AECOM

Gloucester Coal Seam Gas Project
Gloucester to Hexham
Amended Sections

Addendum

Ecological Assessment Report

October 2009

Alison Hunt and Associates Pty Ltd

TERRESTRIAL | MARINE | AQUATIC

Executive Summary

Alison Hunt & Associates Pty Ltd was commissioned by AECOM on behalf of AGL Gloucester L E Pty Ltd (AGL) to prepare an Addendum to the Ecological Assessment Report undertaken by ENSR Australia Pty Ltd (now known as AECOM) 2008 for sections of the Gloucester Coal Seam Gas Project which have not previously been assessed, and for several previously assessed areas requiring clarification. AGL proposes to develop the coal seam methane resources in the Gloucester Basin under *Petroleum Exploration Licence (PEL) No. 285* which was granted in 1992 under the *Petroleum (Onshore) Act 1991.* The proposal comprises a Stage 1 GFDA consisting of 110 wells, gas gathering lines, CPF, (including gas and water treatment and compression) at Stratford, and a gas transmission pipeline (pipeline) from the GFDA near Gloucester to Hexham, in the Hunter Region of NSW. AECOM is currently preparing an Environmental Assessment under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), NSW *Threatened Species Conservation Act 1995* (TSC Act), NSW *Fisheries Management Act 1994* (FM Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Key ecological issues that required clarification included the potential for endangered ecological communities, threatened species and / or their habitat listed under the TSC Act to occur within the study area, the potential for endangered ecological communities, threatened species and / or their habitat listed under the FM Act to occur within the study area, the potential presence of any matters of National Environmental Significance (NES) listed under the EPBC Act and any avoidance, management or mitigation options.

This report has been prepared as an addendum to, and should be read in conjunction with:

> AECOM 2009 *Gloucester Coal Seam Gas Project. Ecological Assessment. Gloucester to Hexham.* Report prepared for AGL, Gloucester NSW.

The project footprint areas which have been amended since the original ecological assessment undertaken by AECOM (2009) are the subject of this addendum report and include:

- Expansion of the Stage 1 Gas Field Development Area (GFD) encompassing approximately 20 additional well site locations (total of 110) within the red boundary of the figure provided by AECOM (Ref. 11/05/09 Ref: 1980);
- Amended pipeline alignment totalling approximately 26 km between the following Kilometre Points (KPs) (note that these KPs relate to the Rev E version of the pipeline):
    - KP 17 – 25 – route realigned between these KPs to avoid a number of horizontal directional drilling (HDD) crossings of the river;
    - KP 27.5 - Ramstation Creek crossing;
    - KP 71 – 82.8 – route realigned; and
    - KP 89.5 – 95 – route realigned.

There are also several areas previously assessed which required clarification and these were:

- Clarifications at the following KPs (KPs relate to Rev C):
    - Approximately KP 68 – identified as *Freshwater Wetland on Coastal Floodplains*. Horizontal directional drilling (HDD) initially recommended but this is not feasible from a constructability perspective. Will need to be reassessed for potential impacts.
    - Approximately KP 68 – 69.5 – identified as *Swamp Sclerophyll Forest of Coastal Floodplains*. It was recommended that clearing be reduced by restricting the route to existing powerline easement. However, this is not practical from constructability perspective; and
    - Approximately KP 49.5 – ecologists recommended creek crossing of a tributary of Bridge Creek by HDD. However, this is not feasible from a constructability perspective and requires reassessment.

This assessment was undertaken after the amendment of the project footprint, to describe the biodiversity values of previously unassessed areas and areas requiring clarification. This was undertaken in order to determine the likely potential impacts associated with the proposal within the framework provided by Part 3A under the EP&A Act, TSC Act, FM Act and Commonwealth EPBC Act and with reference to the *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC 2007) and *EPBC Act Policy Statement 1.1 – Significant Impact Guidelines: Matters of National Environmental Significance* (DEH 2006).

Several tasks were addressed including a review of available literature and databases to assist with the identification of site values especially in relation to threatened species, populations and endangered ecological communities, field investigations undertaken 8 June 2009 to 12 June 2009, to ascertain the current site condition and the presence or likely presence of threatened or protected species, an impact assessment to determine the likely effects of the proposal on the terrestrial and aquatic ecology of the site with particular reference to threatened species, populations and / or ecological communities and preparation of preliminary recommendations to ameliorate and mitigate any impacts. Field assessments included habitat descriptions, records of dominant flora, mapping of vegetation communities, fauna habitat assessments and assessments as to the likely occurrence of threatened species, populations and communities. Due to time constraints this assessment was largely based on predictive modelling using habitat assessment. Consequently this assessment was aimed at providing an overall assessment of the ecological values of the amended areas of the GFDA and pipeline route with particular emphasis on the likely occurrence of threatened species. In line with the central tenet of the precautionary principle it was assumed that if habitat was present for a threatened species then it was considered that the threatened species could potentially occur and assessments were made accordingly.

The amended sections of the proposed pipeline total approximately 26 km of which approximately 5.5 km contain remnant or regrowth vegetation. The majority of the native vegetation along the proposed pipeline route falls within the *Hunter-Macleay Dry Sclerophyll Forests* vegetation class which are transitional between the *Dry Coastal Valley Grassy Woodlands and Northern Hinterland Wet Sclerophyll Forests* of the steeper and wetter slopes (Keith 2004). The canopy vegetation is largely dominated by Spotted Gum (*Corymbia maculata*), Narrow-leaved Ironbark (*Eucalyptus crebra*), Grey Box (*E. moluccana*), Grey Gum (*E. punctata*), Small-fruited Grey Gum (*E. propinqua*) and Grey Ironbark (*E. siderophloia*). Shrubs are characterised by Silver-stemmed Wattle (*Acacia parvipinnula*), Forest Oak (*Allocasuarina torulosa*), Coffee Bush (*Breynia oblongifolia*), Gorse Bitter Pea (*Daviesia ulicifolia*) and Peach Heath (*Lissanthe strigosa*). White Root (*Pratia purpurascens*), Mulga Fern

(*Cheilanthes sieberi subsp. sieberi*), Barbed Wire Grass (*Cymbopogon refractus*), Kangaroo Grass (*Themeda australis*) and Wiry Panic (*Entolasia stricta*) dominate the understorey. These areas grade into the mostly cleared, lower elevation areas of higher rainfall along the lower sections of the proposed pipeline. These areas become more saline-influenced closer to the Hunter River floodplain. Clearing for the amended pipeline route would include 1.51 ha of Spotted Gum Ironbark Forest, 2.24 ha of Grey – Stringybark – Bloodwood Forest, 0.23 ha of Hunter Lowland Redgum Forest (EEC) and 0.08 ha of riparian vegetation at Ramstation Creek. The southern end of the amended pipeline route would be horizontally directionally drilled under the Hunter River and SEPP 14 wetlands at Tomago and consequently no clearing of these sensitive areas is anticipated. These areas form part of the Hunter Estuary National Park and these areas are known to support significant flora, fauna and communities.

Predictive modelling indicates that 13 flora, 29 fauna and 18 migratory / marine species listed under the EPBC Act have the potential to occur within the locality of the GFDA and amended areas of the proposed pipeline route. The amended sections of the proposed pipeline and GFDA would provide potential habitat for 10 flora, 13 fauna and 18 migratory species which are listed under the EPBC Act. None of the listed species were recorded within the assessed areas of amended route although several sections of the GFDA and amended pipeline have habitat which could potentially provide a number of threatened flora with suitable habitat, and fauna with roosting and foraging habitat.

Thirty five EECs listed under the TSC Act are known, or are predicted, to occur within the Hunter CMA sub-region. The only EEC which would be directly impacted by this proposal is *Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions*. Approximately 250 m of the amended pipeline route passes *Hunter Lowland Redgum Forest* at KP 76.3 and runs adjacent to another patch of this EEC at KP 75.7. It is estimated that 0.23 ha would be removed as a consequence of construction of the pipeline. There have been 19 flora and 69 fauna species listed under the TSC Act recorded within the locality (i.e. 5 km buffer). Those species with the potential to occur along the amended sections of the pipeline and GFDA include 12 flora and 43 fauna species. None of the flora and only one of the fauna species was recorded during this study although habitat occurs for many of these species. The Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) which is listed as vulnerable under the TSC Act was recorded (Figure 2) within a wooded area adjacent to the gathering lines of the proposed south-eastern most well in the GFDA, and it is likely that this species would occur along the access tracks and adjacent woodlands of several of the other well sites.

In general, the proposed pipeline route has been located so as to avoid areas of high biodiversity which would be most likely to provide habitat to listed species and endangered ecological communities. In unavoidable areas of high conservation status, (e.g. SEPP 14 Wetlands, Hunter River Estuary, substantial riparian areas), HDD techniques would be undertaken to avoid direct impacts on these areas and potential impacts could be managed and mitigated with stringent environmental management. Therefore, it was concluded that with the implementation of stringent mitigation measures and environmental management, that the Stage 1 GFDA extension and the amended sections of the pipeline route would be unlikely to significantly impact any species, population or habitat listed under the TSC Act, FM Act and EPBC Act.

To ensure protection of ecological values, mitigation measures should be aimed at minimising impacts on site values and protection of biodiversity values across the locality. The recommendations and mitigation measures detailed in AECOM (2009) should also be implemented in the Stage 1 GFDA

extension and along the sections of amended pipeline route. Particular attention should be focussed on avoiding direct and indirect impacts to the *Hunter Lowland Redgum Forest* and indirect impacts to occurrences of *Swamp Oak Floodplain Forest* which occur adjacent to the amended pipeline route. Of particular importance will be the need to minimise changes to natural flow regimes of rivers, streams, floodplains and wetlands as much of the southern section of the amended pipeline route traverses low lying water-logged areas. Central to these measures should be the preparation and implementation of a CEMP and OEMP.

GLOSSARY OF TERMS

Glossary & Acronyms	
AGL	AGL Gloucester L E Pty Ltd
Bioregion	A territory defined by a combination of biological, social and geographical criteria rather than by geopolitical considerations; generally, a system of related, interconnected ecosystems.
CEMP	Construction Environmental Management Plan
CKPoM	Comprehensive Koala Plan of Management
cm	Centimetres
CPF	Central Processing Facilities
CRA	Comprehensive Regional Assessment
DEC	Department of Environment and Conservation (NSW Government Department succeeded by the DECC)
DECC	Department of Environment and Climate Change (NSW Government Department).
DEH	Department of the Environment and Heritage (Commonwealth Government Department succeeded by the DEWHA)
DEWHA	Department of Environment, Water, Heritage and the Arts
E	Endangered
Ecological community	An assemblage of different species occupying a particular area.
Edge effects	The changes in the environmental conditions of a patch of habitat that result from an edge or boundary in the environment.
EEC	Endangered ecological community
Endangered species	Used in reference to a species, population or ecological community, specified in the *Threatened Species Conservation Act 1995*, *Fisheries Management Act 1994* or *Environment Protection and Biodiversity Conservation Act 1999* that is in danger of becoming extinct if threats continue, or its numbers are reduced to a critical level, or its habitat is reduced.
Environment	The aggregate of all conditions that influence the life of a species, including natural, social, cultural, built and spatial elements.
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act*

	1999.
ES	Ecosystem - vegetation mapping units
ESD	Environmentally Sustainable Development
Exotic species	A species occurring in an area outside its historically known natural range as a result of intentional or accidental dispersal by human.
Floodplain	The flat area usually toward the lower end of a river system where periodic flooding has deposited river-borne materials.
Flora	The entire plant life of a site or region.
FM Act	NSW *Fisheries Management Act 1994*
Fragmentation	The division of natural areas by vegetation clearance for human land use, isolating the remnants and the species within them and limiting genetic flow.
GCB	Grey-crowned Babbler (*Pomatostomus temporalis temporalis*)
GFDA	Stage 1 GFDA extension
GGBF	Green and Golden Bell Frog (*Litoria aurea*)
GHFF	Grey-headed Flying-fox (*Pteropus poliocephalus*)
HBT	Hollow-bearing tree
HDD	horizontal directional drilling
hectare (ha)	10,000 square metres
Km	Kilometre
KP	Kilometre Point
KTP	Key threatening processes
L/s	Litres per second
LGA	Local Government Area
LHCC	Lower Hunter and the Central Coast
LHCCREMS	Lower Hunter and the Central Coast Regional Environment Management Strategy
m	Metres
M	Migratory
Mar	Marine
mm	Millimetres
Native	Species that are native to (i.e. occur naturally) in a region.

Native vegetation	Any local indigenous plant community containing throughout its growth the complement of native species and habitats normally associated with that vegetation type or having the potential to develop these characteristics. It includes vegetation with these characteristics that has been regenerated with human assistance following disturbance. It excludes plantations and vegetation that has been established for commercial purposes.
NES	National Environmental Significance
Noxious	Undesirable, troublesome, difficult to control or eradicate.
NPWS	NSW national Parks and Wildlife Service
NW Act	*Noxious Weeds Act 1993*
OEMP	Operational Environmental Management Plan
PAS	Priority Action Statements
PEL	*Petroleum Exploration Licence No 285*
Pipeline	Gas Transmission Pipeline from Central Processing Facilities in Gloucester to Hexham.
Population	A group of individuals of the same species, forming a breeding unit and sharing a habitat.
Preservation	Maintaining the physical material of places or objects in their existing state and retarding deterioration.
Regrowth	Native vegetation containing a substantial proportion of individuals that are in the younger growth phase and are actively growing in height and diameter.
Remnant vegetation	A small fragmented portion of the former dominant vegetation which once covered the area before being cleared.
Riparian	Situated on or within a riverbank.
RoTAP	Rare or Threatened Australian Plants
ROW	Right of Way
Saltmarsh	Saltwater wetland occupied mainly by herbs and dwarf shrubs, characteristically able to tolerate extremes of environmental conditions, notably waterlogging and salinity.
SECP	Sediment and Erosion Control Plan
SEPP 14 Wetlands	*State Environmental Planning Policy 14 - Coastal Wetlands.* State legislation that aims to ensure that coastal wetlands are preserved and protected in the environmental and economic interests of the State.
Species	A group of organisms that is biologically capable of breeding and producing fertile offspring with each other but not with members of other species.

Species diversity	A measure of the number of individuals and their relative abundance in an area.
Threatened	Refers to a species, population or ecological community specified in the *Threatened Species Conservation Act 1995, Fisheries Management Act 1994* or *Environment Protection and Biodiversity Conservation Act 1999* that is either endangered, vulnerable, or presumed extinct.
TSC Act	NSW *Threatened Species Conservation Act 1995*.
V	Vulnerable
Waterlogging	The saturation of soils with water; often associated with insufficient oxygen for good plant growth.
Weed	Any plant that is not cultivated deliberately by humans but that grows entirely or predominantly in situations disturbed by humans.

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1 INTRODUCTION

1.1 Background

Alison Hunt & Associates Pty Ltd was commissioned by AECOM on behalf of AGL Gloucester L E Pty Ltd (AGL) to prepare an Addendum to the Ecological Assessment Report undertaken by ENSR Australia Pty Ltd (now known as AECOM) 2008 for sections of the Gloucester Coal Seam Gas Project which have not previously been assessed, and for several previously assessed areas requiring clarification.

