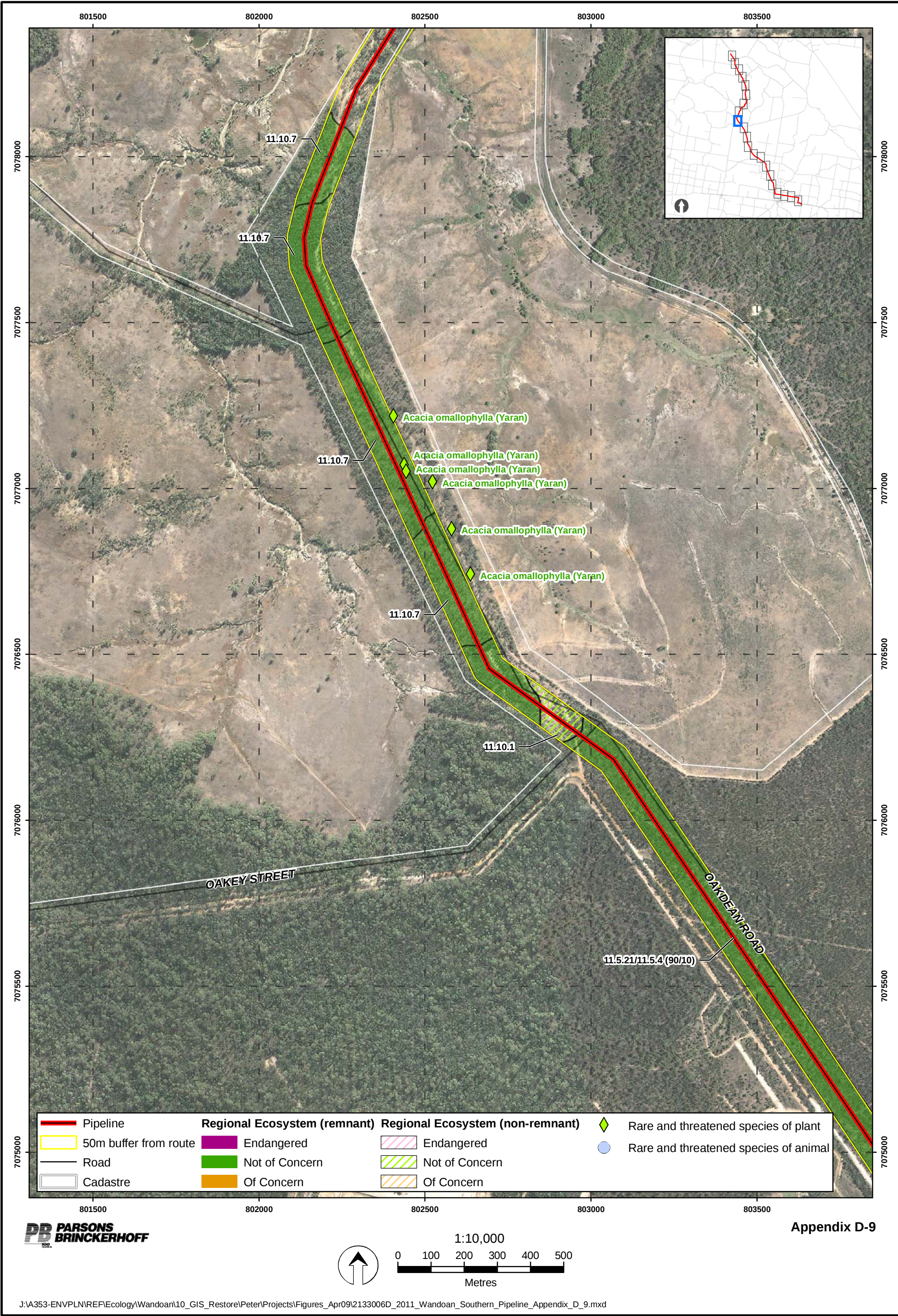


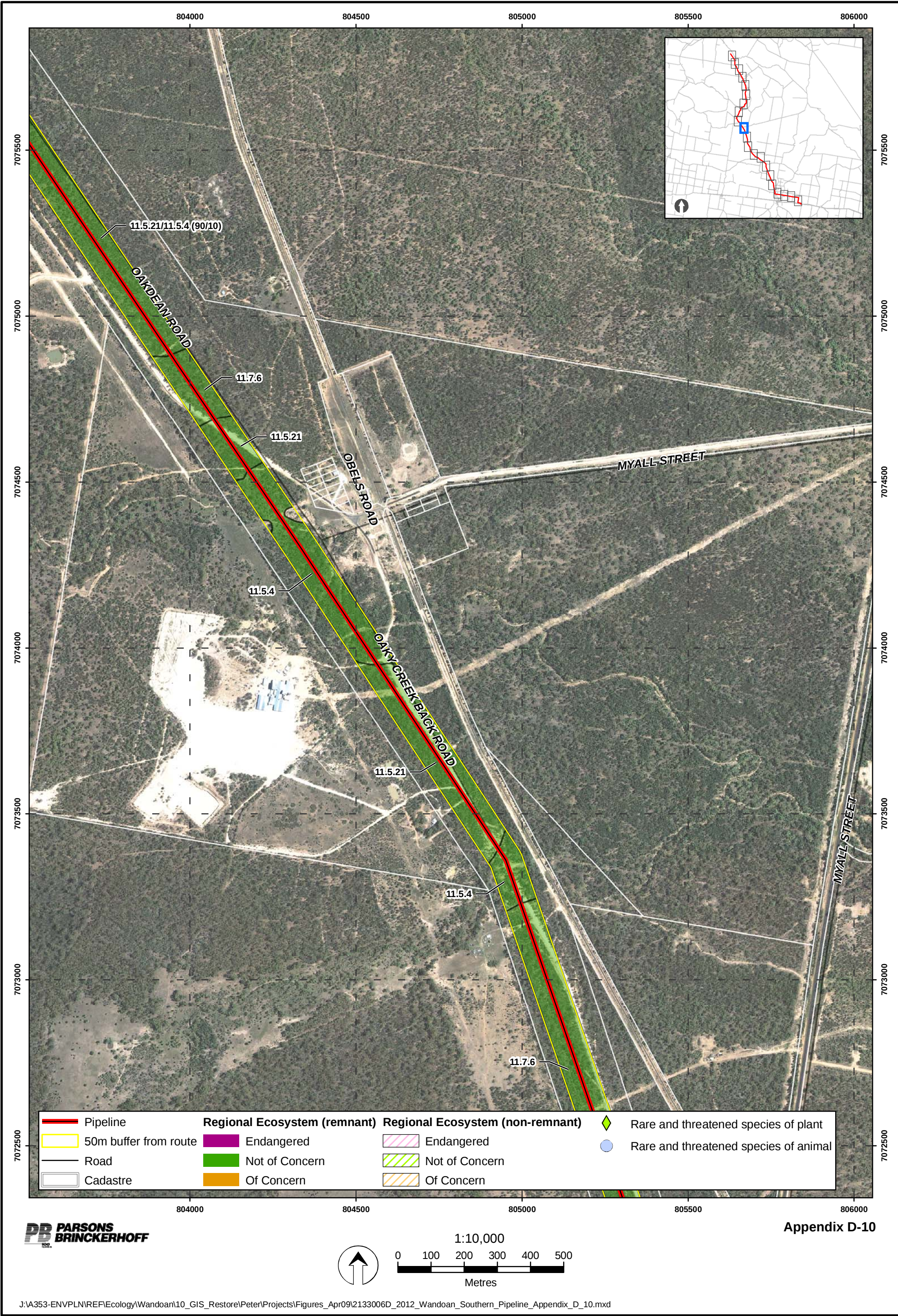


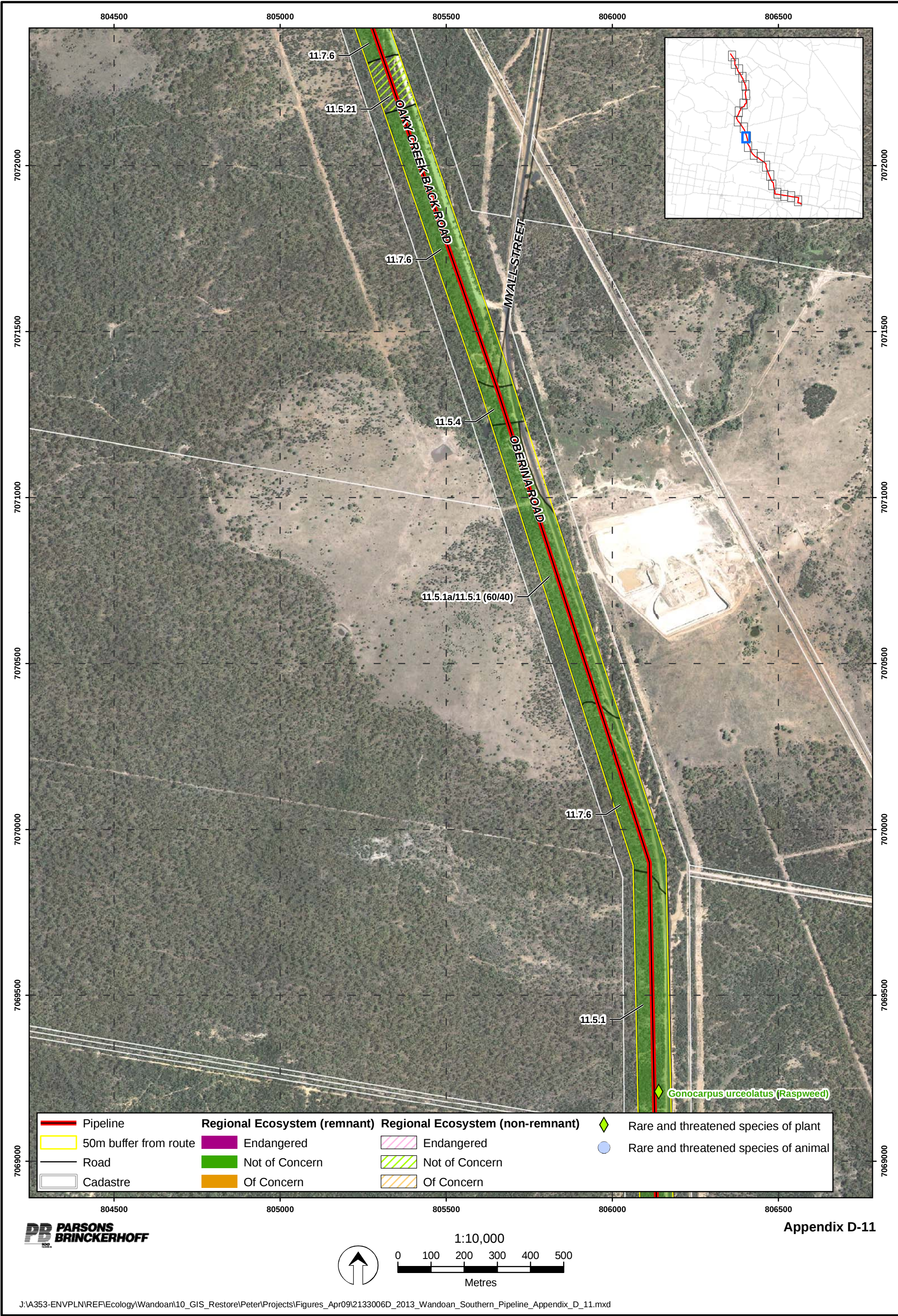


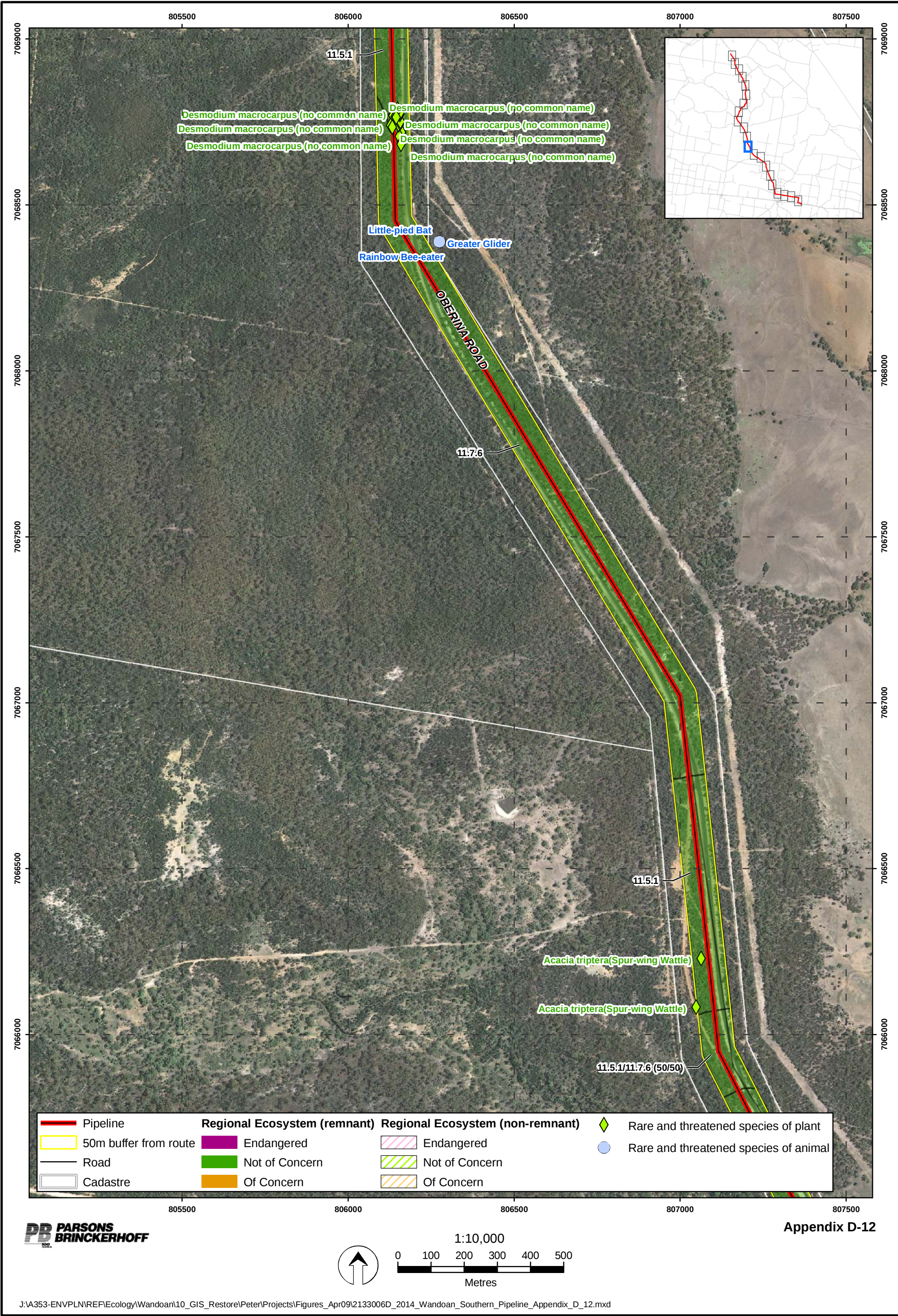


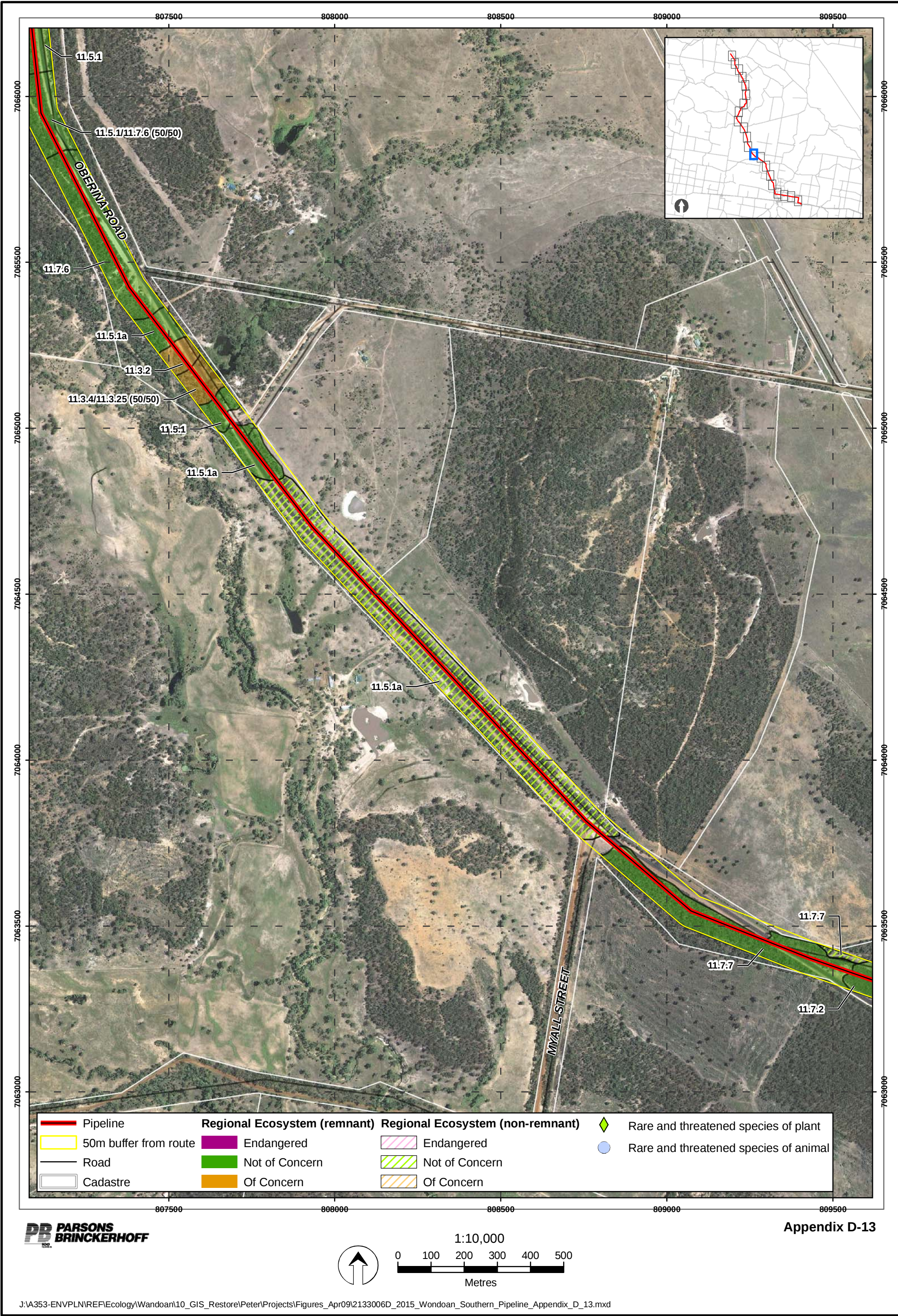


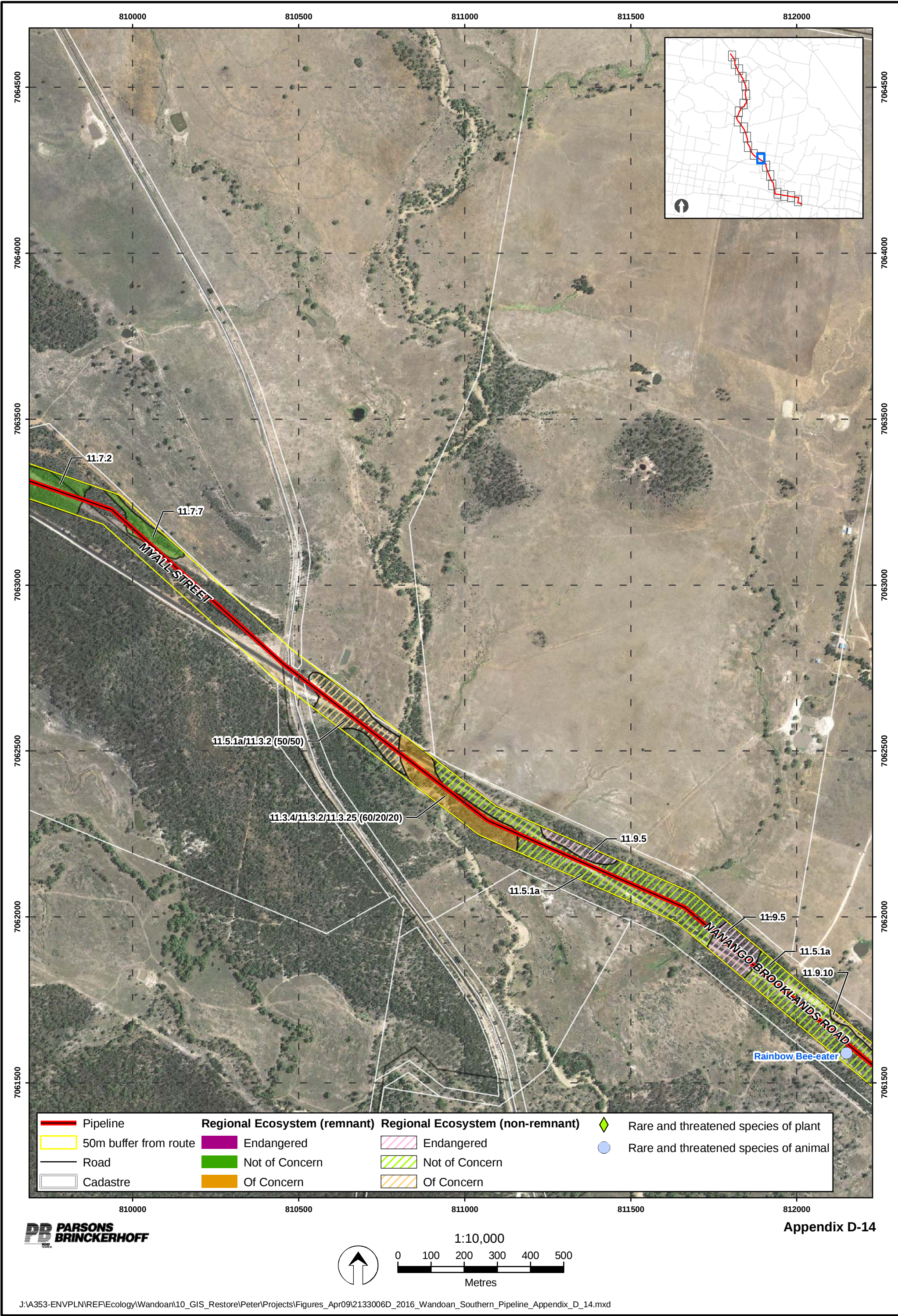


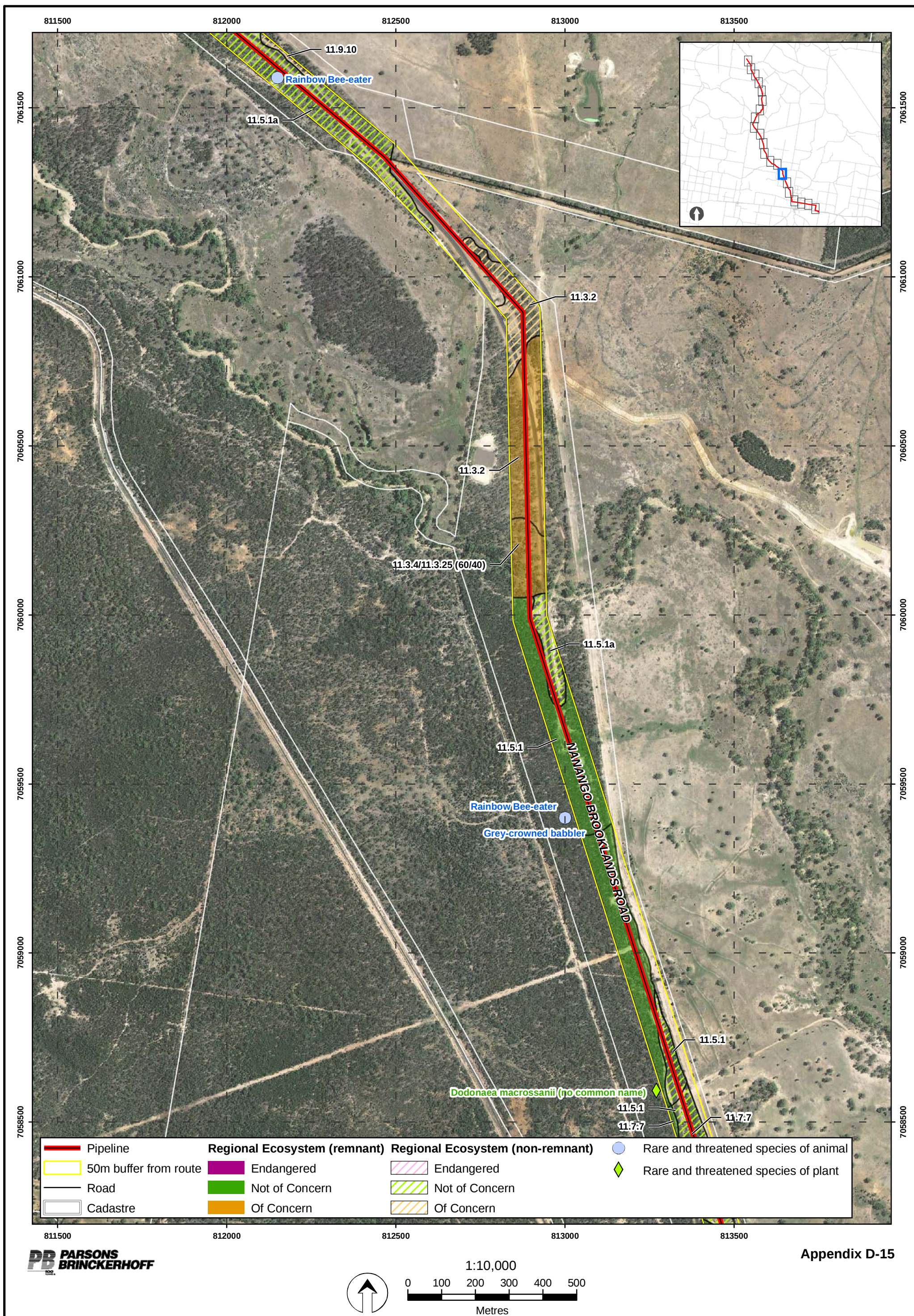


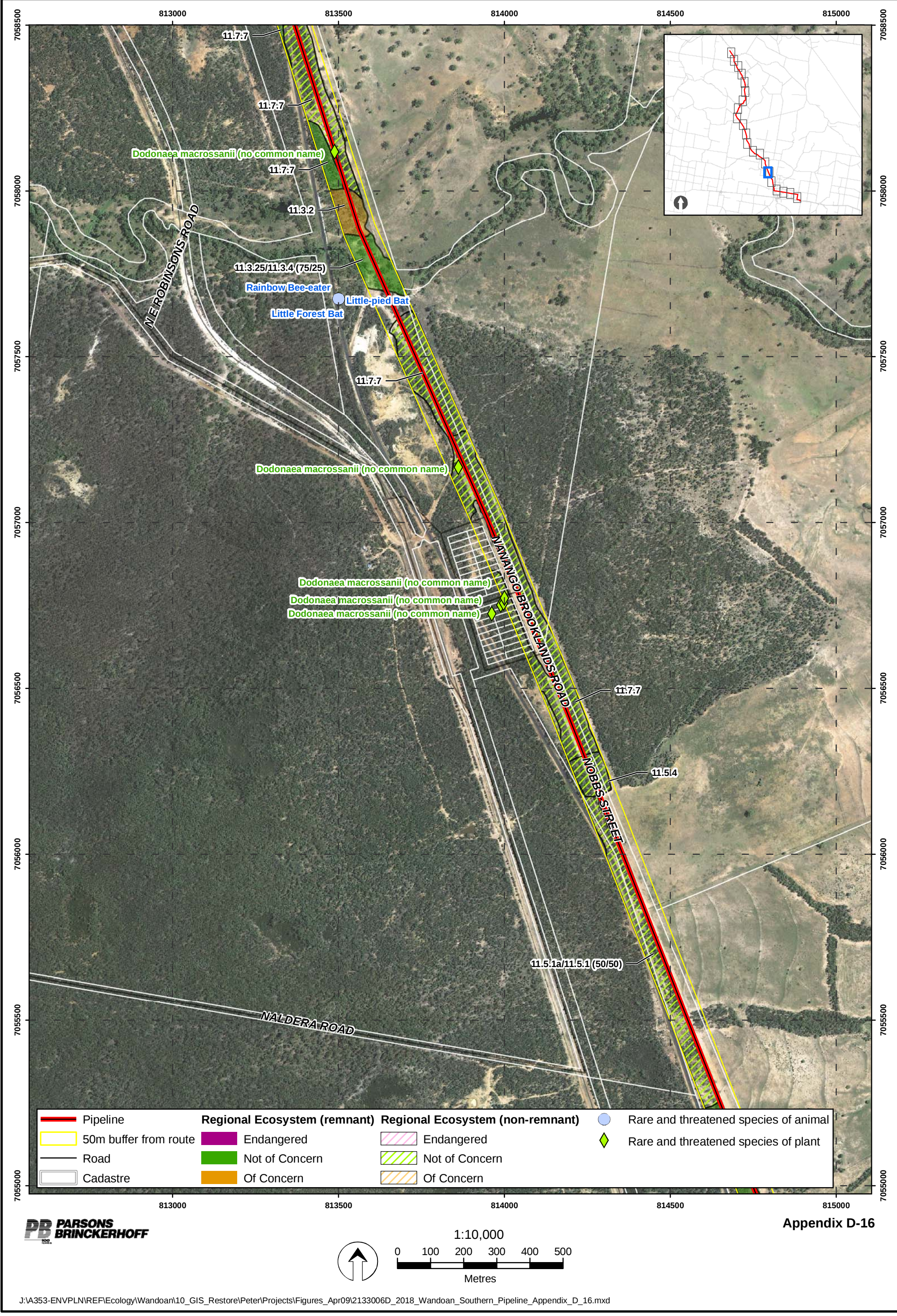


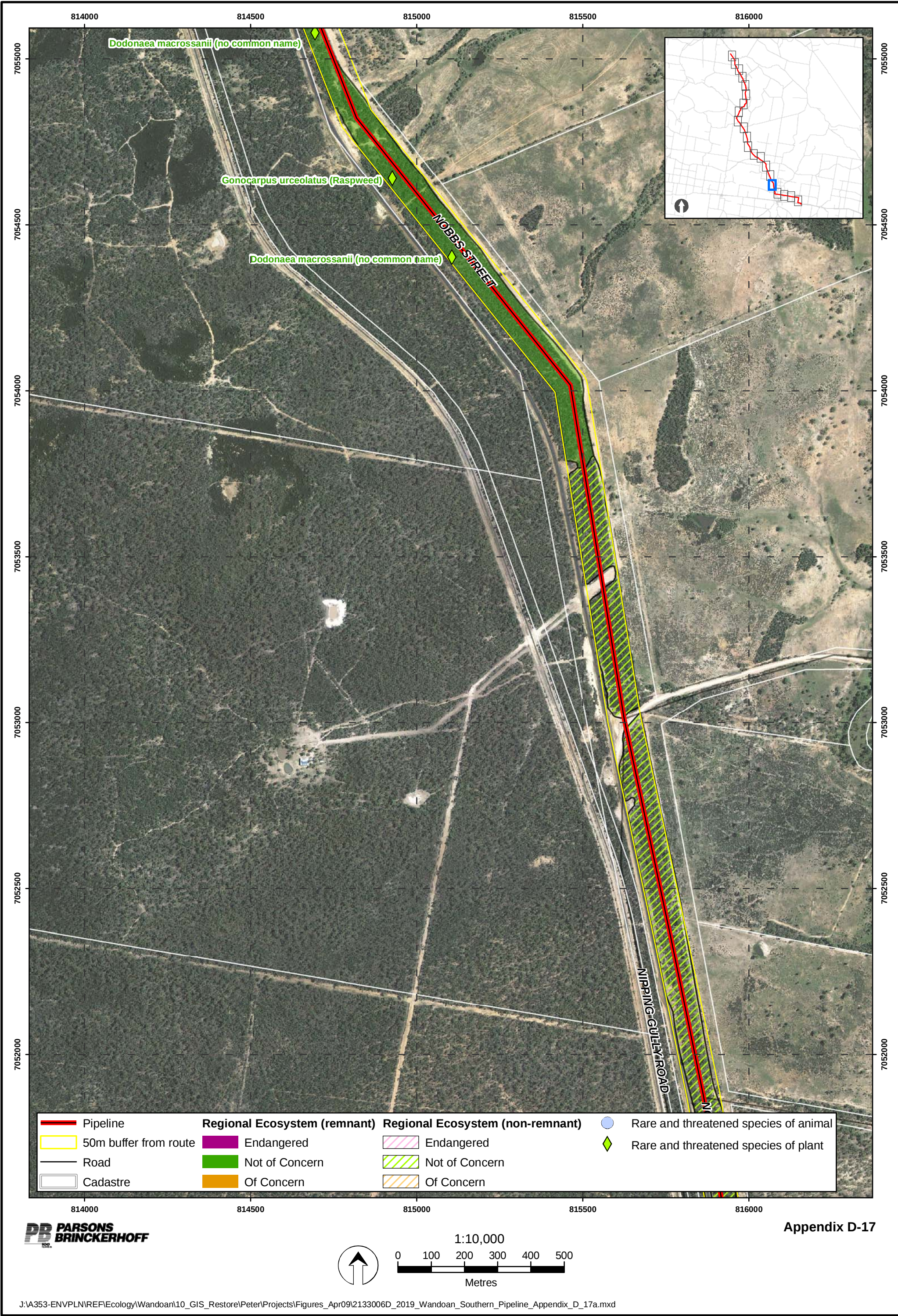


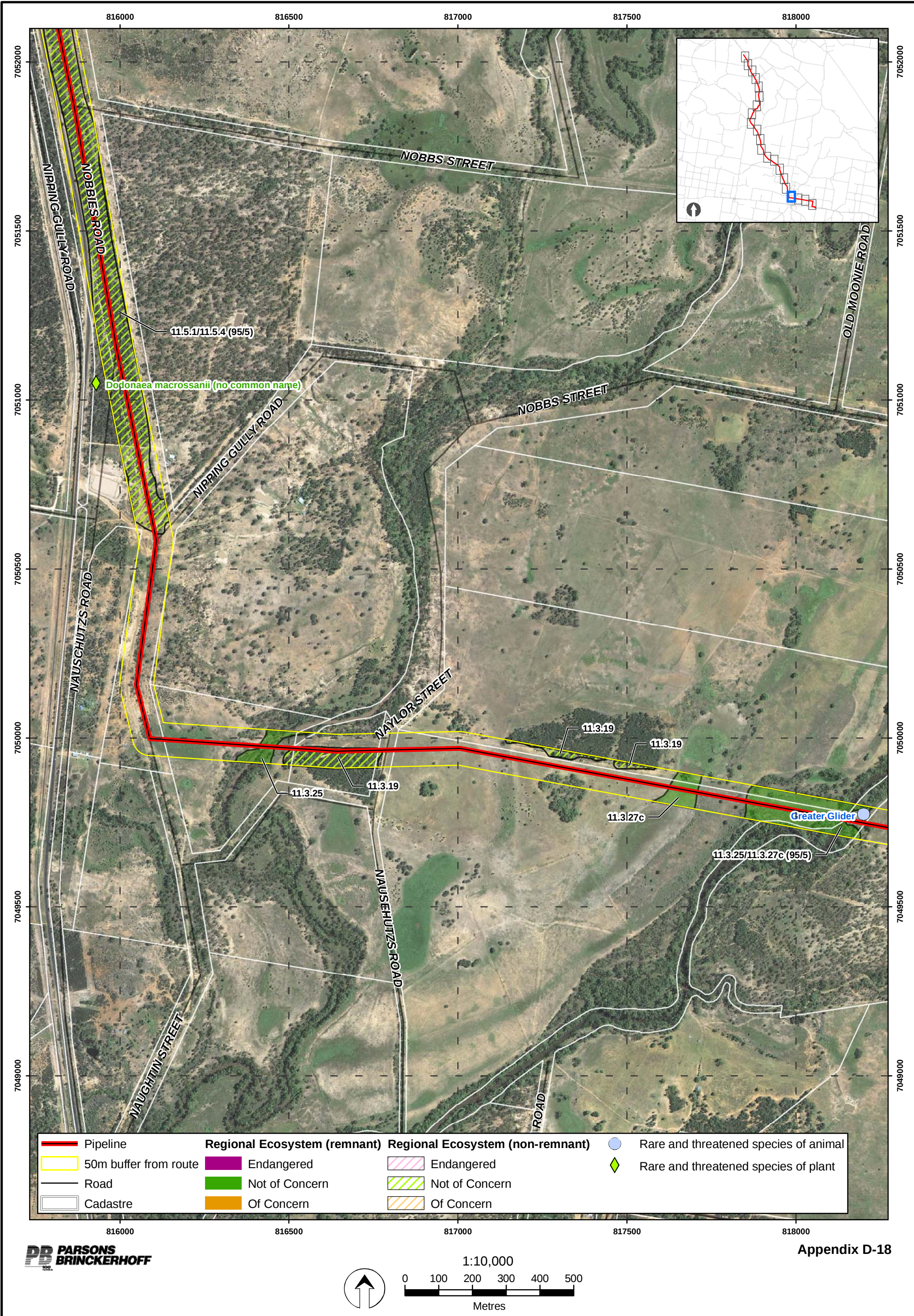




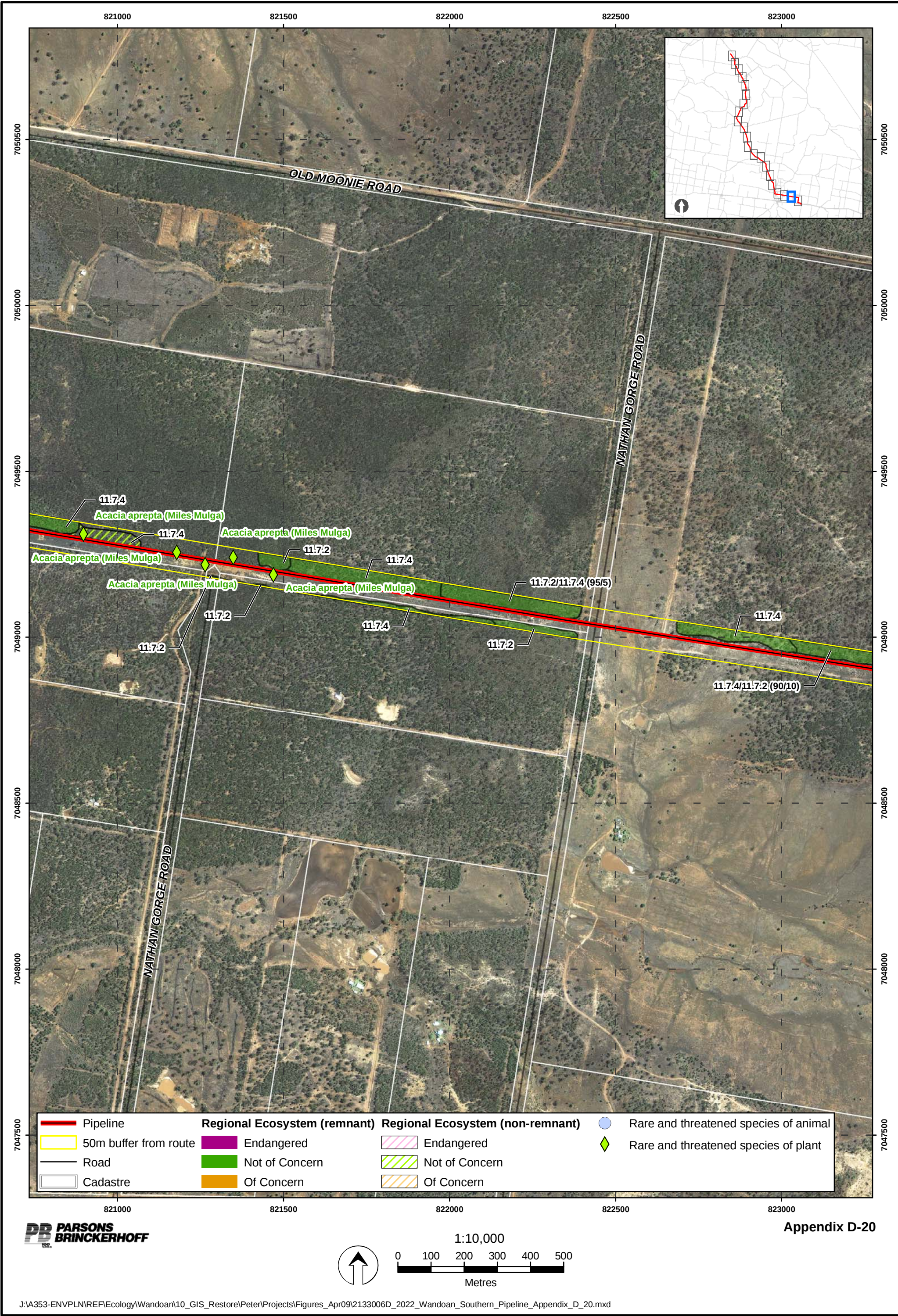


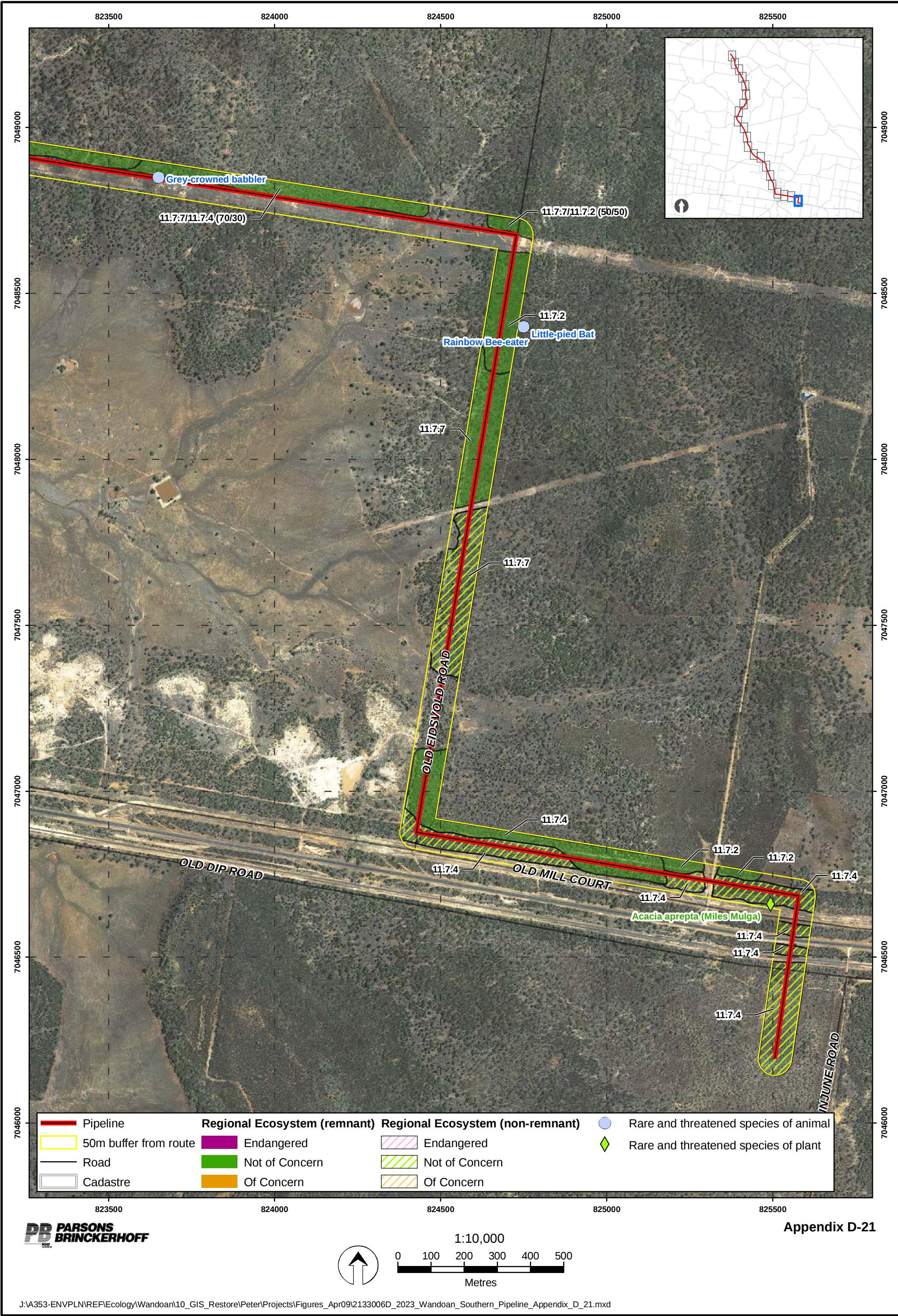












Attachment E

Bat call results and analysis

Attachment E – Bat call results and analysis

Data analysed

Approximately 2,600 Anabat sequence files were recorded in the Study Area. Details of detection sessions are shown in Table E1.

Table E1: Summary of Anabat data analysed

Site code (for this summary)	Site/Date (see Figure 3.2 in body of report for locations)	Number of sequence files	Proportion of files with calls
S1	Baileys Lane North Site 25.2.09	389	>95%