AECOM is currently preparing an Environmental Assessment in accordance with requirements of Condition No. 1 (Environmental Assessment) of *Petroleum Exploration Licence (PEL) No. 285.* An application under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) resulted in the issuance of Director-General's requirements for environmental assessment. A referral under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to the Department of Environment, Water, Heritage and the Arts (DEWHA) resulted in the proposal being deemed a controlled action. Consequently, this assessment was considered within the framework under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), NSW *Threatened Species Conservation Act 1995* (TSC Act), NSW *Fisheries Management Act 1994* (FM Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Key ecological issues that required clarification included:

- The potential for endangered ecological communities (EECs), threatened species and / or their habitat listed under the TSC Act to occur within the study area;
- The potential for endangered ecological communities, threatened species and / or their habitat listed under the FM Act to occur within the study area;
- The potential presence of any matters of National Environmental Significance (NES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); and
- Any avoidance, management or mitigation options.

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    - Approximately KP 49.5 – ecologists recommended creek crossing of a tributary of Bridge Creek by HDD. However, this is not feasible from a constructability perspective and requires reassessment.

1.2 Project Location

The study area (overall project area), is located to the north of Newcastle, from Gloucester to Hexham, NSW (**Figure 1**) and falls within six local government areas (LGAs), including Gloucester, Dungog, Great Lakes, Port Stephens, Maitland and Newcastle. The study area is located with the Hunter – Central Rivers Catchment Management Authority and includes three main catchments (the Avon, Karuah and Williams / Hunter) and the proposed pipeline route crosses numerous waterways (AECOM 2009). Broadly, the locations of the components of the project are:

- Stage 1 Gas Field Development Area (GFDA) is located east of Gloucester and Stratford and covers an area of approximately 50.33 km^2;
- Central Processing Facilities (CPF) is proposed to be located adjacent to an existing rail loop near the south-east corner of the GFDA; and
- Gas Transmission Pipeline (pipeline) from the CPF to Hexham and would be approximately 95km long.

Only the expanded Stage 1 GFDA extension and amended sections of the pipeline route have been addressed in this assessment, being those aspects of the project that have been amended.

1.3 Brief Project Description

AGL proposes to develop the coal seam methane resources in the Gloucester Basin under *Petroleum Exploration Licence (PEL) No. 285* which was granted in 1992 under the *Petroleum (Onshore) Act 1991.* The proposal comprises a Stage 1 GFDA consisting of 110 wells, gas gathering lines, CPF, (including gas and water treatment and compression) at Stratford, and a gas transmission pipeline (pipeline) from the GFDA near Gloucester to Hexham, in the Hunter Region of NSW.

1.3.1 Gas Field Development Area and Central Processing Facilities

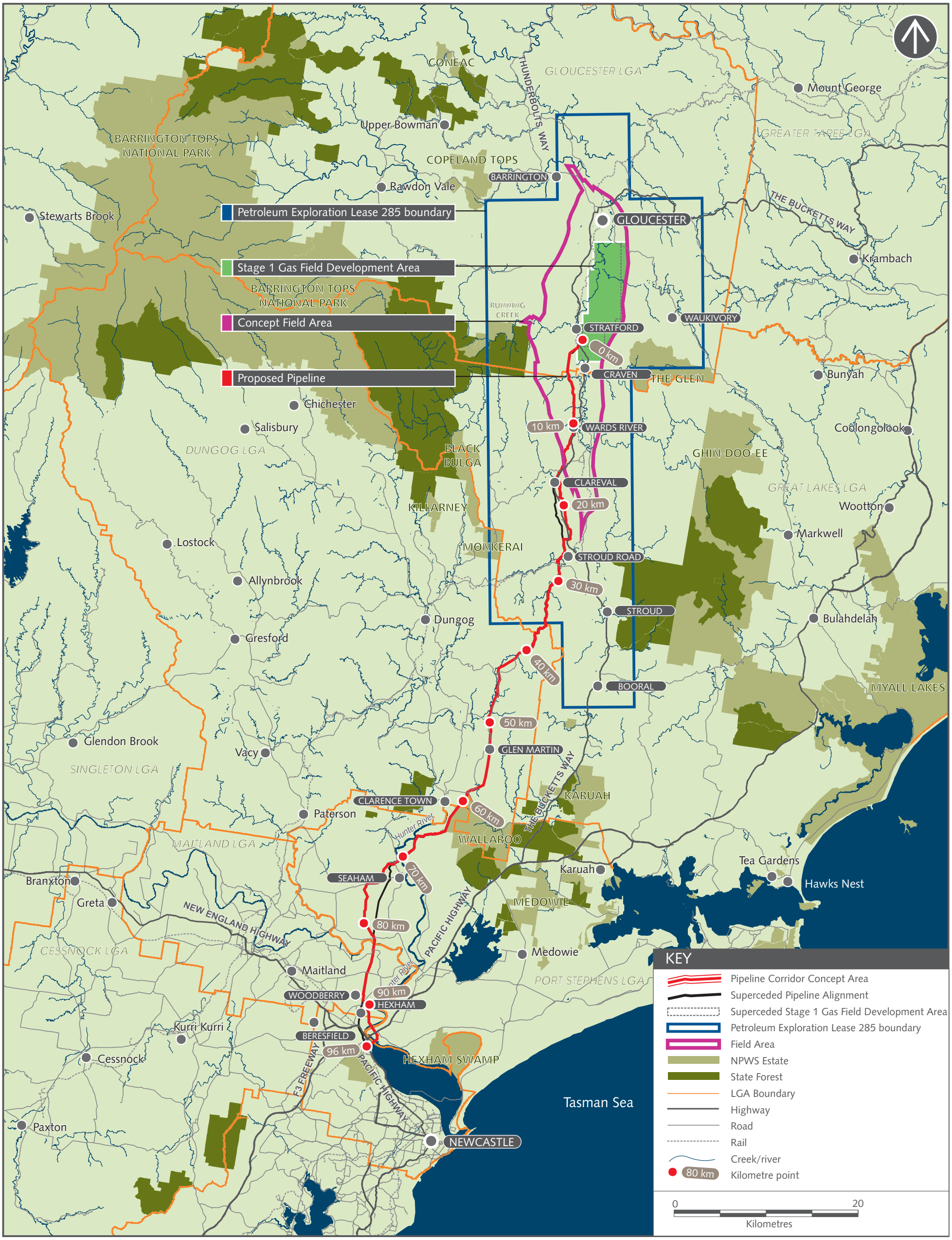
The proposed GFDA is currently comprised of lands used for agriculture and mining. Agricultural practices include grazing and cropping with a number of homesteads located throughout. Stratford Colliery open cut mine is located at the southern end of the GFDA. The proposed location of the CPF is adjacent to an existing rail loop near the south-east corner of the GFDA. The infrastructure would consist of a network of up to 110 wells and associated gas gathering lines. The arrangement of the wells has been loosely identified within the GFDA but detailed locations are to be designed and finalised around the environmental and social constraints identified during the environmental approval process. Gas gathering lines would transport the gas from the individual wellheads into a main trunkline, which would be connected to the CPF. The gas would then be transported to Hexham via an underground pipeline.

1.3.2 Pipeline

The entire proposed gas transmission pipeline would be approximately 95km long, running from the CPF near Gloucester to Hexham. It would pass primarily through cleared agricultural land, but would transect a number of remnant vegetation patches, rivers, creeks and other drainage lines. The proposed pipeline would be underground. In already cleared areas without other constraints, the disturbance footprint would be contained within a 30 m right of way (ROW). In sensitive areas (e.g. remnant native vegetation, stream crossings, on steep slopes), the ROW would be reduced to minimise impacts.

1.4 Legislative Framework

A number of legislative requirements in relation to the biodiversity of the site would be relevant to the proposal and these are detailed in AECOM (2009).



AECOM

GLOUCESTER COAL SEAM METHANE GAS PROJECT LOCATION AND PEL 285 BOUNDARY

FIGURE 1

2 METHODS

This assessment was undertaken after the amendment of the project footprint, to describe the biodiversity values of previously unassessed areas and areas requiring clarification in order to determine the likely potential impacts associated with the proposal within the framework provided by Part 3A under the EP&A Act, TSC Act, FM Act and Commonwealth EPBC Act and with reference to the *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC 2007) and *EPBC Act Policy Statement 1.1 – Significant Impact Guidelines: Matters of National Environmental Significance* (DEH 2006).

Several tasks were undertaken including:

- A review of available literature and databases to assist with the identification of site values especially in relation to threatened species, populations and endangered ecological communities;
- Field investigations to ascertain the current site condition and the presence or likely presence of threatened or protected species;
- An impact assessment to determine the likely effects of the proposal on the terrestrial and aquatic ecology of the site with particular reference to threatened species, populations and / or ecological communities; and
- Preparation of preliminary recommendations to ameliorate and mitigate any impacts.

2.1 Literature Review

Available literature and database records pertaining to the site and locality (i.e. within a 5 km buffer of the proposed pipeline) were reviewed. The full list of reference materials is provided in Section 7 and those of particular relevance are listed below:

- AECOM 2009 Gloucester Coal Seam Gas Project. Ecological Assessment. Gloucester to Hexham. Report prepared for AGL Gloucester LE Pty Ltd, Gloucester NSW.
- GHD 2008 Report on Gloucester Coal Seam Gas Project. Land and Approvals – Task 4. Prepared for Lucas Energy.
- Department of Environment and Climate Change (DECC 2008a) – Threatened species database records (accessed by AECOM 14 August 2008);
- Department of Environment, Water, Heritage and the Arts (DEWHA) – Online protected matters search tool for matters of National Environmental Significance (NES) (accessed by AECOM 14 August 2008).

2.2 Site Assessments

Assessments of the study area were undertaken to determine the current values of the ecology of the Stage 1 GFDA extension and a 100 m wide assessment area associated with the amended sections of pipeline and other areas requiring clarification. Of particular focus was determining the presence, or likely presence of threatened flora or fauna, and the likely potential impacts of construction and operation.

Assessments were undertaken from 8 June 2009 to 12 June 2009. The assessment schedule was brief and not all areas could be walked. However,

- Where possible the assessment areas were traversed by:
    1. foot in areas of intact vegetation or where no vehicular access was available; or
    2. vehicle along areas of clearly disturbed habitat.
- Assessment areas that fell within private landholdings, where permission to access had not been provided, were assessed from the fence line of adjoining properties; and
- Aerial photograph interpretation was also relied upon in some areas.

2.2.1 General Habitat Description

Habitat descriptions were recorded within the GFDA and amended pipeline route. Details recorded included vegetation type (including dominant canopy, shrub and ground cover species), soil type, topography, potential habitat for threatened species (e.g. presence of hollow-bearing trees, waterbodies, nests, fallen logs, rocks); and indirect evidence of species (e.g. diggings, scratches, feed scars, burrows, nests).

2.2.2 Vegetation Assessment

General

The key areas within the Stage 1 GFDA extension were assessed by driving and walking to areas previously identified by aerial photograph interpretation as being in close proximity to remnant vegetation or near drainage lines and farm dams, whilst the amended pipeline route was traversed in areas with remnant vegetation and the dominant flora species were recorded. The majority of the amended portions of the route traversed areas of disturbed agricultural lands devoid of any substantial vegetation. The assessment of flora in these areas consisted of noting the dominant flora species and the degree of disturbance. In areas of intact vegetation more detailed notes were taken to ascertain the species present. Specimens unidentifiable in the field were retained for later identification.

Vegetation Mapping

Previous vegetation mapping for the area was reviewed and included the mapping prepared by:

- Lower Hunter and Central Coast (LHCC) Region vegetation mapping, which covers the southern section of the proposed pipeline from KP 60 to KP 91.6 (NPWS 2000);
- Forest ecosystem Classification and Mapping of the Upper and Lower North East Comprehensive Regional Assessment (CRA) regions (NPWS 1999); and
- The Native Vegetation of New South Wales and the ACT (Keith 2004).

Only small sections of the amended pipeline route and GFDA had been assigned vegetation classification under these mapping systems. Where mapping existed the mapping was ground-verified during the surveys and further details on the dominant species within each community recorded. Where the amended pipeline route traversed unmapped native vegetation detailed records were taken and the communities mapped.

Endangered Ecological Communities (EECs)

Of particular focus was the potential presence of any endangered ecological communities listed under the TSC Act and EPBC Act. A list of species for each of the remnant vegetation patches was compared to characteristic species listed in the Scientific Committee Final Determinations for each of the EECs with the potential to occur within the locality. Other key characteristics such as elevation, soil type and hydrological requirements listed in the Final Determination for the EEC were also used in determining its presence or absence. This was particularly relevant to areas previously assessed which required clarification as these remnants were considered to represent EECs (refer to Section 3.6).

Threatened or Significant Flora

The likelihood of threatened species listed under the TSC Act and / or EPBC Act occurring within the GFDA and amended pipeline route was determined through consideration of vegetation type and condition, and the occurrence of habitat across the locality and review of literature and database records. Targeted surveys for threatened species were not undertaken. Instead data collected during the habitat surveys were used as a predictor of the likelihood of occurrence of these species given the habitat resources, vegetation community, terrain, soil type, level of connectivity and level of disturbance. Consideration was also given to detecting the presence of regionally significant species and those species listed as Rare or Threatened Australian Plants (RoTAP). Regionally significant flora are those which are uncommon, have narrow habitat requirements, are restricted to the local government areas or are close to the limit of their distribution in the area. In line with the central tenet of the precautionary principle it was assumed that if habitat was present for a threatened species then it was considered that the threatened species could potentially occur and assessments were undertaken accordingly.

2.2.3 Fauna

General

Habitat assessments were used to assess the likelihood of the presence of fauna and comprised an assessment of the nature and condition of habitats, specific resources and features of relevance for native fauna. In addition, indirect evidence of fauna (e.g. scats, feathers, fur, tracks, dens, nests, scratches, chew marks and owl wash) was recorded. Incidental records of fauna were also made during the course of the pipeline assessment.

Threatened or Significant Fauna

The likelihood of threatened species listed under the TSC Act and / or EPBC Act occurring across the assessed areas of the pipeline route was determined through consideration of vegetation type and condition, the occurrence of suitable habitat across the locality and its condition, and review of literature and database records. In line with the central tenet of the precautionary principle it was assumed that if habitat was present for a threatened species then it was considered that the threatened species could potentially use this resource and assessments were undertaken accordingly.

2.2.4 Aquatic Habitat Assessment

An assessment of aquatic habitats was undertaken for creeks and drainage lines traversed by the assessed areas of the amended pipeline route. A number of features were noted at each crossing and these included topography, water level, riparian vegetation, stream width, instream features, apparent water quality and riparian zone condition.

2.3 Impact Assessment

As required for Part 3A of the EP&A Act the project impact assessment was undertaken in accordance with the *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC 2007). As requested by the Department of Planning, Assessments of Significance were also undertaken for species, populations and communities of conservation value.