S2	Baileys Lane Sth 25.2.09	54	>90%
S3	Dogwood Creek 26.2.09	188	>95%
S4	Gurulmundi Turnoff 3.2.09	473	>95%
S5	Royd Park 24.2.09	86	>95%
S6	Site 1 26.2.09	30	>90%
S7	Site 2 Wallun Creek 23.2.09	173	>95%
S8	South of Royd Park Top of Pipeline 24.2.09	312	>95%
S9	South Storm Area 3.2.09	255	>95%
S10	Site 3 22.2.09	175	>95%
S11	Site 4 23.2.09	397	>95%
S12	Site 5 22.2.09	116	>95%

Call identification standard

Call identification for this analysis was based on bat call keys for south-eastern Queensland (Reinhold *et al.* 2001) and New South Wales (Pennay *et al.* 2004) as well as an extensive library of reference calls collected from bats in southern inland Queensland.

Analysis results

Recording quality was very good, with a high proportion of files containing recognisable bat calls. Most call sequences included clearly defined call features, thereby affording reliable identification.

Twelve microbat species were positively identified from the call data. At least three, and probably four other species may also have been present but reliability of identification was lower for those species.

Note on reliability of call identification

In the tables below, a species presence during each recording session is coded according to highest level of confidence achieved in call identification. Identification confidence is coded as follows:

- A Definite one or more calls where absolutely no doubt about identification of the bat.
- B Probably most likely the species named; low probability of confusion with species that use similar calls.
- C Possible call is comparable with the listed species, but moderate to high probability of confusion with species with similar calls.

Detailed discussion of the reliability of call identification and likely presence of particular species where several species use similar calls is provided in the 'Species Notes' section, following the tables.

Sample calls that were identified to each species are provided below.

Taxonomy and nomenclature

Scientific names for species used throughout this report follow Churchill (2008), except for *Mormopterus* species, which follow van Dyck & Strahan (2008) and Reardon et al. (2008) (*M. eleryi*). Common names used in the report are those used in van Dyck & Strahan (2008).

Species notes

***Saccolaimus flaviventris* – Yellow-bellied Sheath-tailed Bat**

Easily recognised calls at 18-22 kHz. Some frequency overlap with *T. troughtoni*, *C. jobensis* and *M. beccarii* but pulse shape is diagnostic in good quality calls. *S. flaviventris* was one of the most frequently recorded species for this survey and was present at all sites.

***Taphozous troughtoni* – Troughton's Sheath-tailed Bat**

Research by Reardon & Thomson (2002) has lead to Churchill (2008) now considering this species as present throughout much of central and eastern Queensland rather than *T. georgianus* (Common Sheath-tailed Bat). As such, *T. troughtoni* probably no longer deserves threatened species status.