An assessment was also undertaken of the impacts of the project on ecological communities, populations and species listed under the EPBC Act using the Significant Impact Criteria detailed in the *EPBC Act Policy Statement 1.1 – Significant Impact Guidelines: Matters of National Environmental Significance* (DEH 2006).

Note that for the purposes of the impact assessment, the 'project' refers only to the portions of the project assessed in this report (refer Figures 1 - 8).

2.4 Limitations

All ecological assessments have limitations to the efficacy of the study. Of particular relevance to this study was that this assessment was largely based on predictive modelling using habitat assessment as it was undertaken over a short time period. Targeted surveys could not be undertaken limiting species records to incidental sightings. Adding to this, the field investigation was undertaken during a single season, again limiting the likelihood of opportunistic sightings as species may either be resident or transitory, whilst some species may have been inactive, dormant or with cryptic habits, and some may be nomadic or migratory in nature. Additionally, some fauna species are mobile or transient in their use of resources. Therefore, not all species, either resident or transitory, would have been recorded during the single assessment event.

This assessment was aimed at providing an overall assessment of the ecological values of the amended areas of the GFDA and pipeline route with particular emphasis on the likely occurrence of threatened species. In line with the central tenet of the precautionary principle it was assumed that if habitat was present for a threatened species then it was considered that the threatened species could potentially occur and assessments were made accordingly.

3 RESULTS

This report aims to describe the ecological values of the additional Stage 1 GFDA extension, the amended pipeline route and to provide clarification of three areas previously assessed. AECOM (2009) provides a broader ecological analysis of the project and its environmental setting, and consequently should be read in conjunction with this Addendum Report.

The amended sections of the proposed pipeline total approximately 26 km of which approximately 5.5 km contain remnant or regrowth vegetation. The majority of the native vegetation along the proposed pipeline route falls within the *Hunter-Macleay Dry Sclerophyll Forests* vegetation class which are transitional between the *Dry Coastal Valley Grassy Woodlands and Northern Hinterland Wet Sclerophyll Forests* of the steeper and wetter slopes (Keith 2004). The canopy vegetation is largely dominated by Spotted Gum (*Corymbia maculata*), Narrow-leaved Ironbark (*Eucalyptus crebra*), Grey Box (*E. moluccana*), Grey Gum (*E. punctata*), Small-fruited Grey Gum (*E. propinqua*) and Grey Ironbark (*E. siderophloia*). Shrubs are characterised by Silver-stemmed Wattle (*Acacia parvipinnula*), Forest Oak (*Allocasuarina torulosa*), Coffee Bush (*Breynia oblongifolia*), Gorse Bitter Pea (*Daviesia ulicifolia*) and Peach Heath (*Lissanthe strigosa*). White Root (*Pratia purpurascens*), Mulga Fern (*Cheilanthes sieberi subsp. sieberi*), Barbed Wire Grass (*Cymbopogon refractus*), Kangaroo Grass (*Themeda australis*) and Wiry Panic (*Entolasia stricta*) dominate the understorey. These areas grade into the mostly cleared, lower elevation areas of higher rainfall along the lower sections of the proposed pipeline. These areas become more saline-influenced closer to the Hunter River floodplain.

A précis of the findings for each assessment area of the amended pipeline is provided below and includes dominant flora species. A more detailed list of flora species recorded along the proposed pipeline route is provided in Appendix A.

3.1 Stage 1 GFDA Extension

3.1.1 General

Sections of the GFDA have previously been mapped by NPWS (1999) as *Ecosystem (ES) 145 Sydney Peppermint – Stringybark*, *ES 71 Ironbark*, *ES 47 Escarpment Redgum* and *ES 33 Dry Foothills Spotted Gum*. Well sites would be chosen to avoid intact native vegetation and consequently none of these vegetation communities would be removed during construction.

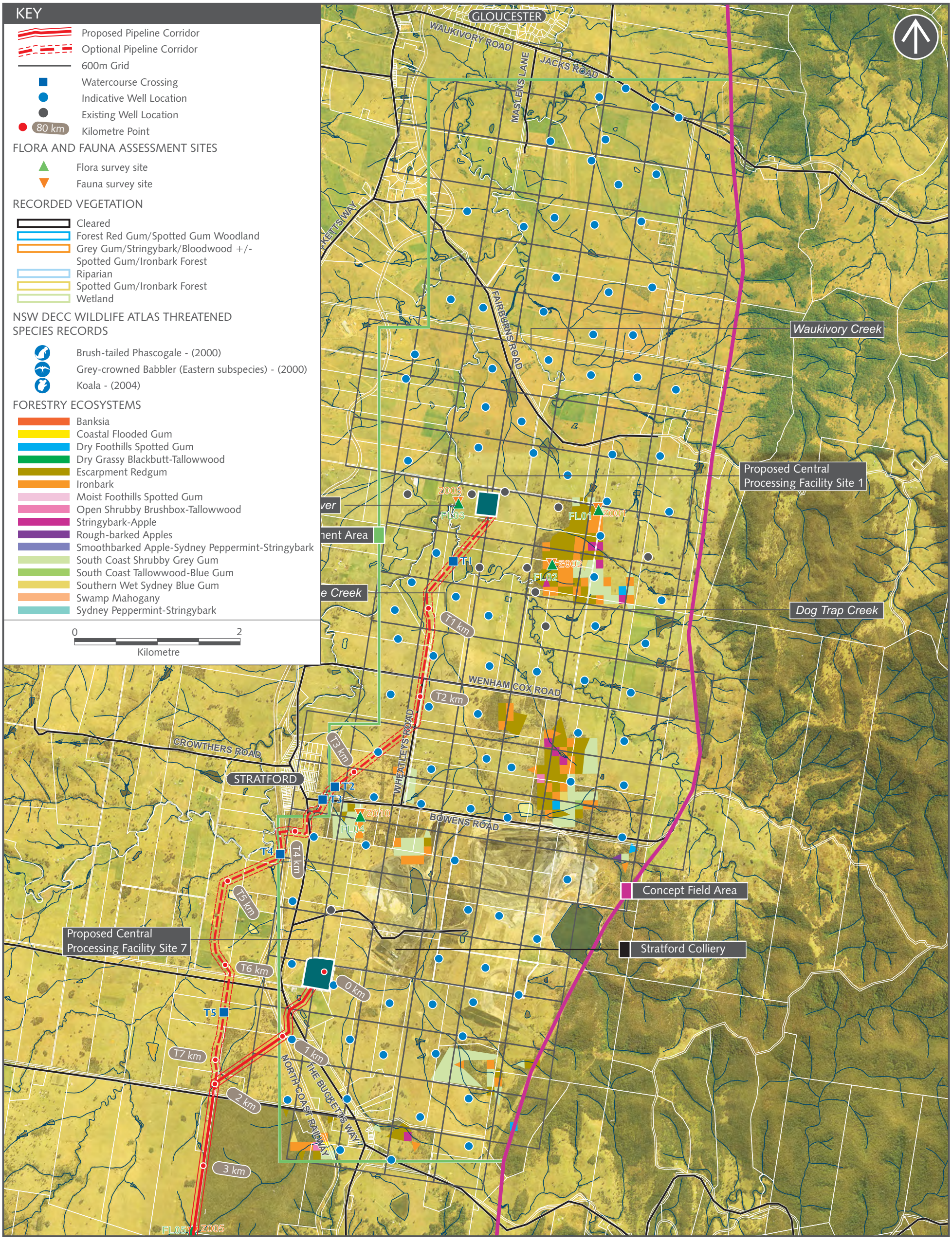
The Stage 1 GFDA extension is located along the south-western and southern boundaries and along the entire eastern boundary of the original GFDA (Figure 2). The location of the revised proposed well sites within this area are confined to the southern half of the GFDA and are all within modified environments that have been cleared of native vegetation, largely revegetated with introduced pasture species and have been used for grazing over a considerable number of years. None of the proposed sites contain remnant native shrubs or trees and none would be located in riparian areas or within seepage zones although some access roads would cross drainage lines.

The lack of structural diversity of the sites means that fauna habitat resources, such as trees, shrubs, rocky areas and fallen timber, are extremely limited and in general, habitat suitable for fauna would generally be limited to those common species of native and introduced fauna regularly found in disturbed areas. However, the Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) which is

listed as vulnerable under the TSC Act, is common to the Gloucester area and is often recorded in roadside reserves and woodland reserves. This Babbler was recorded (Figure 2) within a wooded area adjacent to the gathering lines of the proposed south-eastern most well and it is likely that this species would occur along the access tracks and adjacent woodlands of several of the other well sites.

3.1.2 Summary of Key Ecological Features of the Stage 1 GFDA Extension

- Native vegetation nearby;
- A number of drainage lines would be traversed; and
- Grey-crowned Babbler recorded in adjacent vegetation.



AECOM

FLORA AND FAUNA ASSESSMENT SITES, RECORDED VEGETATION ALONG PIPELINE ROUTE, NSW DECC WILDLIFE ATLAS THREATENED SPECIES RECORDS, FORESTRY ECOSYSTEMS AND WATERCOURSE CROSSINGS - STAGE 1 GAS FIELD DEVELOPMENT AREA

FIGURE 2

3.2 Amended Pipeline Rev E KP 17 - 25

This section of the proposed pipeline traverses cleared paddocks, woodlands and several drainage lines (Figure 3 and Figure 4).

3.2.1 Vegetation

There is no previous mapping provided by NPWS (1999) for this section of the proposed pipeline. Woodland communities along this section of the amended pipeline route have been mapped in this study as *Spotted Gum – Ironbark Forest* due to the dominance of Spotted Gum (*Corymbia maculata*) and Narrow-leaved Ironbark (*Eucalyptus crebra*).

Spotted Gum – Ironbark Forest occurs between KP 18 and 20. Grey Gum (*Eucalyptus punctata*), and Grey Box (*Eucalyptus moluccana*) also occur sporadically and on occasion become co-dominant. Most of these trees are regrowth although there are some fully mature specimens throughout especially along the ridgeline at KP 20. The shrub layer of the *Spotted Gum – Ironbark Forest* is dominated by Peach Heath, Coffee Bush, Prickly Moses (*Acacia ulicifolia*), Blackthorn (*Bursaria spinosa*) and Cherry Ballart (*Exocarpos cupressiformis)*. The ground layer is comprised of Mulga Fern, Barbed Wire Grass, Bordered Panic (*Entolasia marginata*), *Glycine clandestina*, Blady Grass (*Imperata cylindrica*) and Dusky Coral Pea (*Kennedia rubicunda*). Weed species are relatively infrequent but occasional infestations of Lantana (*Lantana camara*) and Blackberry (*Rubus fruiticosus*) occur in places as does Veined Verbena (*Verbena rigida*), Fireweed (*Senecio madagascariensis*) and a range of flat weeds, all of which are recognised as agricultural weeds.

The remaining pipeline route from approximately KP 20 – 25 traverses rolling paddocks containing scattered paddock trees and several steep sided ridges, two of which are vegetated with stands of trees. Of particular note is the steep ridge at KP 23 which is well vegetated with Spotted Gum, Grey Gum and Grey Box. This areas is used by cattle as a camp and consequently the understorey is largely absent although Kangaroo Grass was present throughout, as was fallen timber. Although largely isolated from other patches of trees there is a loose connection to vegetation to the east and Mammy Johnsons River via sparsely scattered eucalypts.

3.2.2 Fauna habitat

The lack of structural diversity of the cleared paddocks means that fauna habitat resources, such as trees, shrubs, rocky areas and fallen timber, are extremely limited and in general, habitat suitable for fauna would be limited to those common species of native and introduced fauna regularly found in disturbed areas.

However, the generally intact remnant and regrowth vegetation communities would provide good quality habitat for a range of native fauna including macropods, microchiropteran bats, some arboreal mammals and woodland birds. Macropod scats were recorded along the proposed pipeline route and the Eastern Grey Kangaroo (*Macropus giganteus*) and Eastern Wallaroo (*Macropus robustus*) were both sighted. Cattle pats scattered along the pipeline indicated that many of these areas are currently used for grazing of cattle (*Bos taurus*). Scratches on some of the smooth barked Eucalypts indicate that these trees were being used by arboreal mammals. Hollows were evident in some of the larger trees and these could provide habitat suitable for hollow-dependent birds, possums, gliders and microchiropteran bats.

This section of the pipeline route is a part of a patch of vegetation that would provide east – west stepping stone habitat for mobile and dispersing fauna and flora. Although densely vegetated links do not occur, scattered paddock trees and riparian vegetation along Karuah River, Mammy Johnsons River, creeks and other drainage lines would provide loose but adequate connections for some species between densely vegetated areas within Buckleys Range, Copper Mine Ridge and vegetation beyond.

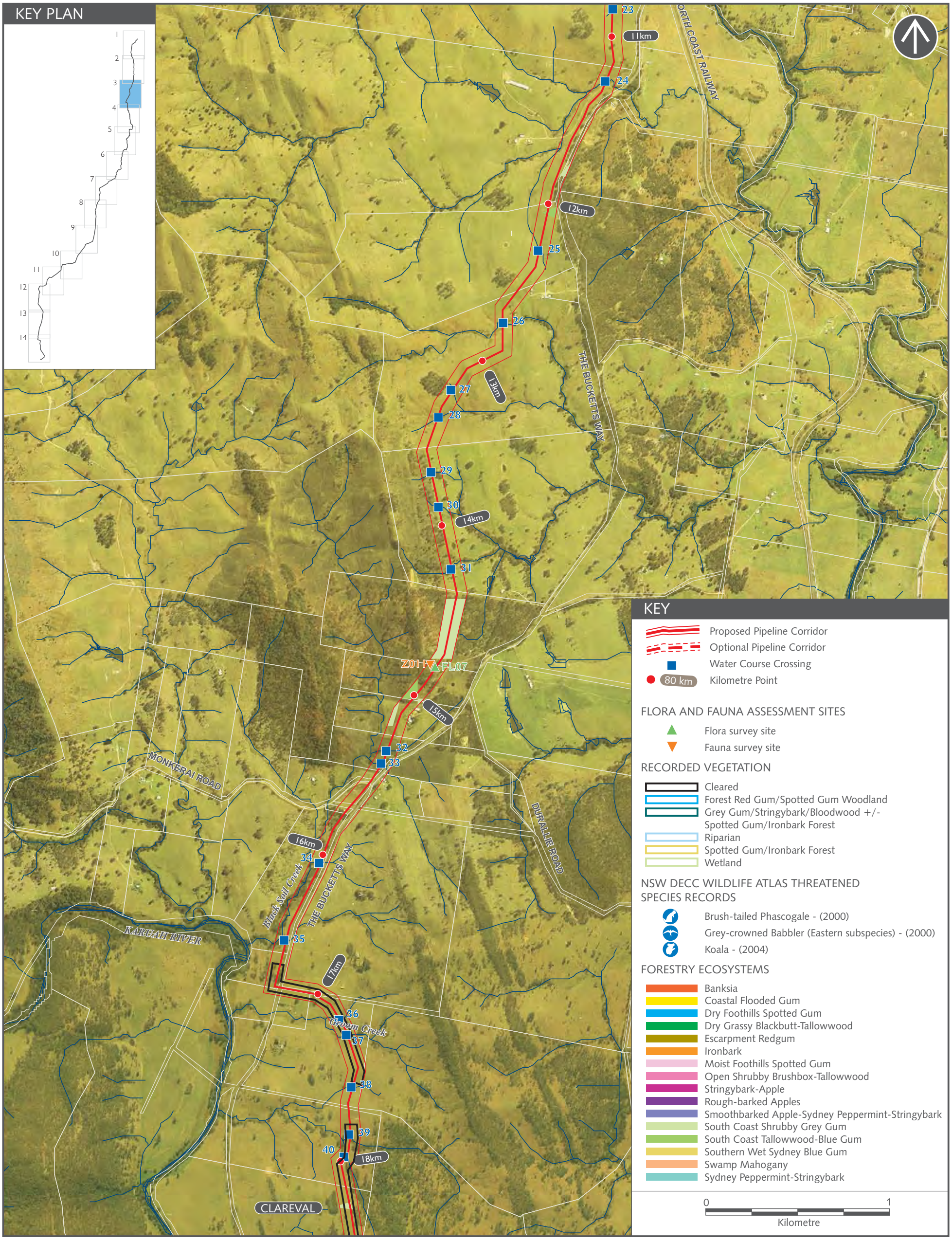
3.2.3 Aquatic environments

Groom Creek and several drainage lines which drain into the Karuah River occur along this section of the proposed pipeline route. The majority of these drainage lines are broad and eroded, grassed or bare ground gullies, the majority of which show signs of pugging by cattle. Common species within these drainage lines included Blady Grass, Spear Thistle (*Cirsium vulgare*), Giant Parramatta Grass (*Sporobolus fertilis*) and *Carex* sp. There were several steeper sided eroded channels that were better vegetated and these supported species such as Grey Gum, Prickly-leaved Tea Tree (*Melaleuca styphelioides*), Grey Myrtle (*Backhousia myrtifolia*), Native Raspberry (*Rubus parvifolius*), Maidenhair Fern (*Adiantum aethiopicum*), Silver-stemmed Wattle, Peach Heath, Kidney Weed (*Dichondron repens*), *Carex* sp. and large areas of Lantana. The catchment area of this section of the pipeline route is reality small due to the steepness of the ridgeline to the east of the pipeline route. The pipeline traverses the headwaters of a number of these drainage lines. Whilst the majority of the drainage lines had no flow at the time of the assessment, headwaters are considered to be important sites for processing of organic matter and nutrient cycling and are thought to contribute to the maintenance of health of whole river networks (various authors cited in Clarke *et al*. 2008). Several small farm dams occur nearby to the proposed pipeline route. These are mostly unvegetated areas and these would be avoided.

3.2.4 Summary of Key Ecological Features of Amended Pipeline KP 17 – 25

- Route passes through native vegetation; and
- The headwaters of a number of drainage lines would be traversed.

KEY PLAN



KEY

- Proposed Pipeline Corridor
- Optional Pipeline Corridor
- Water Course Crossing
- 80 km Kilometre Point

FLORA AND FAUNA ASSESSMENT SITES

- Flora survey site
- Fauna survey site

RECORDED VEGETATION

- Cleared
- Forest Red Gum/Spotted Gum Woodland
- Grey Gum/Stringybark/Bloodwood +/- Spotted Gum/Ironbark Forest
- Riparian
- Spotted Gum/Ironbark Forest
- Wetland

NSW DECC WILDLIFE ATLAS THREATENED SPECIES RECORDS

- Brush-tailed Phascogale - (2000)
- Grey-crowned Babbler (Eastern subspecies) - (2000)
- Koala - (2004)

FORESTRY ECOSYSTEMS

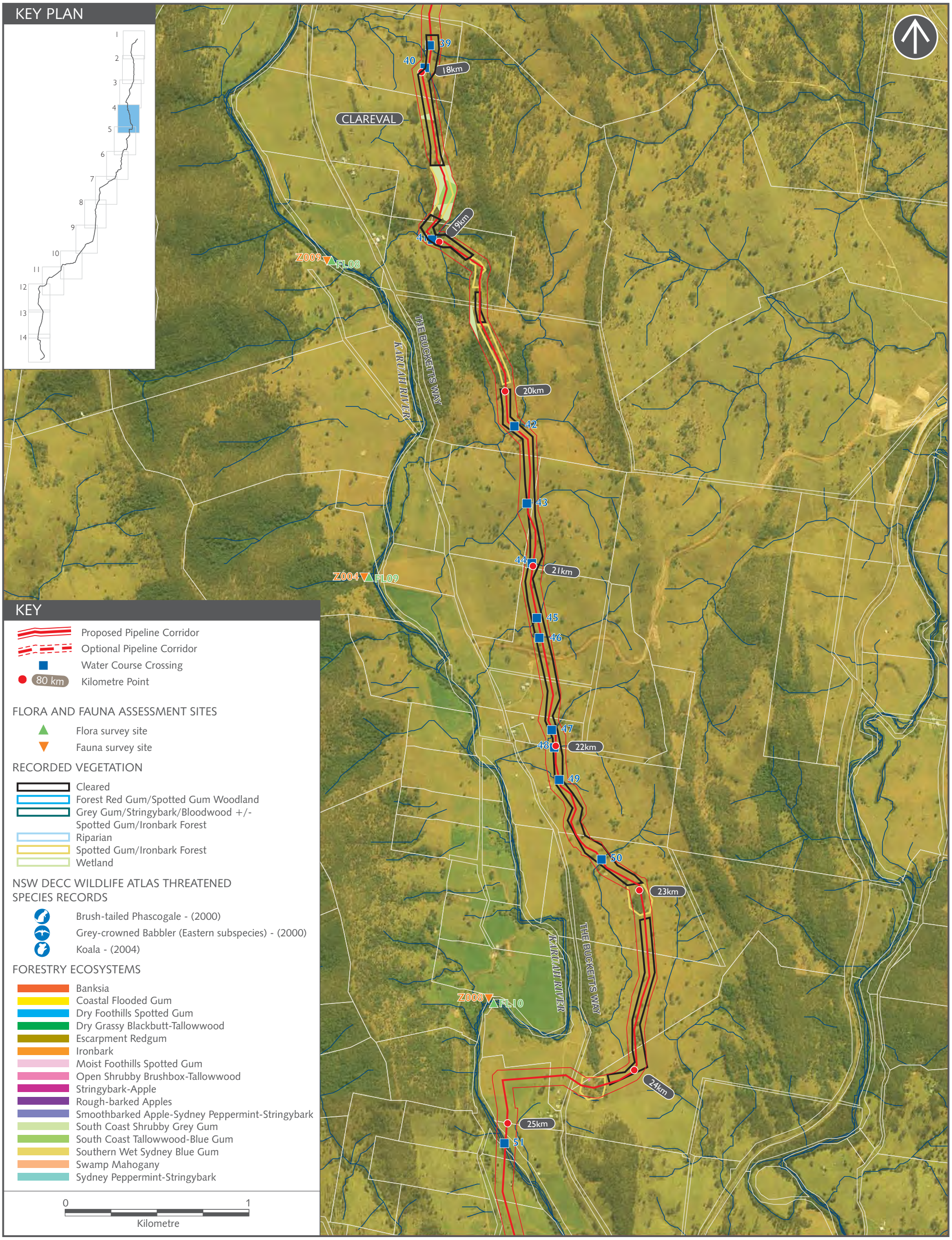
- Banksia
- Coastal Flooded Gum
- Dry Foothills Spotted Gum
- Dry Grassy Blackbutt-Tallowwood
- Escarpment Redgum
- Ironbark
- Moist Foothills Spotted Gum
- Open Shrubby Brushbox-Tallowwood
- Stringybark-Apple
- Rough-barked Apples
- Smoothbarked Apple-Sydney Peppermint-Stringybark
- South Coast Shrubby Grey Gum
- South Coast Tallowwood-Blue Gum
- Southern Wet Sydney Blue Gum
- Swamp Mahogany
- Sydney Peppermint-Stringybark

0 1
Kilometre

AECOM

FLORA AND FAUNA ASSESSMENT SITES AND NSW DECC WILDLIFE ATLAS THREATENED SPECIES RECORDS AND FORESTRY ECOSYSTEMS ALONG PIPELINE ROUTE KILOMETRE POINT 11 - 18KM

FIGURE 3



AECOM

FLORA AND FAUNA ASSESSMENT SITES AND NSW DECC WILDLIFE ATLAS THREATENED SPECIES RECORDS AND FORESTRY ECOSYSTEMS ALONG PIPELINE ROUTE KILOMETRE POINT18 - 25KM

FIGURE 4

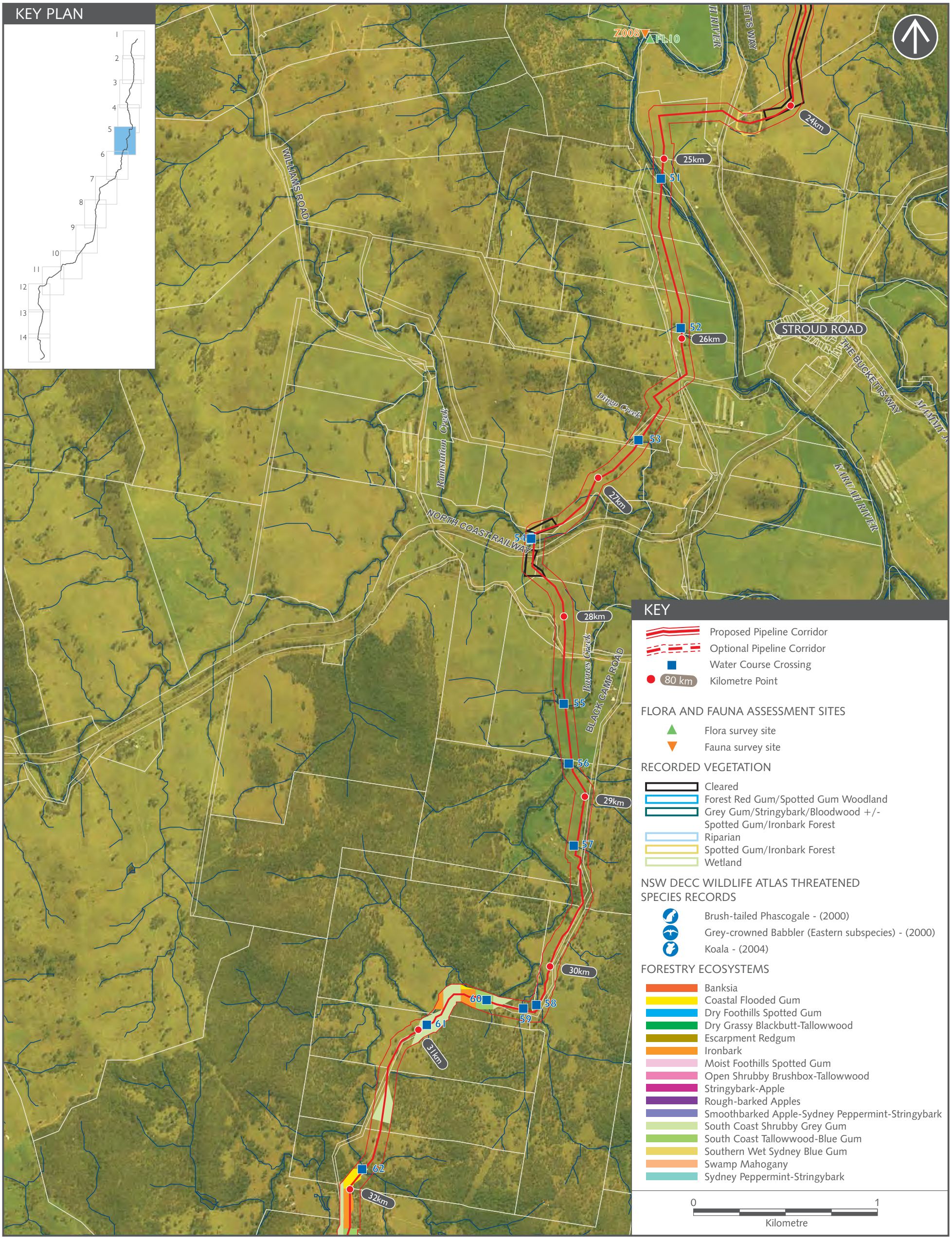
3.3 Amended Pipeline Route Rev E KP 27.5

The pipeline route was amended near KP 27.5 to cross Ramstation Creek (Figure 5) approximately 250 m to the west of the Rev C alignment. The approach to the new point of crossing passes through a paddock and crosses an open area between a patch of Forest Red Gum saplings (*Eucalyptus tereticornis*) and Flax-leaved Paperbark (*Melaleuca linariifolia*) on the floodplain.

The riparian area of Ramstation Creek has been cleared and any vegetation remaining occurs below the top of bank. At the point of crossing, the creek channel is approximately 15 m wide and 4 m deep. The sides are comprised of compacted silt material and are badly eroded. On the day of assessment the creek was flowing gently and several snags were present along the reach. Cattle access the creek and this activity may have contributed to the degree of erosion. A small terrace area down from the top of bank was infested with Stinging Nettles. The remaining riparian vegetation was dominated by Spiny-headed Mat-rush (*Lomandra longifolia*), Maidenhair, Grey Myrtle with River Oak (*Casuarina cunninghamiana*) occurring nearby. On the southern side of the creek the pipeline would traverse a small area of paddock before traversing a railway line.

3.3.1 Summary of Key Ecological Features of Amended Pipeline KP 27.5

- Riparian areas and aquatic environment of Ramstation Creek.



AECOM

FLORA AND FAUNA ASSESSMENT SITES AND NSW DECC WILDLIFE ATLAS THREATENED SPECIES RECORDS AND FORESTRY ECOSYSTEMS ALONG PIPELINE ROUTE KILOMETRE POINT 25 - 32KM

FIGURE 5

3.4 Amended Pipeline Rev E KP 71.5 - 83

This section of the proposed pipeline traverses several landscape types including cleared paddocks, swampy ground and well vegetated areas (Figure 6, Figure 7, Figure 9 and Figure 11).

3.4.1 Vegetation

Areas between KP 71.5 and 73.8 and KP 76 and 77 have previously been mapped as *SE 71 Ironbark* and *SE 134 South Coast Shrubby Grey Gum* by NPWS (1999).

The proposed pipeline route between KP 71.5 and 73.8 traverses a steep and rocky ridgeline and partly follows a powerline easement bordered by intact and mature forest. Canopy species along this section are generally dominated by Spotted Gum and Ironbark with Grey Gum, Bloodwood, Red Gum and Grey Box grading in and out of co-dominance depending on drainage and elevation. Much of this area is densely infested with Lantana although in other areas, especially nearer KP 74, there is an intact understorey. Shrub species are characterised by Peach Heath, Prickly Moses, Blackthorn, Dogwood (*Jacksonia scoparia*) and Prickly Beard-heath (*Leucopogon juniperinus*). Groundcover species were also diverse in places and included, Mulga Fern, Blady Grass, Old Man's Beard (*Clematis aristata*), Purple Coral Pea (*Hardenbergia violacea*), Blue Flax-lily (*Dianella caerulea var. producta*), Wiry Panic, *Glycine tabacina*, Dusky Coral Pea, Whiteroot, Barbed Wire Grass, Threeawn Speargrass (*Aristida vagans*) and *Drosera* sp.