The call of this species overlaps in frequency with those of *S. flaviventris* and *M. beccarii*; however, it can be distinguished on pulse shape and duration in better quality recordings. A few calls recorded at Site 4 on the Southern Pipeline looked very like *T. troughtoni* but it is possible they were from *M. beccarii*

***Chaerephon jobensis* – northern free-tailed bat**

Overlaps in frequency mainly with *S. flaviventris*, but distinguished by erratic changes in pulse shape and frequency within a single call sequence. A few brief calls from some Southern Pipeline sites were possibly from *C. jobensis* but the survey area is probably beyond the southern limit of this species' range.

***Mormopterus beccarii* – Beccari's Free-tailed Bat**

Usually has distinctive pulse shape at around 23-26 kHz. Some calls at lower frequency (19-22 kHz) overlap with those of *S. flaviventris*, *T. troughtoni* and *C. jobensis*, but can usually be recognised by different pulse shape. Numerous calls obviously from *M. beccarii* were recorded at most sites.

***Mormopterus eleryi* – Bristle-faced Free-tailed Bat**

Formerly referred to as *Mormopterus* species 6 (Adams et al. 1988), this species has now been formally described and named (Reardon et al. 2008). Its echolocation call is very similar to that produced by *S. greyii* (see below) and likely to be difficult to differentiate from that species. A number of calls from some sites were thought to perhaps be from *M. eleryi* based on consistently down-curved pulse tails, a characteristic evident in some other *Mormopterus* spp. but atypical of *S. greyii*.

Table E2: Bats recorded

SPECIES	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
<i>Saccolaimus flaviventris</i>	A	A	A	A	A	A	A	A	A	A	A	A
<i>Taphozous troughoni</i>											B	
<i>Austronomus australis</i>	A	A		B	B			A	A	A	A	A
<i>Chaerephon jobensis</i>				C	C		C					
<i>Mormopterus beccarii</i>	A	A	B	A	A			A		A	A	A
<i>Mormopterus eleryi</i>			B				B				C	C
<i>Mormopterus</i> species 2 / 3	A	B	A	A				B	A	B	A	A
<i>Chalinolobus gouldii</i>	A	A	A	A	A	A	A	A	A	A	A	A
<i>Chalinolobus picatus</i>	B	A	A	A	B	C	A	B	A	B	A	C
<i>Miniopterus australis</i>									B			
<i>Miniopterus orianae oceanensis</i>	C	C	A								C	C
<i>Nyctophilus</i> species		A	A	A			B		A		A	A
<i>Scotorepens balstoni</i>	A	A	B	A				B	B	B	A	A
<i>Scotorepens greyii</i>	A	A	A	A		B	A	B	A	A	A	A
<i>Vespadelus baverstocki</i> / <i>V. vulturnus</i>	C	A	A	A			A	C	A	C	A	A
<i>Vespadelus troughoni</i>			C	A			A	C	A			

***Mormopterus* sp. 2 and/or sp. 3 – Eastern and/or Inland Free-tailed Bats**

These two species produce calls with similar pulse shape and frequency, and are very difficult to differentiate. They also overlap in frequency with, and sometimes have similar pulse shapes to *C. gouldii* and *S. balstoni* (see below). Short duration calls or those with poor signal quality (e.g. noisy or weak) are not reliably differentiated between these species. One or both of these small *Mormopterus* spp. was definitely present at about half the survey sites and they were probably present at most sites but could not be confirmed due to lower call quality and similarities with other species.

***Chalinolobus gouldii* – Gould's Wattled Bat**

Generally emits highly distinctive calls with steeply-curved pulses that alternate in frequency; however, when flying in open space, calls tend to have more gently curved ('flatter') pulse shape and alternation may become indistinct, making them similar to calls from the small *Mormopterus* species (see above). Some calls may also be confused with those of *S. balstoni* (see below). *Chalinolobus gouldii* one of the most frequently recorded species for this survey and was present at every site. A few poorer quality calls at some sites could not be reliably split between this species and *Mormopterus* spp.

***Chalinolobus picatus* – Little Pied Bat**

This species produces calls around 38-42 kHz, often with distinctive frequency alternation; however, some calls lack frequency alternation and can be confused with those of *S. greyii* and, occasionally, with calls from *V. baverstocki* (see below). Large numbers of good quality calls were recorded from *C. picatus*, with the species being present at most sites.

***Miniopterus australis* – Little Bent-winged Bat**

Generally produces calls with characteristic frequency much higher than any other species likely to occur in the survey area. A single brief call from the Study Area may have been from this species; however, it is also possible that this call was from *V.roughtoni* (see below).

***Miniopterus orianae oceanensis* – Eastern Bent-winged Bat**

Miniopterus orianae oceanensis calls usually have a distinctive but variable pulse shape, with erratic pulse repetition rate and variable characteristic frequency within a single call. Some calls from *C. picatus* and *Vespadelus* species (see below) overlap in frequency and can display similar pulse shapes, thereby making identification difficult in lower quality calls.

A few calls from the Dogwood Creek site in the Study Area survey were almost certainly emitted by *M. o. oceanensis*; however, throughout the remaining sites, most calls in the relevant frequency range were definitely or more likely attributable to *Vespadelus* spp.

***Nyctophilus* species – long-eared bat**

Nyctophilus calls are readily identifiable from those of other bats, but it is virtually impossible to differentiate species within the genus using call data. *Nyctophilus* calls were positively identified from ten sites. At least two species are likely to occur in the survey area - *N. geoffroyi* (Lesser Long-eared Bat) and *N. gouldii* (Gould's Long-eared Bat) (Churchill 2008). The Vulnerable South-eastern Long-eared Bat (*N.* species) may also occur in larger remnant forest and woodland patches in this region (e.g. see Turbill et al. 2008).

***Scotorepens balstoni* – Inland Broad-nosed Bat**

Produces calls that overlap in frequency with those of *C. gouldii* and *Mormopterus* sp. 2/3 (see above); however, pulse shape is generally diagnostic and *S. balstoni* lacks frequency alternation evident in most *C. gouldii*. *S. balstoni* was present at most sites.

***Scotorepens greyii* – Little Broad-nosed Bat**

Call frequency overlaps with that of *C. picatus* and differentiation can be difficult for some sequences; however, *S. greyii* lacks the alternating pulse frequency seen in good calls of *C. picatus*. Some calls of *Vespadelus baverstocki* (see below) may also overlap with *S. greyii* and would be impossible to

differentiate. *S. greyii* was one of the most frequently recorded species for this survey and was present at most sites.

***Vespadelus baverstocki* and/or *V. vulturnus* – Inland and/or Little Forest Bats**

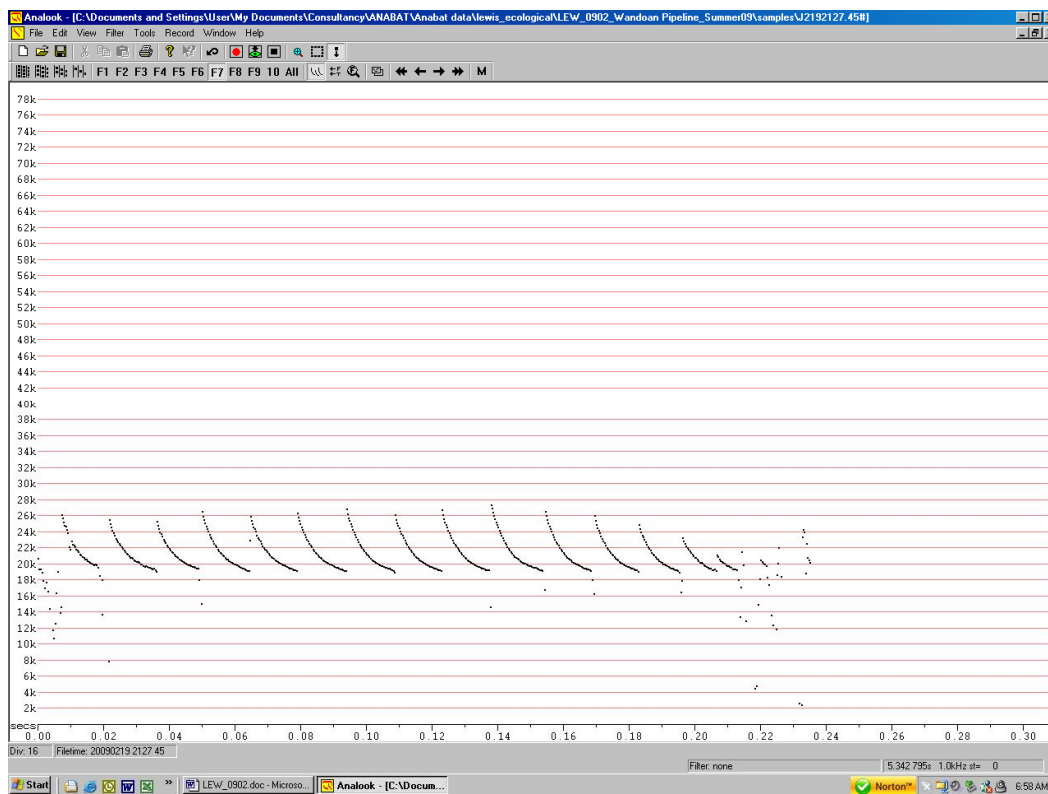
It is highly probable that both species occur in the survey area (Churchill 2008; Reardon et al. 2008; Tidemann et al. 2008). The two species emit calls with very similar pulse shape and frequency, and are difficult to differentiate. Frequency overlaps also with *M. o. oceanensis* (see above), but pulse shape is generally diagnostic. One or both of these *Vespadelus* species were present at most sites.

***Vespadelus troughtoni* – Eastern Cave Bat**

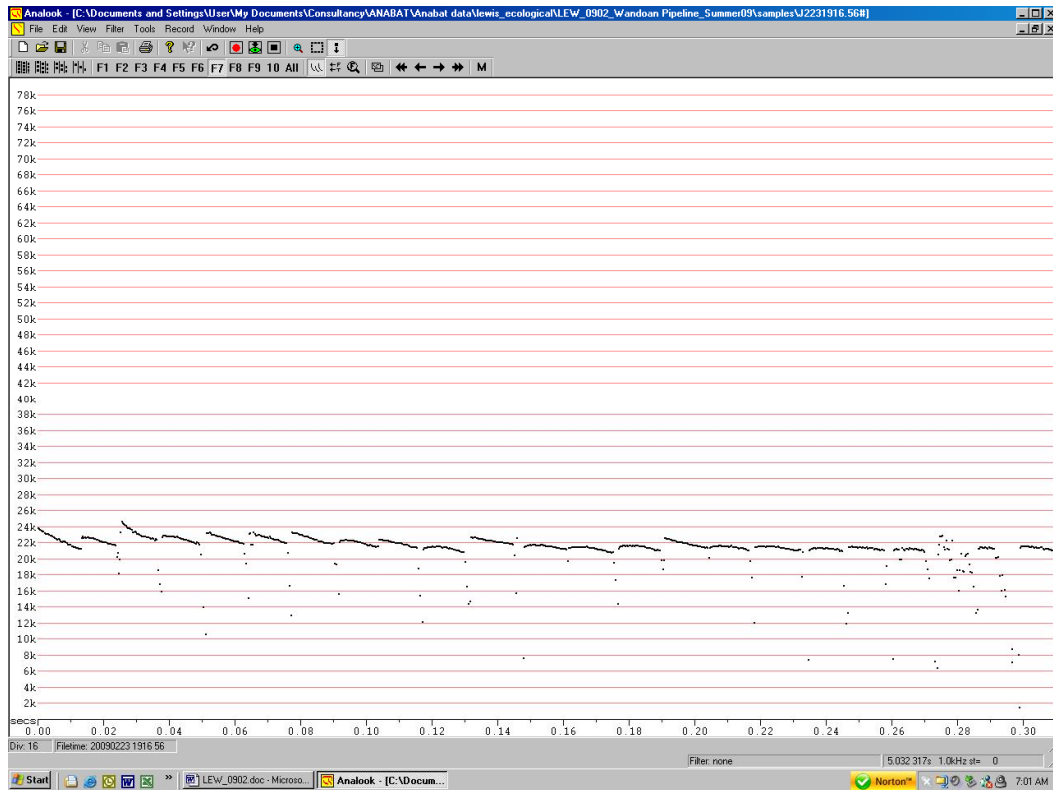
Calls are similar to those of other *Vespadelus* spp., but at a higher frequency (>48 kHz). Frequency overlaps with *Chalinolobus morio* (Chocolate Wattled Bat) but better quality calls have distinctive pulse shapes. *V. troughtoni* was definitely present at several Southern Pipeline sites. A few poorer calls from this area were thought most likely from *V. troughtoni* but some may have been from *C. morio*.