From KP 76 to 78 the pipeline route passes through paddocks and adjacent to a remnant patch of woodland at around KP 75.4 and through another remnant woodland patch at KP 76. Both of these woodland patches are dominated by mature Spotted Gum, Forest Red Gum, Grey Gum, Grey Box and Ironbark. Trees are large and mature in both woodland patches. However, the woodland remnant at KP 75.4 contains a number of very large and old specimens and has a largely intact grassy understorey characterised by Wiry Panic, Bordered Panic, Kangaroo Grass, Whiteroot, Mulga Fern, Prickly Moses and Blackthorn. Weed species included Lantana, Apple of Sodom (*Solanum linnaeanum*) and Fireweed. The woodland at around KP 76 is more degraded with the understorey almost completely comprised of introduced pasture species and fewer signs of saplings growing throughout which is likely to reflect the differences in grazing history.

It is likely that these two woodland remnants are characteristic of *Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions*, an EEC listed under the TSC Act (see Section 3.7.2).

From KP 77 to 83 the proposed pipeline route traverses low-lying paddocks. It passes close to paddock trees and clumps of vegetation which is characteristic of poorly drained areas such as River Oak and Flax-leaved Paperbark. Other species present within the paddocks were Kikuyu (*Pennisetum clandestinum*), *Carex* sp. and *Juncus pallidus* and the dominance of each varied with the degree of waterlogging of the paddock.

3.4.2 Fauna habitat

The proposed pipeline route between KP 71.5 and 73.5 traverses the edge of intact forest which is contiguous with a large tract of vegetation to the west. Consequently, this area could provide habitat for a wide range of fauna, especially those which have large home ranges or particular habitat requirements provided by steep and rocky country. There were several areas of exposed rock

benches and these would also provide ideal basking habitat for reptiles especially given that well vegetated areas occur nearby. The remnant woodland patches and paddock trees which occur along the pipeline route are more isolated and degraded and consequently these would most likely provide habitat for more mobile species such as woodland birds and microchiropteran bats. The open paddock areas would also provide habitat for water birds during times of inundation.

The two patches of remnant *Hunter Lowland Redgum Forest* and Deadmans Creek (see Section 3.4.3) are mapped as Koala habitat in the *Port Stephens Council Comprehensive Koala Plan of Management*.(CKPoM; Port Stephens Council 2002) The importance of these areas as Koala habitat is discussed further in Section 3.7.6.

3.4.3 Aquatic environments

This section of the proposed pipeline route traverses several drainage lines, channels and passes nearby to small farm dams.

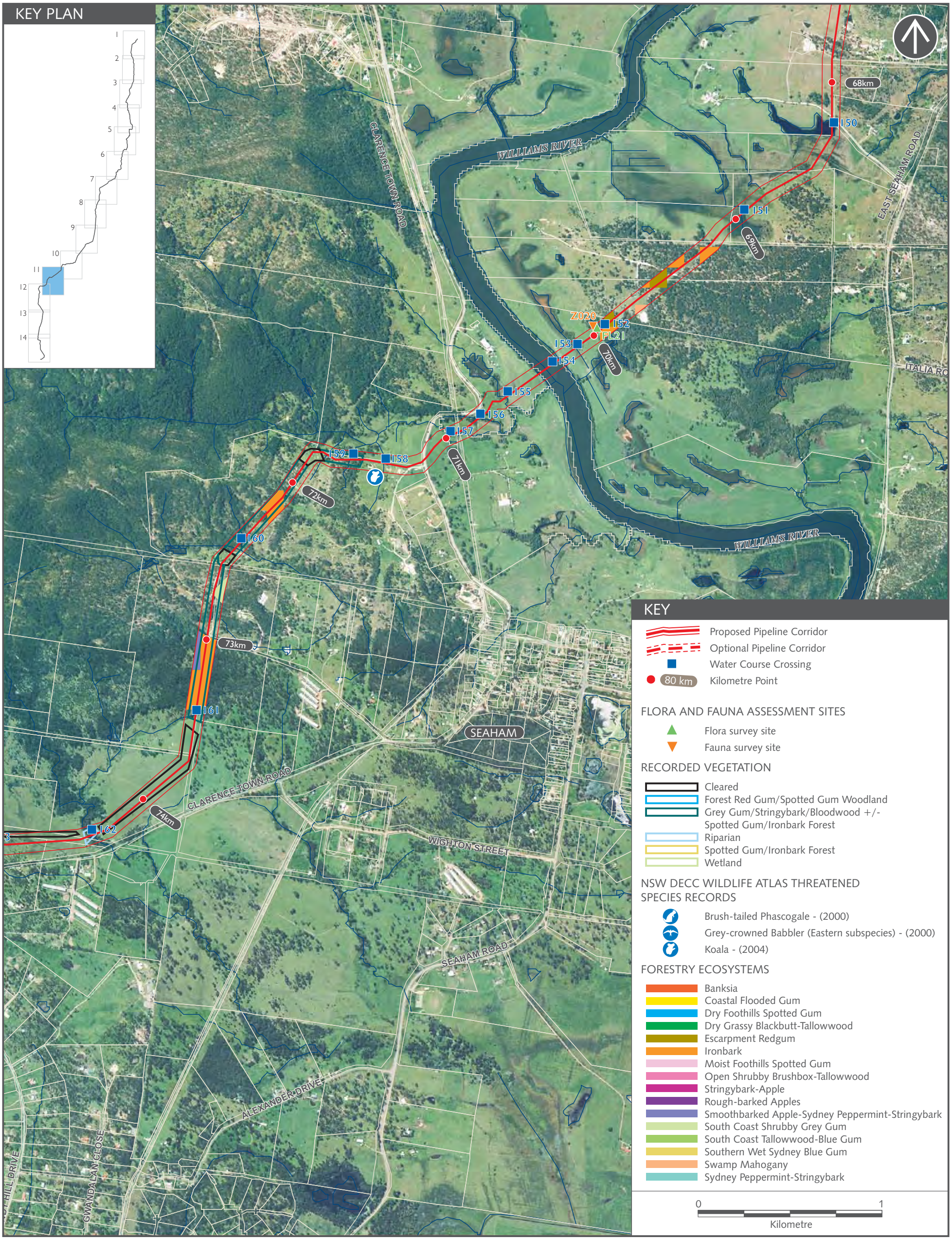
The most substantial of the creek crossings is Deadmans Creek located at approximately KP 74.3. Although disturbed, this creek contains several small pools and instream vegetation such as Slender Knotweed (*Persicaria decipien*s). The pools are connected by 'runs' and on the day of assessment water was flowing between the pools. Brown algae covers some sections of the banks and snags indicating nutrient enrichment. Some sections of the banks are infested with Lantana and Blackberry but in general there is relatively good diversity within the riparian area. Vegetation is characterised by Green Wattle (*Acacia parramattensis*), Common Bracken (*Pteridium esculentum*), Whiteroot, Kidney Weed, Prickly-leaved Tea Tree, Common Silkpod (*Parsonsia straminea*), Blackthorn, Broad-leaved White Mahogany (*Eucalyptus umbra*), Mulga Fern, Peach Heath, Old Man's Beard, Weeping Grass (*Microlaena stipoides*), Forest Red Gum, Cheese Tree (*Glochidion ferdinandi*) and Grey Myrtle.

The remaining drainage line crossings are characterised by open eroded channels largely devoid of vegetation other than weeds and agricultural grasses. The low-lying areas from KP 77 to 83 were waterlogged on the day of assessment although no standing water was evident. Several small farm dams also occur nearby to the proposed pipeline route. These are mostly unvegetated areas that would be avoided.

3.4.4 Summary of Key Ecological Features of Amended Pipeline KP 71.5 - 83

- Intact remnant vegetation;
- *Hunter Lowland Redgum Forest* – EEC;
- EEC remnants also mapped as 'Marginal Koala Habitat' under the *Port Stephens Council CKPoM* (Port Stephens Council 2002);
- Riparian areas and aquatic environment of Deadmans Creek; and
- Deadmans Creek mapped as 'Preferred Koala Habitat' under the *Port Stephens Council CKPoM* (Port Stephens Council 2002).

KEY PLAN



KEY

- Proposed Pipeline Corridor
- Optional Pipeline Corridor
- Water Course Crossing
- 80 km Kilometre Point

FLORA AND FAUNA ASSESSMENT SITES

- Flora survey site
- Fauna survey site

RECORDED VEGETATION

- Cleared
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- Grey Gum/Stringybark/Bloodwood +/- Spotted Gum/Ironbark Forest
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- Spotted Gum/Ironbark Forest
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NSW DECC WILDLIFE ATLAS THREATENED SPECIES RECORDS

- Brush-tailed Phascogale - (2000)
- Grey-crowned Babbler (Eastern subspecies) - (2000)
- Koala - (2004)

FORESTRY ECOSYSTEMS

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- Dry Grassy Blackbutt-Tallowwood
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- Smoothbarked Apple-Sydney Peppermint-Stringybark
- South Coast Shrubby Grey Gum
- South Coast Tallowwood-Blue Gum
- Southern Wet Sydney Blue Gum
- Swamp Mahogany
- Sydney Peppermint-Stringybark

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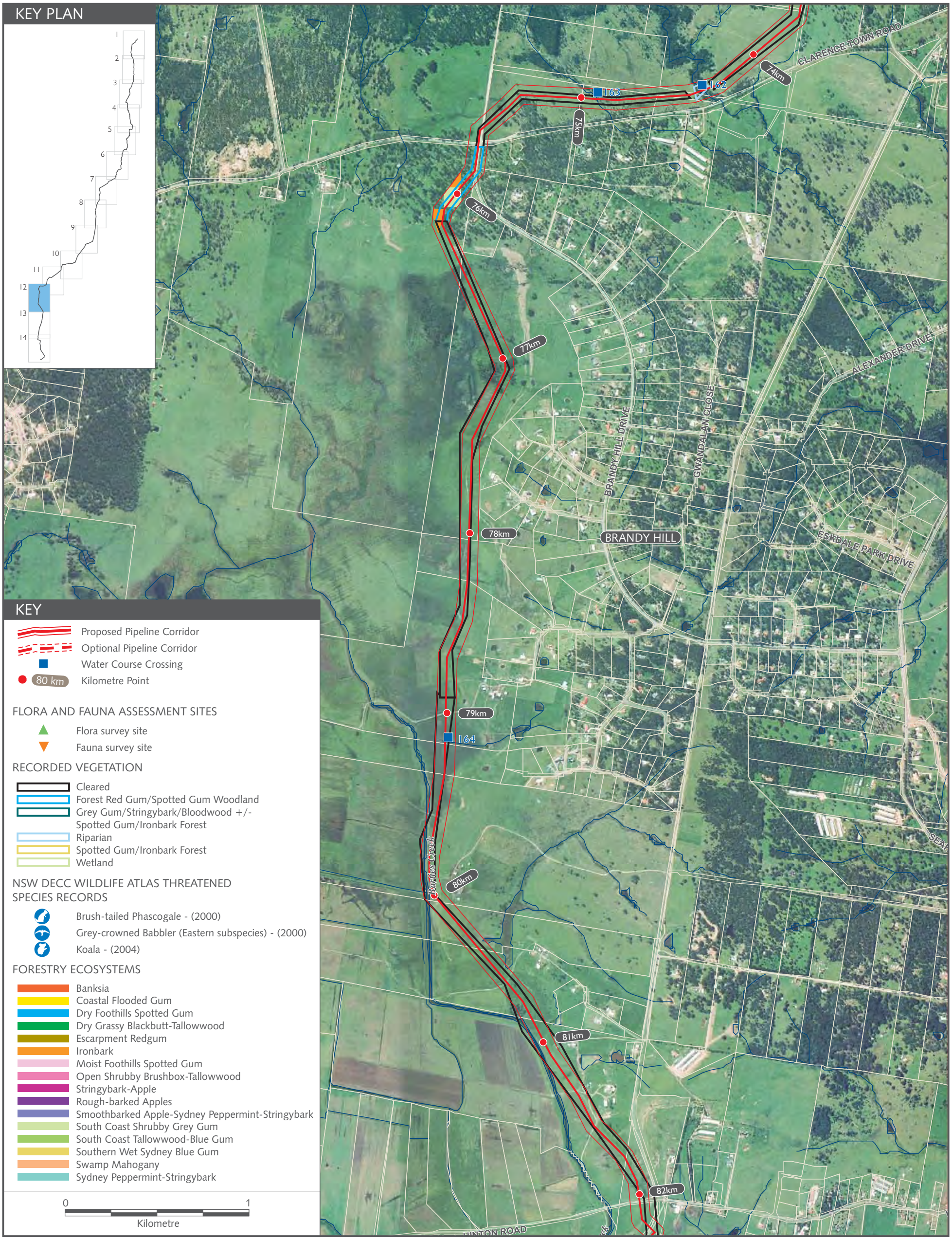
Kilometre

AECOM

FLORA AND FAUNA ASSESSMENT SITES AND NSW DECC WILDLIFE ATLAS THREATENED SPECIES RECORDS AND FORESTRY ECOSYSTEMS ALONG PIPELINE ROUTE KILOMETRE POINT 68 - 74KM

FIGURE 6



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FLORA AND FAUNA ASSESSMENT SITES AND NSW DECC WILDLIFE ATLAS THREATENED SPECIES RECORDS AND FORESTRY ECOSYSTEMS ALONG PIPELINE ROUTE KILOMETRE POINT 74 - 82KM

FIGURE 7

3.5 Amended Pipeline Rev E KP 89.5 - 95

This section of the proposed pipeline traverses several landscape types which include cleared paddocks, swampy ground and two SEPP 14 Coastal Wetlands (Figure 8 and Figure 11). HDD would be used to pass under the Hunter River and SEPP 14 wetlands.

3.5.1 Vegetation

Freshwater Wetland Complex was mapped by LHCCREMS (NPWS 2000) as occurring between KP 89.5 and 90. Ground-verification of this mapping showed that the areas mapped as *Freshwater Wetland Complex* were Kikuyu dominated pastures used for cattle grazing.

At approximately KP 89.1 the proposed pipeline passes adjacent to an area mapped by AECOM (2009) as *Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions* (an EEC) before heading south through cleared paddocks and through gaps between several groups of Swamp Oak (*Casuarina glauca*) and paperbark trees (*Melaleuca* spp.) to approximately KP 92.4 where it crosses the north arm of the Hunter River. Tomago SEPP 14 Coastal Wetlands No. 830 and 831 are located on the southern side of the Hunter River, both of which contain reedlands, saltmarsh and mangrove communities. Adjacent to Wetland No. 831 is a caravan park located on a raised platform of fill which has been grassed and landscaped with Weeping Willows (*Salix babylonica*), Radiata Pines (*Pinus radiata*) and other common landscaping species. The surrounding areas at the base of the fill batters appear to be used as an illegal dumping site for building and household refuse. The proposed pipeline route joins Old Punt Road adjacent to the SEPP 14 Wetland No. 831. The boundary of this wetland is bordered by weeds such as Whisky Grass (*Andropogon virginicus*), Lantana, Sharp Rush (*Juncus acutus*), Kikuyu and Pampas Grass (*Cortaderia selloana*). The proposed pipeline route then crosses the north arm of the Hunter River again and emerges at Hexham.