Example calls

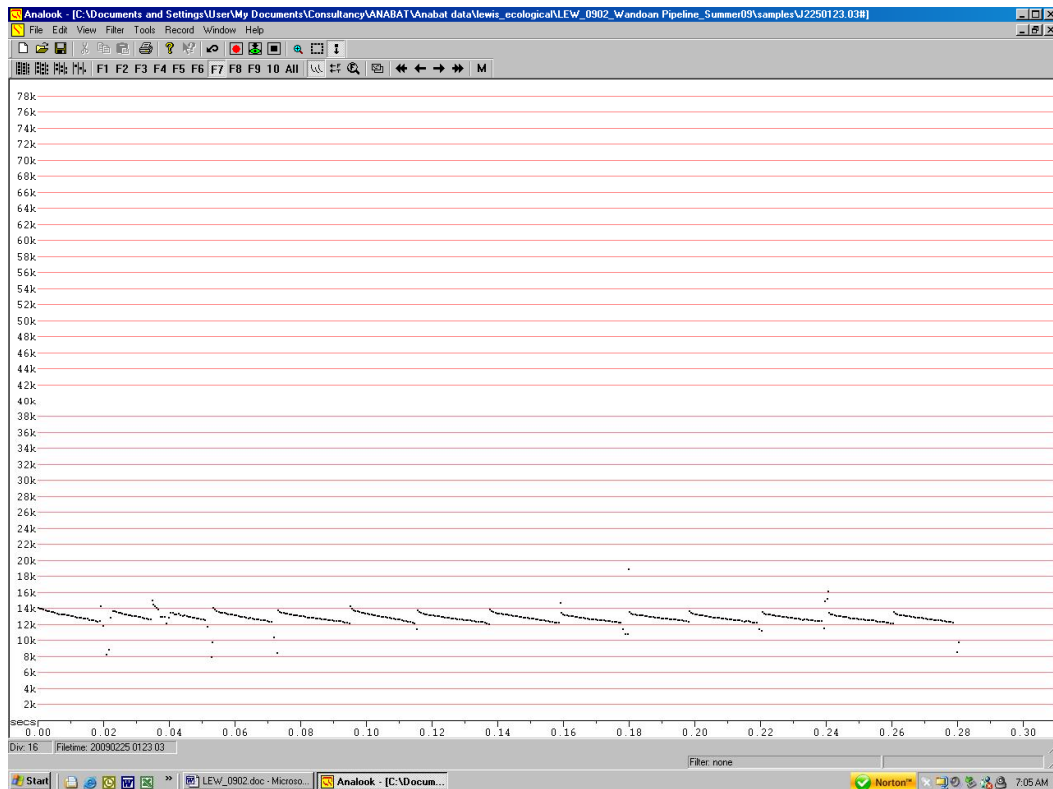
Saccolaimus flaviventris



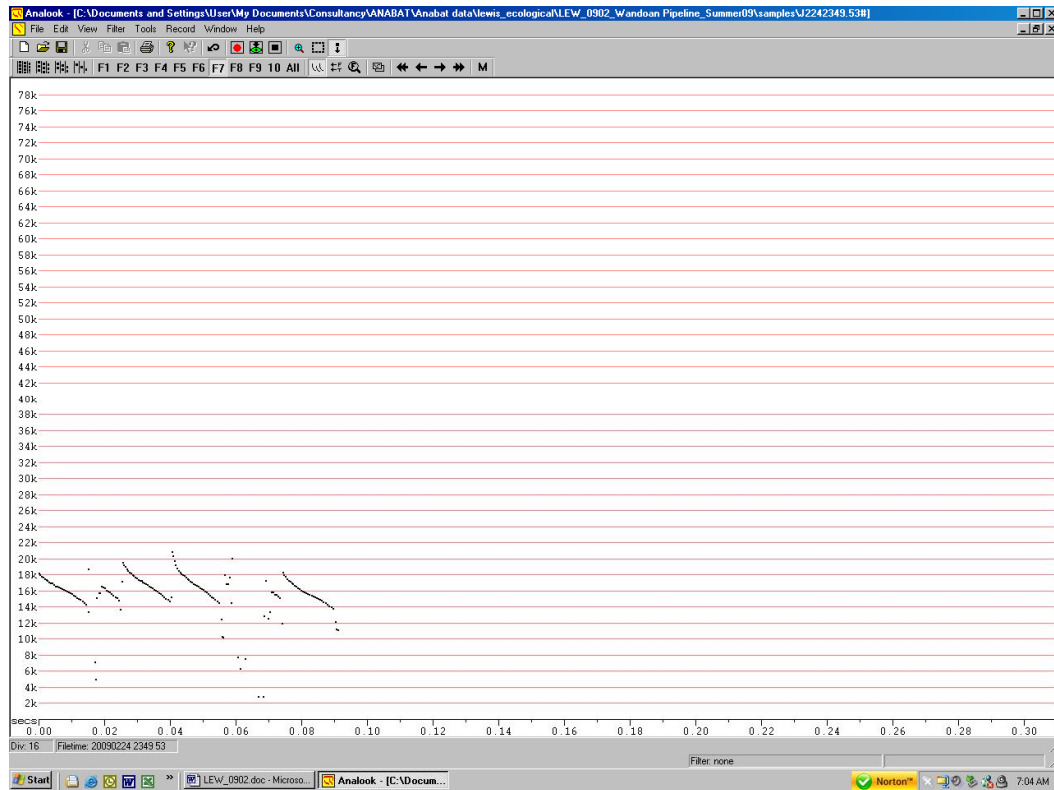
Possibly *Taphozous troughoni*



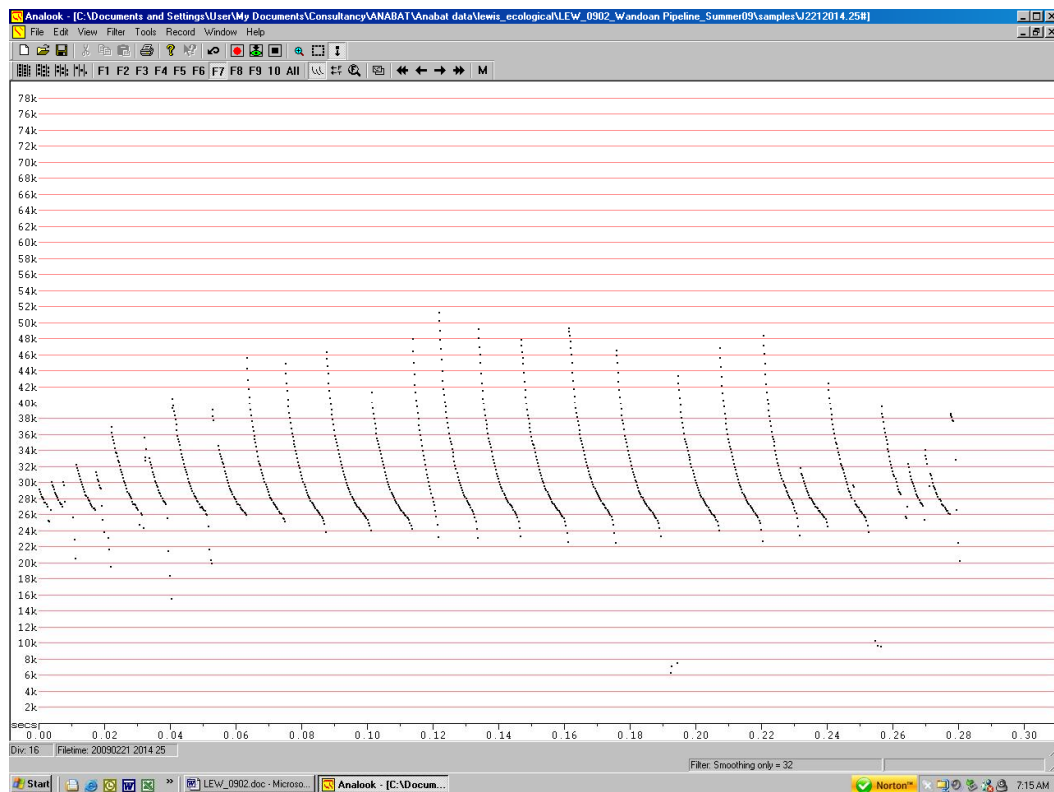
Austronomus australis



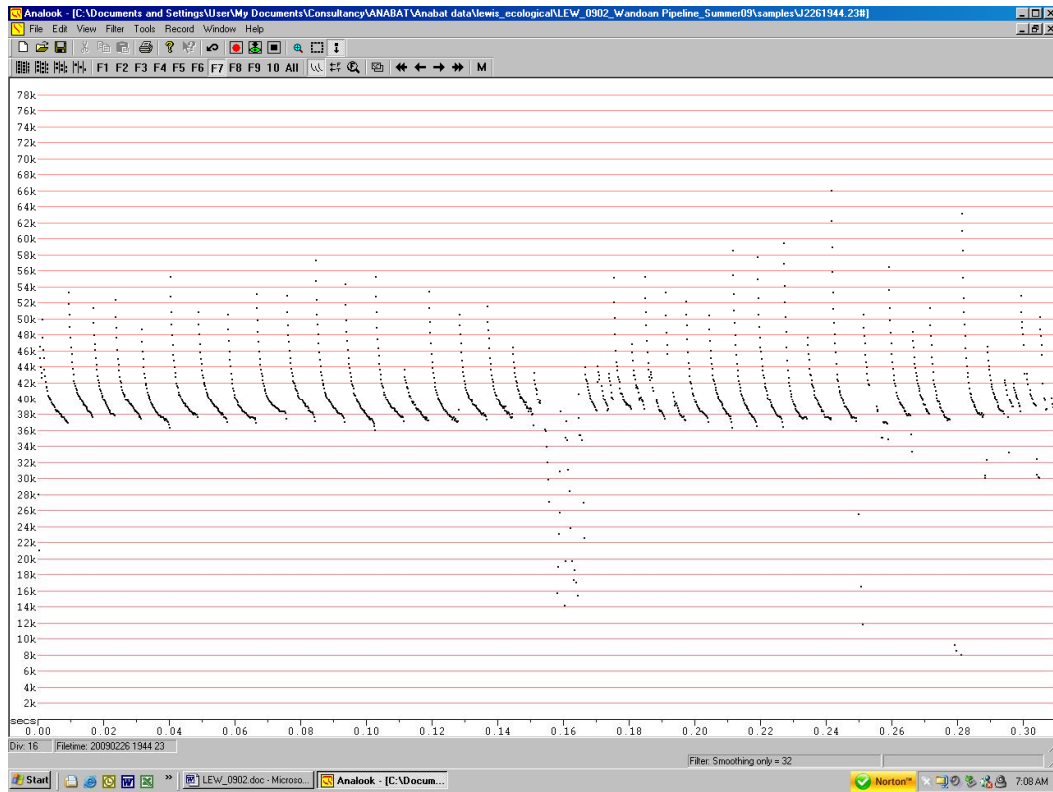
Possibly *Chaerephon jobensis*



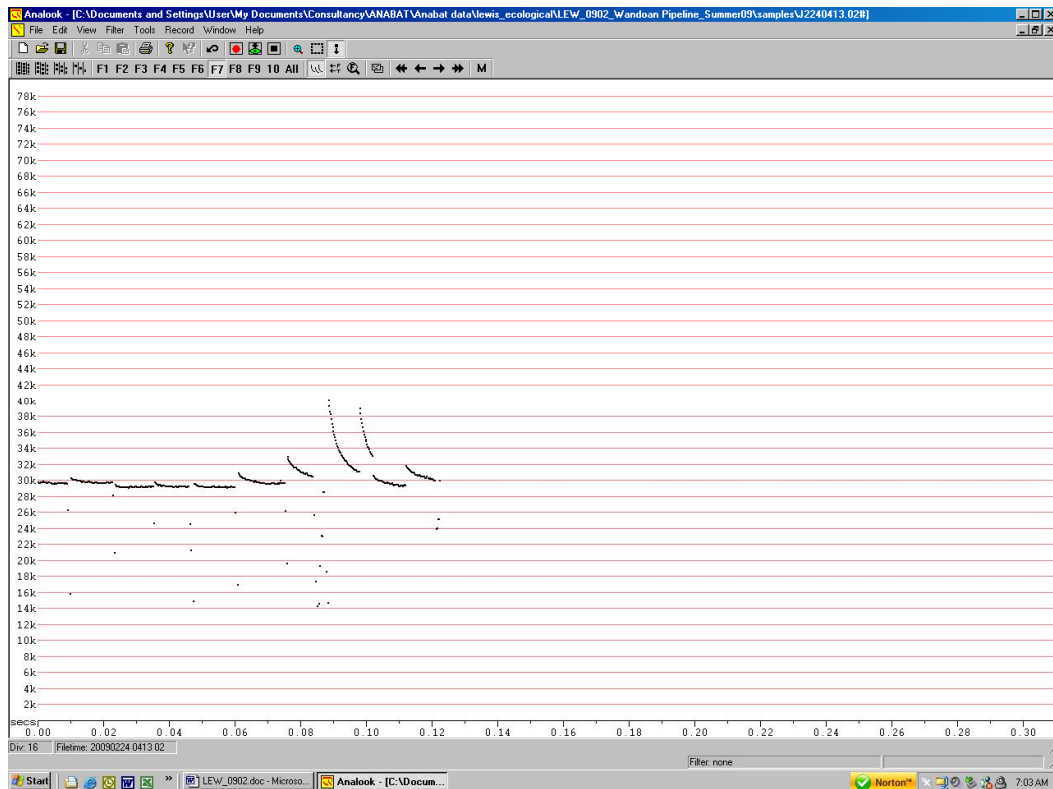