3.5.2 Fauna habitat

The Tomago Wetlands and the Hunter River north arm are upstream of the Hunter Estuary National Park. Kooragang Island, Hunter Estuary, Hexham Swamp, and a section of Ash Island form part of the Hunter Estuary National Park (formerly the Kooragang Nature Reserve) and these areas are known to support significant fauna habitat including:

- SEPP14 Wetlands 830 and 831;
- Hunter Estuary National Park;
- Tidal creeks;
- Green and Golden Bell Frog (*Litoria aurea*) habitat (TSC and EPBC Act listed species);
- Grass Owl (*Tyto capensis*) habitat (TSC Act listed species);
- Migratory wader habitat (many of which are protected under the EPBC Act);
- Mangrove forests (protected under the FM Act); and
- Coastal Saltmarsh (EEC listed under the FM Act) areas within the wetlands and in the locality.

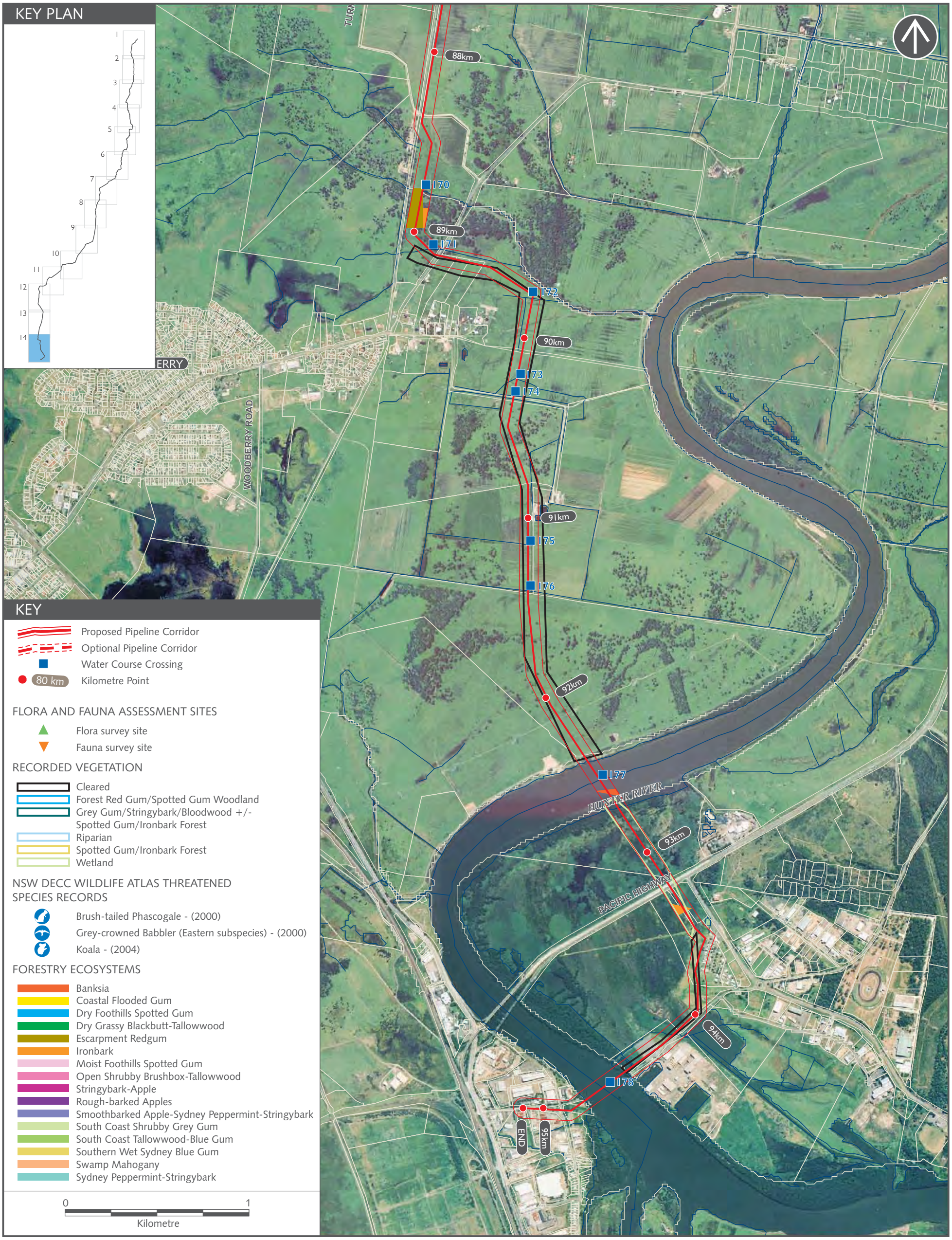
3.5.3 Aquatic environments

The amended pipeline route passes through paddocks, many of which appear to be drained using constructed earthen drainage channels. These areas are largely devoid of vegetation other than low growing pasture grasses and hence would not provide high quality fauna habitat due to their lack of complexity.

Tomago Wetlands (Coastal Wetlands No. 830 and 831) are upstream from Kooragang Island / Hunter Estuary which is known to provide internationally recognised water bird habitat as well as providing habitat for a number of threatened species listed under the TSC Act and EPBC Act.

3.5.4 Key Ecological Features of the Amended Pipeline KP 89.5 – 96

- Riparian area and aquatic habitat of the Hunter River;
- Internationally recognised migratory wader habitat;
- Hunter Estuary National Park is located downstream of the crossing points of the Hunter River north arm;
- SEPP 14 Coastal Wetlands No. 830 and 831;
- Adjacent Swamp Oak Floodplain Forest at KP 89.5;
- Listed migratory water bird habitat;
- Coastal Saltmarsh listed under the FM Act;
- Mangrove communities protected under the FM Act; and
- Threatened species including Grass Owl (TSC Act) and Green and Golden Bell Frog (TSC Act and EPBC Act).

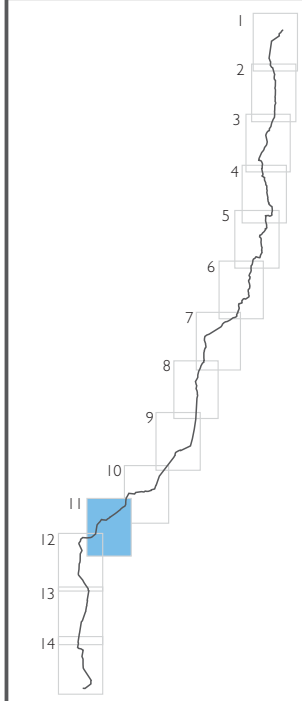


AECOM

FLORA AND FAUNA ASSESSMENT SITES AND NSW DECC WILDLIFE ATLAS THREATENED SPECIES RECORDS AND FORESTRY ECOSYSTEMS ALONG PIPELINE ROUTE KILOMETRE POINT 88 - END

FIGURE 8

KEY PLAN



WILLIAMS RIVER
CLARENCE TOWN ROAD
EAST SEAHAM ROAD
ITALIA RO
68km
69km
70km
71km
72km
73km
74km
150
151
152
153
154
155
156
157
158
159
160
161
162
SEAHAM
WIGHTON STREET
SEAHAM ROAD
ALEXANDER DRIVE
GWANDALAN CLOSE
HILL DRIVE

KEY

- Proposed Pipeline Corridor
- Water Course Crossing
- 80 km Kilometre Point

LHCCREMS Vegetation Mapping

- Alluvial Tall Moist Forest
- Freshwater Wetland Complex
- Hunter Lowland Redgum Forest
- Hunter Valley Dry Rainforest
- Hunter Valley Moist Forest
- Lower Hunter Spotted Gum - Ironbark Forest
- Seaham Spotted Gum Ironbark Forest
- Swamp Mahogany - Paperbark Forest
- Swamp Oak Rushland Forest
- Mangrove Estuarine Complex

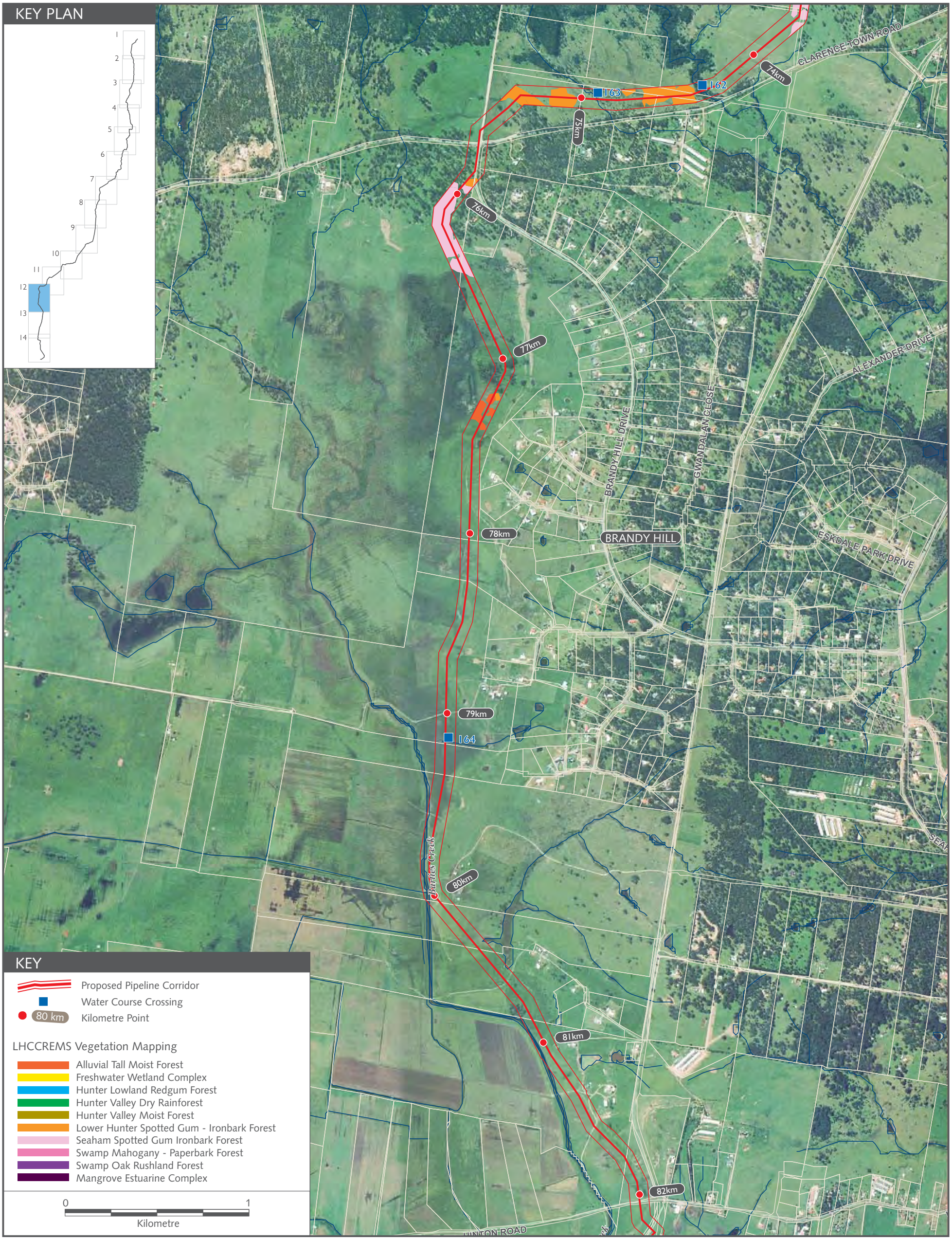
0 1
Kilometre

AECOM

EXTANT VEGETATION OF THE LOWER HUNTER & CENTRAL COAST
KILOMETRE POINT 68 - 74KM

FIGURE 9

KEY PLAN



KEY

- Proposed Pipeline Corridor
- Water Course Crossing
- 80 km Kilometre Point

LHCCREMS Vegetation Mapping

- Alluvial Tall Moist Forest
- Freshwater Wetland Complex
- Hunter Lowland Redgum Forest
- Hunter Valley Dry Rainforest
- Hunter Valley Moist Forest
- Lower Hunter Spotted Gum - Ironbark Forest
- Seaham Spotted Gum Ironbark Forest
- Swamp Mahogany - Paperbark Forest
- Swamp Oak Rushland Forest
- Mangrove Estuarine Complex

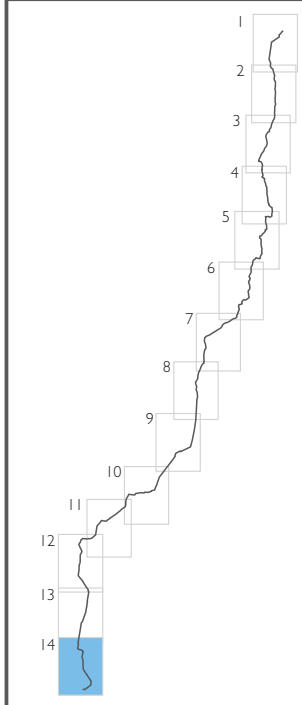
0 1
Kilometre

AECOM

EXTANT VEGETATION OF THE LOWER HUNTER & CENTRAL COAST
KILOMETRE POINT 74 - 82KM

FIGURE 10

KEY PLAN



88km
170
89km
171
172
90km
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91km
175
176
92km
177
93km
94km
178
END
95km
TURR
ERRY
WOODBERRY ROAD
MAIN NORTHERN RAILWAY
TARRO
NEW ENGLAND HIGHWAY
HUNTER RIVER
PACIFIC HIGHWAY

KEY

- Proposed Pipeline Corridor
- Water Course Crossing
- 80 km Kilometre Point

LHCCREMS Vegetation Mapping

- Alluvial Tall Moist Forest
- Freshwater Wetland Complex
- Hunter Lowland Redgum Forest
- Hunter Valley Dry Rainforest
- Hunter Valley Moist Forest
- Lower Hunter Spotted Gum - Ironbark Forest
- Seaham Spotted Gum Ironbark Forest
- Swamp Mahogany - Paperbark Forest
- Swamp Oak Rushland Forest
- Mangrove Estuarine Complex

0 1
Kilometre

AECOM

EXTANT VEGETATION OF THE LOWER HUNTER & CENTRAL COAST
KILOMETRE POINT 88 - END

FIGURE 11

3.6 Areas of Clarification

The ecological features of these areas have been clarified although no further impact assessment has been undertaken for these areas as they form part of the assessment undertaken by AECOM (2009).