Mormopterus beccarii



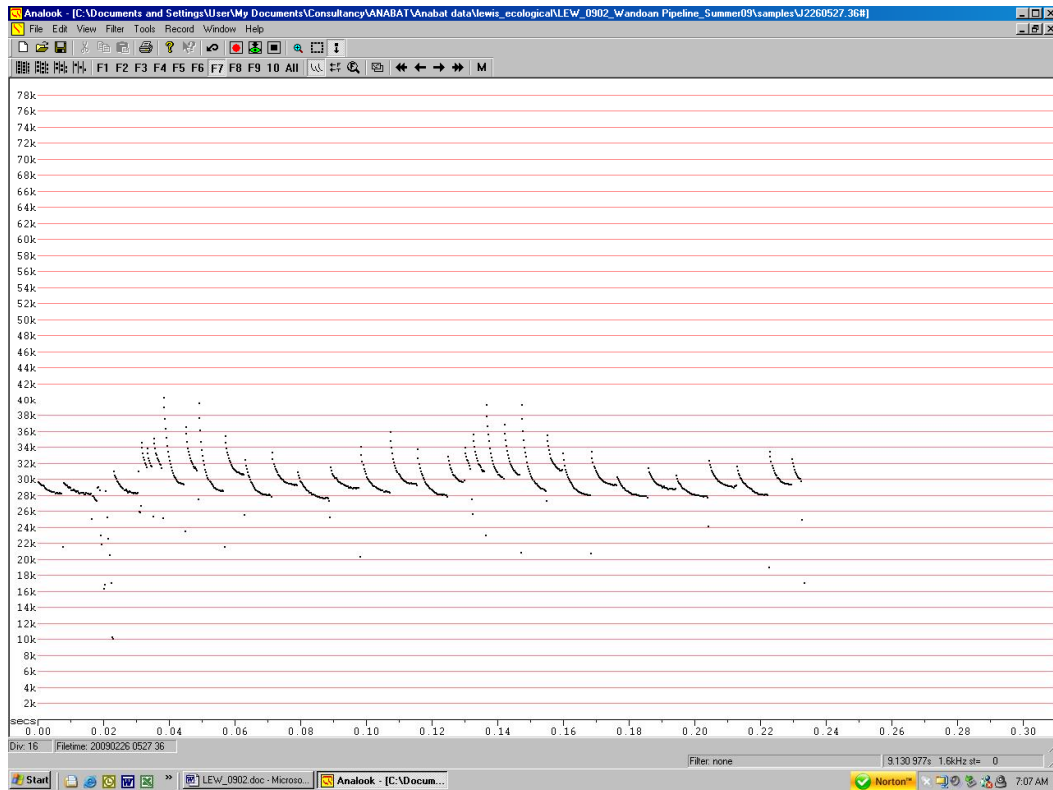
Probably *Mormopterus eleryi*



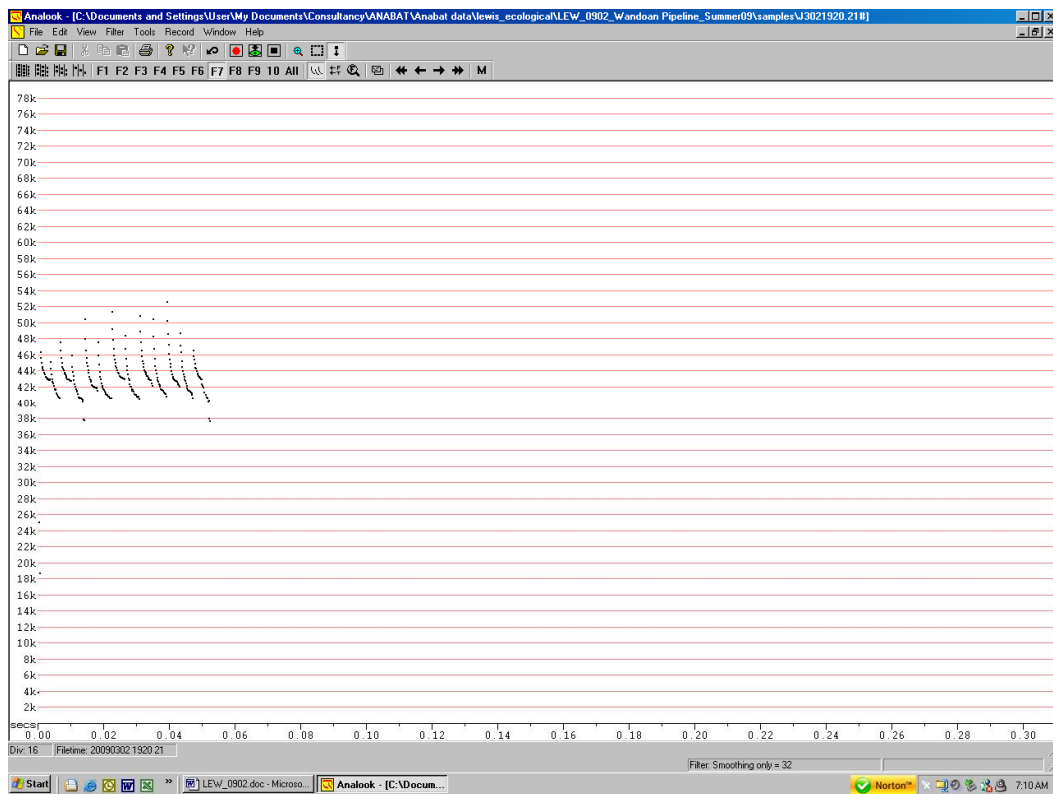
Mormopterus species 2 or *M.* species 3



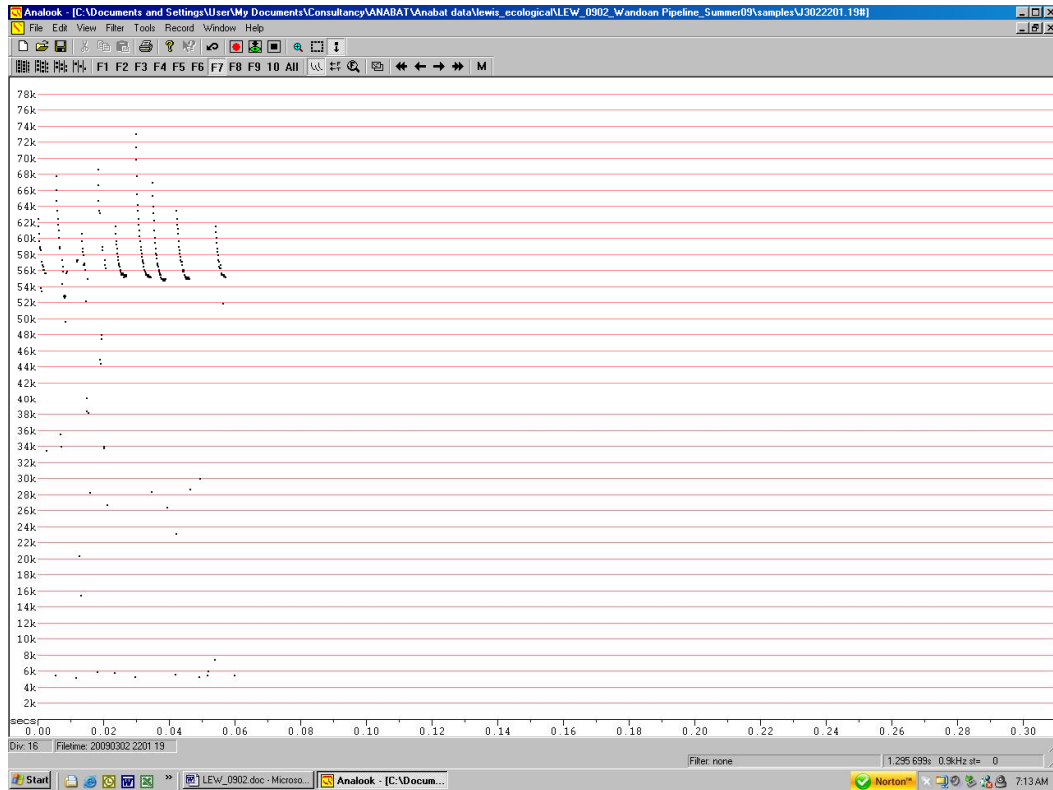
Chalinolobus gouldii



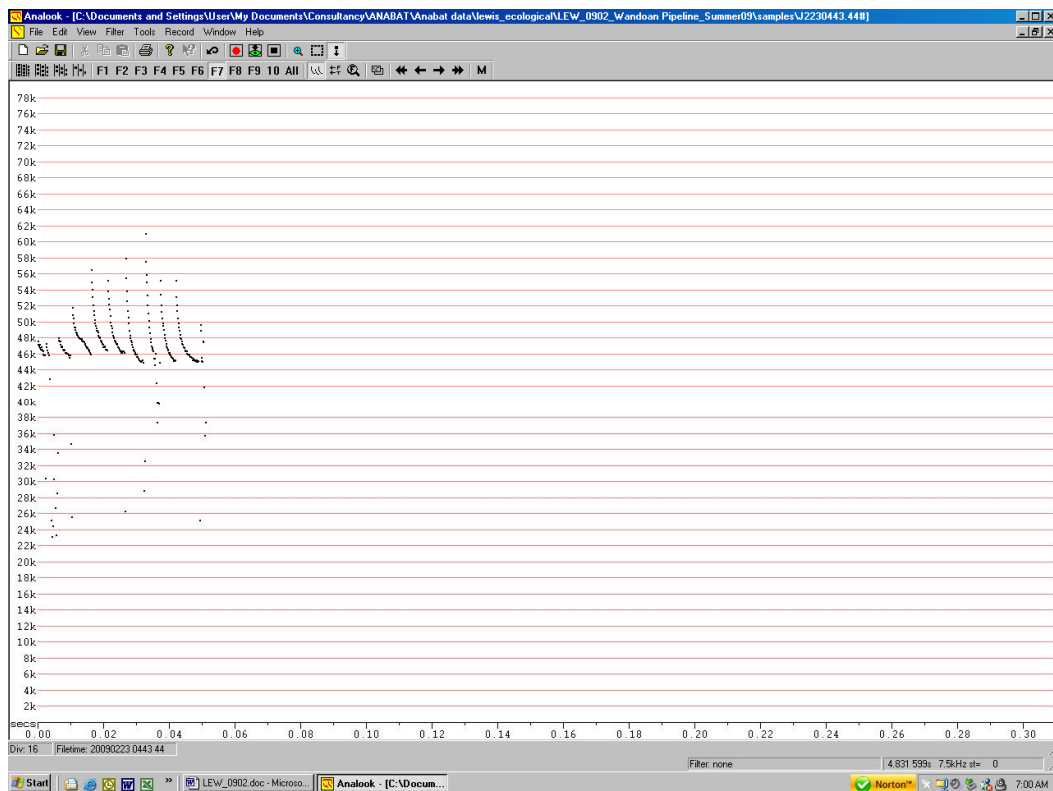
Chalinolobus picatus



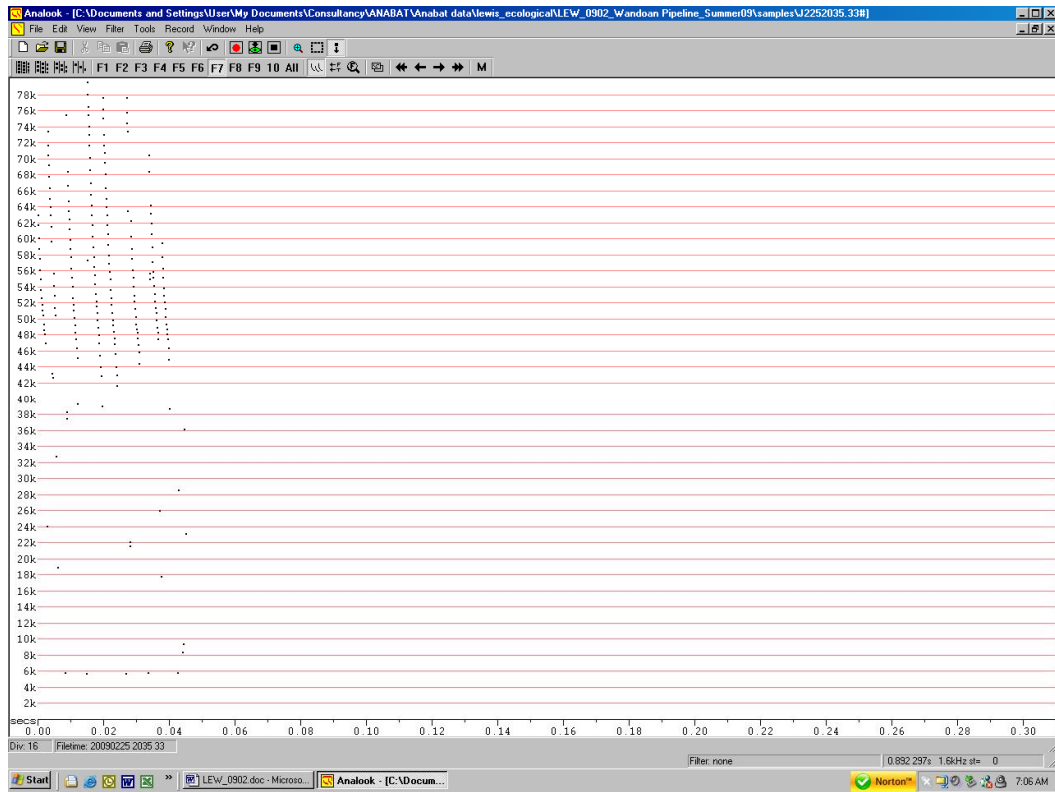