3.6.1 Freshwater Wetlands Rev. C KP 68

An ephemeral wetland dominated by sedges was recorded along approximately 0.9 km of the pipeline route near the Williams River at Rev. C KP 68 (AECOM 2009, Fig 10.1.15). The pipeline would transect the wetland for approximately 0.15 km, an artificial drainage channel which is fringed by sedges for about 5 to 10 m and pass through cleared pasture just east of the wetland for 0.7 km (AECOM 2009). This ephemeral wetland was considered to be representative of *Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*, an EEC listed under the TSC Act.

This area is most likely representative of this EEC. On-ground discussions at the time of reassessment resulted in the proposed pipeline route being relocated to the northern side of the powerline easement thus avoiding a large part of this wetland area and avoiding the most intact and diverse section altogether. However, where the proposed pipeline route traverses an additional wetland to the north at around KP Rev. C 67.3 it is recommended that this area be underbored using horizontal directional drilling (HDD) to avoid direct impacts.

3.6.2 Swamp Sclerophyll Forest Rev. C KP 69.5

Approximately 30 m of a paperbark swamp is traversed by the proposed pipeline at Rev. C KP 69.5 (AECOM 2009, Fig 10.1.15), just north of the Williams River. At this location a 10 m wide strip directly underneath a powerline has been completely cleared but 10 to 20 m on either side contain well established regenerating paperbark trees (AECOM 2009). This area is not only a SEPP 14 wetland but is also considered to be representative of *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*, an EEC listed under the TSC Act (AECOM 2009).

AECOM (2009) recommended that to reduce impacts on this EEC and SEPP 14 wetland, construction impacts should be confined to the powerline easement. A review of this recommendation has shown that from an engineering perspective that some clearing outside of the easement would be necessary. Consequently, a review of the potential impacts on this SEPP 14 wetland and EEC was sought.

This review found that this area is a highly sensitive area of conservation significance that should be avoided. The outcome of the on ground reassessment is that the entire area would be horizontally directionally drilled. The drilling platform would be located in an already cleared area at approximately Rev. C KP 68.8 and all direct impacts would be avoided.

3.6.3 Creek Crossing Rev. C KP 49.5

The pipeline route crosses a tributary of Bridge Creek at around Rev. C KP 49.5 (AECOM 2009, Fig 10.1.11) and would require the removal of around 0.08 ha of riparian vegetation. This removal could be avoided if HDD is used instead of open trenching of the pipeline. AECOM (2009) recommended that HDD be used at this crossing. Since then, an engineering assessment has determined that this

would not be possible. Consequently a review of the potential impacts on this creek and rainforest vegetation was sought.

This review found that the area of crossing would occur at the headwaters of this tributary. The approach to this creek is through paddocks used for cattle grazing. A very narrow band of riparian vegetation occurs along the top of bank and this is characterised by Grey Myrtle, Red Ash and Celery Wood (*Polyscias elegans*). However, Lantana dominated the shrub layer and Wandering Jew (*Tradescantia fluminensis*) was the dominant groundcover. The banks were eroded and showed signs of use by cattle. Mature trees are absent from the proposed crossing area but are present further downstream. At the time of assessment the cobble filled creek bed was dry. Upstream of the proposed crossing area are small but intact sandstone benches.

Crossing of the creek by open trenching at the proposed point could be undertaken provided that stringent environmental management measures are followed and these should include:

- Areas containing mature Eucalypt trees should be avoided;
- Clearing width should be minimised to 12 m;
- The sandstone benches at the headwater should be avoided and protected from any direct impacts;
- Cobbles from the creek bed should be collected, stockpiled and then reinstated after backfilling of the trench; and
- Trenching should be undertaken during dry weather to avoid the risk of erosion and sedimentation on habitats downstream.

3.7 Conservation Significance

The site and locality (i.e. 5 km buffer around the pipeline route) have a number of features considered to be of conservation significance and these are outlined below.

3.7.1 Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

Communities

One critically endangered community is predicted to occur within the locality: *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland*. The amended sections of the proposed pipeline route do not traverse woodland areas with the characteristic species of White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*) and / or Blakely's Red Gum (*E. blakelyi*) and consequently this EEC is unlikely to occur along or adjacent to the route.

Species

Predictive modelling indicates that 13 flora, 29 fauna and 18 migratory / marine species listed under the EPBC Act have the potential to occur within the locality of the GFDA and amended areas of the proposed pipeline route. Table T6, T9 and T10 of AECOM (2009) lists these species along with their habitat requirements and the likelihood of their occurrence. The amended sections of the proposed

pipeline and GFDA would provide potential habitat for 10 flora, 13 fauna and 18 migratory species which are listed under the EPBC Act (Table 1). None of the listed species were recorded within the assessed areas of amended route although several sections of the GFDA and amended pipeline have habitat which could potentially provide a number of threatened flora with suitable habitat and fauna with roosting and foraging habitat.

3.7.2 NSW *Threatened Species Conservation Act 1995*

Communities

Thirty five EECs listed under the TSC Act are known, or are predicted, to occur within the Hunter CMA sub-region and these are listed in Table T5 (AECOM 2009). Given the geographic location, soil, other ecological requirements and characteristic species of the listed EECs, it was concluded that three (Table 2) were considered to have the potential to occur along or adjacent to the amended sections of the pipeline route and GFDA. *Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*, and *Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* occur within areas of clarification assessed within this report. These have been assessed in AECOM (2009) and hence are not assessed further in this report.

The only EEC which would be directly impacted by this proposal is *Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions*. *Hunter Lowland Redgum Forest* is an open forest which characterises the gentle slopes of depressions and drainage flats on the Hunter Valley floor. It is characterised by the canopy tree species, Forest Red Gum and Grey Gum with other frequently occurring canopy species such as Sydney Red Gum (*Angophora costata*), Spotted Gum, Narrow-leaved Ironbark and Grey Box. The mid-storey is open and characterised by sparse shrubs such as Coffee Bush, Prickly Beard-heath (*Leucopogon juniperinus*), Gorse Bitter Pea (*Daviesia ulicifolia*) and Dogwood. The ground cover typically comprises grasses and herbs (DEC 2005a). Approximately 250 m of the amended pipeline route passes *Hunter Lowland Redgum Forest* at KP 76.3 and runs adjacent to another patch of this EEC at KP 75.7. The remnant EEC at KP 76.3 has been degraded through years of grazing resulting in the removal of the majority of native shrub and groundcover species, although mature trees remain. The remnant EEC at KP 76.7 still contains elements of an intact vegetation community with representatives from all strata present. The pipeline route has been amended to traverse the paddock area to the north of this patch of forest.

Swamp oak floodplain forest of the NSW North Coast; Sydney Basin and South East Corner Bioregions occurs adjacent to the amended pipeline route at KP 89.5 (AECOM 2009). The proposed pipeline route has been designed to avoid this patch of *Swamp oak floodplain forest* so that it passes through an open paddock to the south which is currently used for grazing of cattle.

Spotted Gum communities recorded in the Lower Hunter region of the amended pipeline route (i.e. from Clarence Town south) are likely to be representative of *Seaham Spotted Gum - Ironbark Forest* and not the EEC *Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion* as the canopy was dominated by Narrow-leaved Ironbark and the occasional Grey Ironbark rather than Broad-leaved Ironbark (*Eucalyptus fibrosa*) which is characteristic of this EEC. Furthermore, the LHCCREMS mapping (NPWS 2000) did not map *Lower Hunter Spotted Gum – Ironbark Forest* along the amended sections of the pipeline route.

Table 1 Threatened flora and fauna recorded or with the potential to occur within a 5 km buffer

Scientific Name	Common Name	Conservation Rating	Habitat Requirements	Recorded in buffer or potential habitat
Flora				
Asperula asthenes	Trailing Woodruff	V-EPBC V-TSC ROTAP-3VC-	Grows in damp soils often along river banks.	Potential habitat.
Callistemon linearifolius	Netted Bottle Brush	V-TSC ROTAP-2RCi	Dry sclerophyll forest on the coast and adjacent ranges.	Potential habitat.
Cryptostylis hunteriana	Leafless Tongue Orchid	V-EPBC V-TSC ROTAP-3VC-	Various, including swamp-heath and woodland, mostly in coastal areas.	Potential habitat.
Eucalyptus glaucina	Slaty Red Gum	V-EPBC V-TSC ROTAP-3VCa	A medium-sized tree to 30 m tall. Grows in grassy woodland and dry eucalypt forest. Grows on deep, moderately fertile and well-watered soils.	Potential habitat.
Grevillea guthrieana	Guthrie's Grevillea	E-EPBC E-TSC ROTAP-3V	Grows along creeks and cliff lines in eucalypt forest, on granitic or sedimentary soil.	Potential habitat.
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea	E-TSC	Grows in heath or shrubby woodland, in sandy or light clay soils usually over shale substrates.	Recorded by AECOM 2009 near to Wallaroo National Park, Seaham.
Maundia triglochinoides		V-TSC	Grows in swamps, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients.	Potential habitat.

Scientific Name	Common Name	Conservation Rating	Habitat Requirements	Recorded in buffer or potential habitat
Persicaria elatior	Tall Knotweed	V-EPBC V-TSC ROTAP-3V	Grows in damp sites, especially beside streams and lakes and occasionally in swamp forest.	Potential habitat.
Pomaderris queenslandica	Scant Pomaderris	E-TSC	Moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks.	Potential habitat.
Rhizanthella slateri	Eastern Australian Underground Orchid	V-TSC ROTAP-3KC-	Sclerophyll forest in shallow to deep loams.	Potential habitat.
Tetratheca juncea	Black-eyed Susan	V-EPBC V-TSC ROTAP-3VCa	Sandy, occasionally swampy heath and in dry sclerophyll forest; mostly in coastal districts.	Potential habitat.
Zannichellia palustris		E-TSC ROTAP-3R+	Submerged in fresh or slightly saline stationary or slowly flowing water.	Potential habitat.
Amphibians				
Litoria aurea	Green and Golden Bell Frog	V-EPBC E-TSC	Marshes, dams and stream-sides particularly those containing *Typha* or *Eleocharis*. Need waterbodies unshaded, free of predatory fish and that have a grassy area nearby.	Potential habitat.
Reptiles				
Hoplocephalus bitorquatus	Pale-headed Snake	V-TSC	Dry eucalypt forests, woodlands, cypress woodland and occasionally rainforest / moist eucalypt forest. Prefers streamside areas. During day, shelters between loose bark and tree trunks, or in hollow trunks and limbs of dead trees.	Potential habitat.

Scientific Name	Common Name	Conservation Rating	Habitat Requirements	Recorded in buffer or potential habitat
Birds				
Anseranas semipalmata	Magpie Goose	V-TSC	Wetlands usually < 1 m deep with dense growth of rushes and sedges. Wetlands associated with floodplains of rivers and large shallow wetlands formed by run off.	Potential habitat.
Botaurus poiciloptilus	Australasian Bitten	V-TSC	Emergent vegetation in freshwater and brackish wetlands. Forage in wetlands, tussocky wet paddocks and drains.	Potential habitat.
Burhinus grallarius	Bush Stone-curlew	E-TSC	Open forests and woodlands with sparse grassy ground layer and fallen timber – nocturnal, especially active on moonlit nights.	Potential habitat.
Callocephalon fimbriatum	Gang-gang Cockatoo	V-TSC	Summer - found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Winter - lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas.	Potential habitat.
Calyptorhynchus lathami	Glossy Black-cockatoo	V-TSC	Inhabits open forest and woodlands. Feeds on Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*).	Potential habitat.
Climacteris picumnus victoria	Brown Treecreeper (eastern subspecies)	V-TSC	Eastern subspecies lives in eastern NSW in eucalypt woodlands through central NSW and in coastal areas with drier open woodlands, such as the	Potential habitat.

Scientific Name	Common Name	Conservation Rating	Habitat Requirements	Recorded in buffer or potential habitat
			Hunter Valley and Clarence Valley.	
Coracina lineata	Barred Cuckoo-shrike	V-TSC	Rainforest, eucalypt forests and woodlands, clearings in secondary growth, swamp woodlands and timber along watercourses.	Potential habitat.
Ephippiorhynchus asiaticus	Black-necked Stork	E-TSC	Permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on inter-tidal shorelines, mangrove margins and estuaries.	Potential habitat.
Ixobrychus flavicollis	Black Bittern	V-TSC	Forested, freshwater and saline wetlands. Breeding along watercourses.	Potential habitat.
Lathamus discolor	Swift Parrot	E-EPBC Mar-EPBC E-TSC	Migrates to the Australian SE mainland between March and October. Favoured feed trees include winter flowering species such as Swamp Mahogany, Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*). Commonly used lerp infested trees include Grey Box (*E. microcarpa*), Grey Box (*E. moluccana*) and Blackbutt (*E. pilularis*).	Potential habitat.

Scientific Name	Common Name	Conservation Rating	Habitat Requirements	Recorded in buffer or potential habitat
Lophoictinia isura	Square-tailed Kite	V-TSC	Found in a variety of timbered habitats including dry woodlands and open forests especially along timbered watercourses.	Potential habitat.
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V-TSC	Structurally diverse drier eucalypt woodlands, forests, scrubs with fallen timber.	Potential habitat.
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern sub-species)	V-TSC	Occurs in open forests and woodlands dominated by box and ironbark eucalypts generally west of the Great Dividing Range.	Potential habitat.
Neophema pulchella	Turquoise Parrot	V-TSC	Lives on edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Prefers to feed in the shade of a tree and spends majority of day on ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter.	Potential habitat.
Ninox connivens	Barking Owl	V-TSC	Breeds in HBT >20 cm diameter. Forages throughout woodlands, grassy woodlands, forests and into grasslands (250 m).	Potential habitat.
Ninox strenua	Powerful Owl	V-TSC	A range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Roosts in dense vegetation comprising species: Turpentine, Black She-oak, Blackwood, Rough-barked Apple, Cherry	Potential habitat.

Scientific Name	Common Name	Conservation Rating	Habitat Requirements	Recorded in buffer or potential habitat
			Ballart and a number of eucalypt species.	
Pomatostomus temporalis temporalis	Grey-crowned Babbler	V-TSC	Found in drier open forest, scrubby woodlands, road reserves, farmland and sometimes urbanised areas.	Recorded adjacent to Stage 1 GFDA extension.
Pyrrholaemus saggitatus	Speckled Warbler	V-TSC	Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies.	Potential habitat.
Rostratula benghalensis	Painted Snipe	M-EPBC Mar-EPBC V-TSC	Prefers fringes of swamps, dams and nearby marshy areas with a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation. Forages nocturnally.	Potential habitat.
Stagonopleura guttata	Diamond Firetail	V-TSC	Occurs in open eucalypt forest, mallee and acacia scrubs.	Potential habitat.
Tyto capensis	Grass Owl	V-TSC	Grass Owls are found in areas of tall grass, including grass tussocks in swampy areas, grassy plains, swampy heath, and cane grass, or sedges on flood plains.	Potential habitat.
Tyto novaehollandiae	Masked Owl	V-TSC	Lives in dry eucalypt forests and woodlands. Pair's home-range of 500 to 1000 ha. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	Potential habitat.