Possibly *Miniopterus australis*



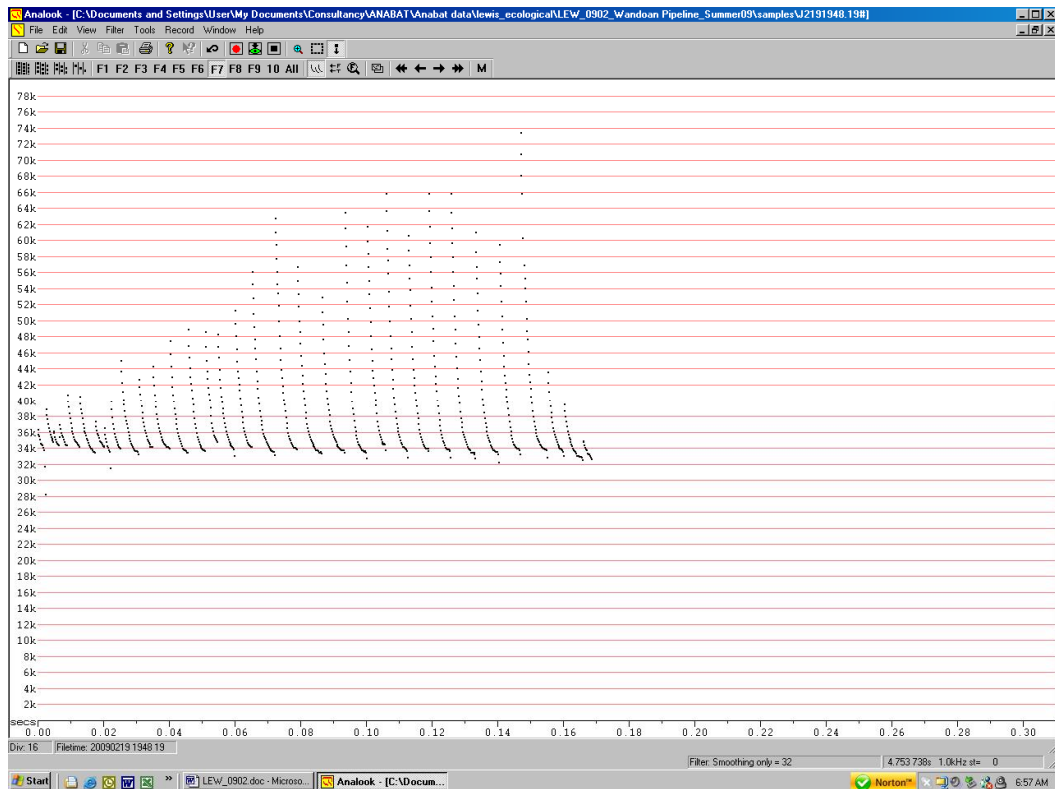
Probably *Miniopterus orianae oceanensis*



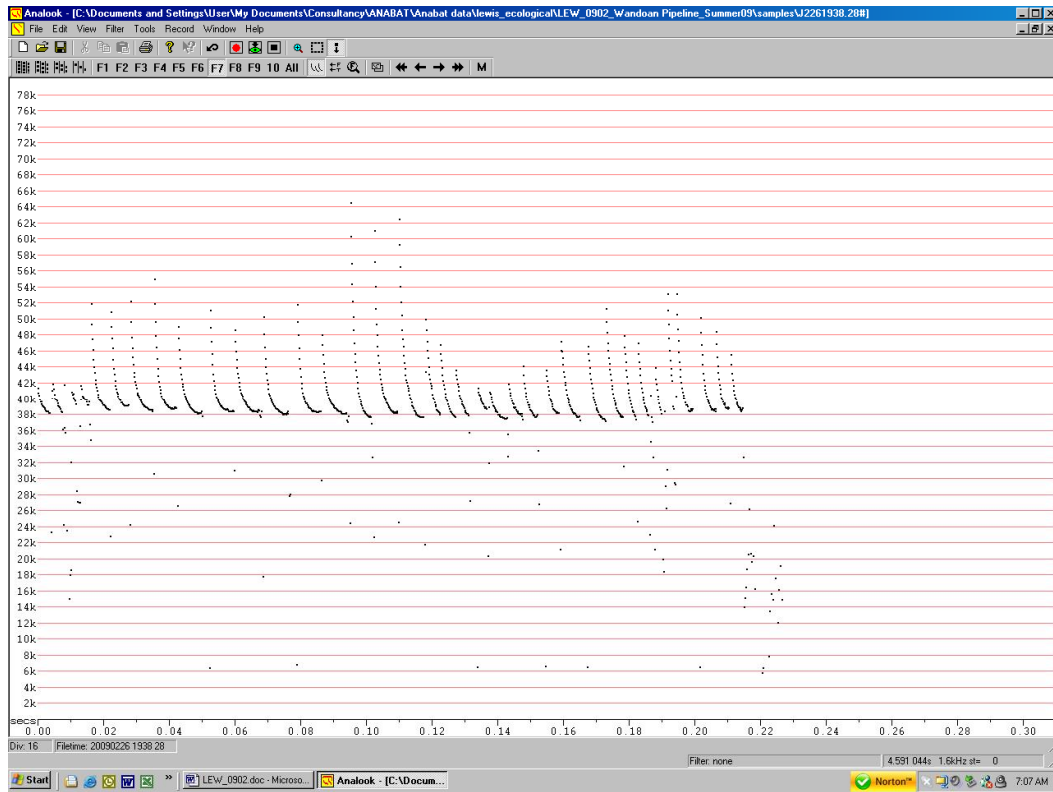
Nyctophilus species



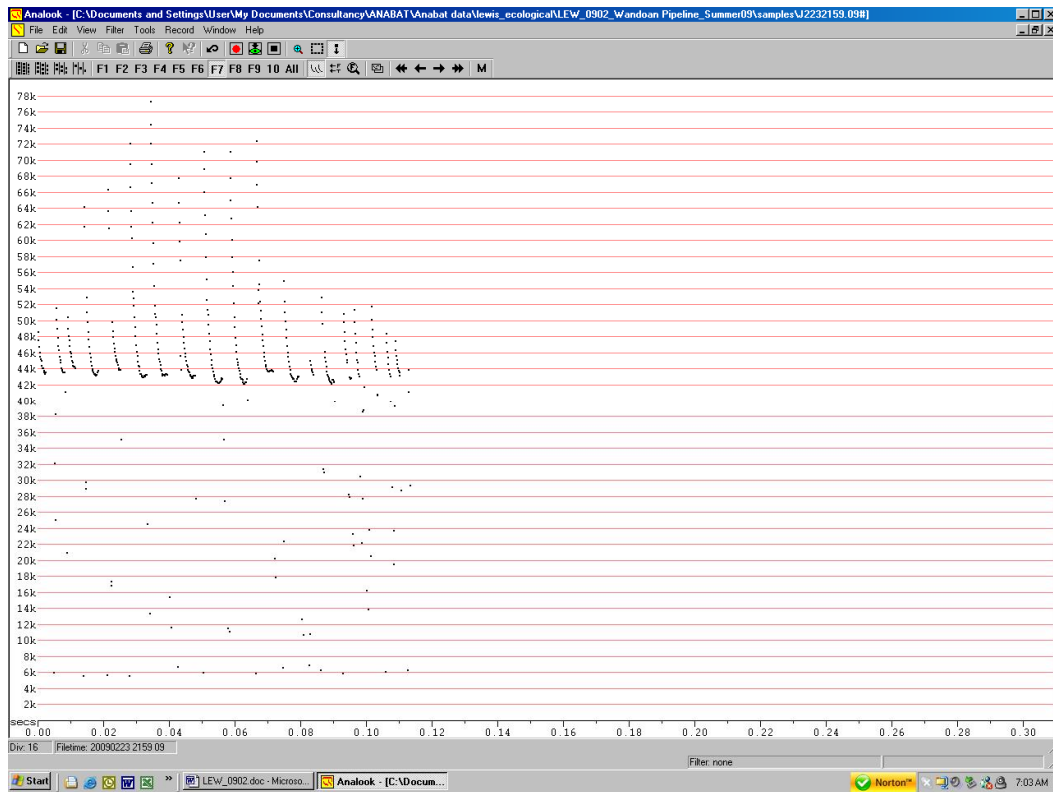
Scotorepens balstoni



Scotorepens greyii



Vespadelus baverstocki or *V. vulturnus*



Vespadelus troughtoni