Scientific Name	Common Name	Conservation Rating	Habitat Requirements	Recorded in buffer or potential habitat
Tyto tenebricosa	Sooty Owl	V-TSC	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation.	Potential habitat.
Xanthomyza phrygia	Regent Honeyeater	E-EPBC M-EPBC E-TSC	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak (*Casuarina cunninghamiana*). Regent Honeyeaters inhabit woodlands with a significantly high abundance of bird species. Should have large numbers of mature trees, high canopy cover and abundance of mistletoes.	Potential habitat.
Migratory and Marine Birds (solely)				
Haliaeetus leucogaster	White-bellied Sea-Eagle	M-EPBC Mar-EPBC	Found in coastal areas, on islands, estuaries, inlets, large rivers, inland lakes and reservoirs where they forage over water. Builds huge nests of sticks.	Potential habitat.
Ardea alba	Great Egret	M-EPBC Mar-EPBC	Overfly marine area. Found in shallows of rivers, estuaries, tidal mudflats, freshwater wetlands, sewage ponds, irrigation areas and larger dams.	Potential habitat.
Ardea ibis	Cattle Egret	M-EPBC Mar-EPBC	Overfly marine area. Found in stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats and drains.	Potential habitat.

Scientific Name	Common Name	Conservation Rating	Habitat Requirements	Recorded in buffer or potential habitat
Gallinago hardwickii	Latham's Snipe	M-EPBC Mar-EPBC	Summer migrant to coastal Australia where it feeds on soft wet ground or shallow water with tussocks and woodland, saltmarshes and mangrove fringes.	Potential habitat.
Arenaria interpres	Ruddy Turnstone	M-EPBC Mar-EPBC	Summer migrant to coastal Australia where it feeds on tidal reefs and pools, sandy shores or even ploughed fields.	Potential habitat.
Calidris acuminate	Sharp-tailed Sandpiper	M-EPBC Mar-EPBC	Widespread summer migrant to coastal Australia where it feeds in coastal areas and inland wetlands.	Potential habitat.
Calidris ferruginea	Curlew Sandpiper	M-EPBC Mar-EPBC	Summer migrant to coastal Australia where it can be found in coastal areas, inland, mudflats and often at saltworks.	Potential habitat.
Pluvialis fulva	Pacific Golden Plover	M-EPBC Mar-EPBC	Widespread summer migrant to coastal Australia. Found in estuaries, mudflats, saltmarshes, mangroves, rocky reefs and shallow open inland swamps, sewage ponds and paddocks.	Potential habitat.
Limosa lapponica	Bar-tailed Godwit	M-EPBC Mar-EPBC	Widespread summer migrant to coastal Australia. Found in intertidal flats and sandbanks.	Potential habitat.
Numenius madagascariensis	Eastern Curlew	M-EPBC Mar-EPBC	Common migrant to coastal areas during summer. In estuaries, tidal mudflats, sandspits, saltmarshes, mangroves and occasionally fresh or brackish lakes, bare grasslands near water.	Potential habitat.

Scientific Name	Common Name	Conservation Rating	Habitat Requirements	Recorded in buffer or potential habitat
Numenius phaeopus	Whimbrel	M-EPBC Mar-EPBC	Summer migrant to coastal Australia. Found in coastal estuaries, mudflats and mangroves.	Potential habitat.
Apus pacificus	Fork-tailed Swift	M-EPBC Mar-EPBC	Overfly marine area. Summer migrant to Australia. Overflies open country from semi-deserts to coasts and sometimes over forests and cities.	Potential habitat.
Hirundapus caudacutus	White-throated Needletail	M-EPBC Mar-EPBC	The White-throated Needletail feeds on flying insects, such as termites, ants, beetles and flies. They catch the insects in flight. Birds usually feed in rising thermal currents associated with storm fronts and bushfires and they are commonly seen moving with wind fronts.	Potential habitat.
Merops ornatus	Rainbow Bee-eater	M-EPBC Mar-EPBC	Summer breeding migrant to south-east Australia. Found in open woodlands with sandy, loamy soil, sandridges, sandpits, riverbanks, cliffs, mangroves, rainforest and woodland.	Potential habitat.
Monarcha melanopsis	Black-faced Monarch	M-EPBC Mar-EPBC	Summer breeding migrant to coastal south-eastern Australia. Found in rainforests, nearby eucalypt woodlands and mangroves.	Potential habitat.

Scientific Name	Common Name	Conservation Rating	Habitat Requirements	Recorded in buffer or potential habitat
Monarcha trivirgatus	Spectacled Monarch	M-EPBC Mar-EPBC	Summer breeding migrant to NSW coast. Prefers wet forests and mangroves mostly on outer branches of the lower canopy.	Potential habitat.
Myiagra cyanoleuca	Satin Flycatcher	M-EPBC Mar-EPBC	Summer breeding migrant to the south of its range on the south eastern Australian coast. Can be found in wetter denser forests, often at high elevations.	Potential habitat.
Rhipidura rufifrons	Rufous Fantail	M-EPBC Mar-EPBC	Breeding migrant to south-eastern Australia during July to December. Prefers wetter eucalypt forests, gullies, coastal scrub, watercourses and rainforests where it feeds on insects.	Potential habitat.
Mammals				
Cercartetus nanus	Eastern Pygmy-possum	V-TSC	Rainforest, sclerophyll forest and woodland to heath – but heath and woodland preferred. Forages on banksias, eucalypts and bottlebrushes.	Potential habitat.
Chalinolobus dwyeri	Large-eared Pied Bat	V-EPBC V-TSC	Roosts - caves (near their entrances), crevices in cliffs, derelict mines and in the disused, bottle-shaped mud nests of the Fairy Martin frequenting low to mid-elevation dry open forest and woodland close to these features.	Potential habitat.

Scientific Name	Common Name	Conservation Rating	Habitat Requirements	Recorded in buffer or potential habitat
Dasyurus maculatus	Spotted-tailed Quoll	E-EPBC V -TSC	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits and insects; also eats carrion and takes domestic fowl.	Potential habitat.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V-TSC	Prefers moist habitats with trees >20 m. Roosts in HBT or under bark or in buildings.	Potential habitat.
Macropus parma	Parma Wallaby	V-TSC	Moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest.	Potential habitat.
Miniopterus australis	Little Bentwing-bat	V-TSC	Found in well timbered areas including rainforest, wet and dry sclerophyll forests, melalecua swamps and coastal forests. Roosts in caves.	Potential habitat.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V-TSC	Roosting – caves, derelict mines, stormwater tunnels, buildings. Forages over and within forested areas.	Potential habitat.

Scientific Name	Common Name	Conservation Rating	Habitat Requirements	Recorded in buffer or potential habitat
Mormopterus norfolkensis	Eastern Freetail-bat	V-TSC	Dry sclerophyll forest and woodland. Roosts - hollows and under bark or man-made structures.	Potential habitat.
Myotis macropus	Large-footed Myotis	V-TSC	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, HBTs, stormwater channels, buildings, under bridges and in dense foliage. Forages over streams and pools catching insects and small fish by raking their feet across the water surface.	Potential habitat.
Petaurus australis	Yellow-bellied Glider	V-TSC	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soil.	Potential habitat.
Petaurus norfolcensis	Squirrel Glider	V-TSC	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or *Acacia* midstorey. Require abundant tree hollows for refuge and nest sites.	Potential habitat.
Phascogale tapoatafa	Brush-tailed Phascogale	V-TSC	Dry sclerophyll open forest with sparse groundcover. Also heath, swamps, rainforest and wet sclerophyll forest.	Potential habitat.
Phascolarctos cinereus	Koala	V-TSC	Eucalypt woodlands and forests. Has preferred feed tree species.	Potential habitat.
Potorous tridactylus	Long-nosed Potoroo	V - EPBC V – TSC	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an	Potential habitat.

Scientific Name	Common Name	Conservation Rating	Habitat Requirements	Recorded in buffer or potential habitat
			essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of Tea-trees or *Melaleucas*. A sandy loam soil is also a common feature.	
Pteropus poliocephalus	Grey-headed Flying-fox	V-EPBC V-TSC	Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps.	Potential habitat.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V-TSC	Roosts singly or in groups of up to six, in HBTs and buildings. Will use mammal burrows. Forages in most habitats across areas with and without trees. Appears to defend an aerial territory.	Potential habitat.
Scoteanax rueppellii	Greater Broad-nosed Bat	V-TSC	Woodland, moist and dry eucalypt forest and rainforest but prefers tall wet forest. Roosts - tree hollows but also buildings.	Potential habitat.

Note*:* TSC Act = *Threatened Species Conservation Act 1995*; EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*, V = Vulnerable, E = Endangered, CE = Critically Endangered, M = Migratory, Mar = Marine; HBT = Hollow-bearing tree. **Source**: Botanic Gardens Trust 2009, DEC 2005a, NPWS 1999; Simpson and Day 2004.

Table 2 EECs listed under the TSC Act which occur or have the potential to occur along amended areas of the GFDA and pipeline route.

Vegetation Community	Conservation Status	Preferred Habitat	Likely Occurrence Along Pipeline Route
Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions	EEC	Open forest on gentle slopes of depressions and drainage flats on the Hunter Valley floor. The most common canopy tree species are Forest Red Gum and Grey Gum and subdominants of Smooth-barked Apple, Spotted Gum, Narrow-leaved Ironbark and Grey Box. The mid-storey is characterised by sparse shrubs such as *Breynia oblongifolia, Leucopogon juniperinus, Daviesia ulicifolia* and *Jacksonia scoparia* with ground cover typically grasses and herbs.	Recorded along and adjacent to the amended pipeline route between approximately KP 75.7 and 76.2.
Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion	EEC	Open forest dominated by Spotted Gum and Broad-leaved Ironbark with occasional Grey Gum and Narrow-leaved Ironbark. Understorey comprises tall shrubs and the understorey is diverse.	Unlikely. Spotted Gum communities likely to be representative of Seaham Spotted Gum Ironbark Forest due to species composition.
Swamp oak floodplain forest of the NSW North Coast; Sydney Basin and South East Corner bioregions	EEC	This community is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which *S*wamp Oak is the dominant species northwards from Bermagui.	Recorded adjacent to the amended pipeline route at KP 90.5.
Note: TSC Act = *Threatened Species Conservation Act 1995*, EEC = endangered ecological community. **Source**: DEC 2005a, Botanic Gardens Trust 2009, NPWS 1999.			

Populations

There are nine endangered populations listed under the TSC Act that have been recorded within the wider study area around the GFDA and amended pipeline route (Table T4 AECOM 2009). The amended GFDA and pipeline route provide potential habitat for two populations (Table 3).

Table 3 Endangered Populations (TSC Act) with the potential to occur within the amended area

Endangered Population	Description
Cymbidium canaliculatum population in the Hunter Catchment	Large epiphytic orchid commonly occurring within *Eucalyptus albens* woodland typically in a single clump between 2 and 6 m above ground level. Less commonly found on *E. dawsonii, E. crebra, E. moluccana, Angophora floribunda, Acacia salicina*. Narrow-leaved Ironbark (*E. crebra*) and Grey Box (*E. moluccana*) were recorded along the amended sections of the pipeline route. Potential habitat predominantly north of KP 76.
Rhizanthella slateri population in the Great Lakes LGA	The Eastern Australian Underground Orchid is known to occur in sclerophyll forest. The population in the Great Lakes local government area (LGA) occurs at the known northern limit of the species' range and is disjunct from other known populations of the species. The dominant vegetation type within the amended areas is sclerophyll forest and consequently there is potential for this species to occur in these areas. Potential habitat predominantly north of KP 76.
Note*:* TSC Act = *Threatened Species Conservation Act 1995.* **Source**: DEC 2005a, Botanic Gardens Trust 2009, NPWS 2000	

Species

There have been 19 flora and 69 fauna species listed under the TSC Act recorded within the locality (i.e. 5 km buffer). Table T6, T9 and T10 of AECOM (2009) lists these species along with their habitat requirements and the likelihood of their occurrence. Those species with the potential to occur along the amended sections of the pipeline and GFDA are listed in Table 1, and these include 12 flora and 43 fauna species. None of the flora and only one of the fauna species was recorded during this study. The Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) which is listed as vulnerable under the TSC Act was recorded (Figure 2) within a wooded area adjacent to the gathering lines of the proposed south-eastern most well in the GFDA and it is likely that this species would occur along the access tracks and adjacent woodlands of several of the other well sites.

The majority of the amended GFDA and pipeline route traverses modified habitats which are unlikely to provide high quality flora and fauna habitat suitable for the majority of threatened species unless the species are highly mobile. However, there are a number of sections of pipeline which traverse vegetated areas, including KP 18.5 to 20 and KP 71.5 to 73.5 and KP 76 and KP 92.3 to 95 which encompasses the Hunter River and SEPP 14 wetlands at Tomago (SEPP 14 Wetland No. 830 and

831), and there are large tracts of intact vegetation nearby allowing mobile species from larger stands of intact vegetation to use neighbouring areas of lesser habitat value from time to time.

3.7.3 RoTAP Species

Seventy two *Rare or Threatened Australian Plants* (RoTAP) are listed as occurring within the Gloucester, Dungog, Great Lakes, Port Stephens and Newcastle LGAs (Botanic Gardens Trust 2009). None of these species were recorded along the amended pipeline route or within amended GFDA area. All of these species are also listed as threatened under the TSC Act and hence those species for which habitat occurs have been considered under the TSC Act (Table 1).

3.7.4 Declared Noxious Weeds

In NSW the identification, classification and control of noxious weeds is governed by the *Noxious Weeds Act 1993* (NW Act). Plants that have been declared as noxious weeds are classified into specific control classes in each Local Control Area. Those plants listed as Noxious Weeds for the six local government areas covered by this project and that were found along the pipeline route are listed in Table 4

Table 4 Noxious weeds recorded along the proposed pipeline route

Botanic Name	Common Name	Noxious Weed Control Class
Sporobolus fertilis	Giant Parramatta Grass	3
Lantana camara	Lantana	5
Cortaderia selloana	Pampas Grass	4
Nassella trichotoma	Serrated Tussock	3
Rubus fruiticosus	Blackberry	4
Salix babylonica	Weeping Willow	5
Ligustrum lucidum	Large Leaved Privet	4
Ligustrum sinense	Small Leaved Privet	4
Source: DPI 2009		

The control requirements for each of these classes are:

- **Class 3 - Regionally Controlled Weeds**: Plants that pose a serious threat to primary production or the environment of an area to which the order applies, and are likely to spread in the area or to another area. Legal requirements are that the plant must be fully and continuously suppressed and destroyed.
- **Class 4 - Locally Controlled Weeds**: Plants that pose a threat to primary production, the environment or human health, are widely distributed in an area to which the order applies

and are likely to spread in the area or to another area. Legal requirements are that the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local authority.

- **Class 5 - Restricted Plants**: Plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State. Legal requirements are that the requirements in the NW Act for a notifiable weed must be complied with.

Blackberry is also listed as a Weed of National Significance (Weeds in Australia 2009) and the plans and controls associated with this listing should also be implemented for control of this weed.

3.7.5 Corridors and Connectivity

The amended sections of the pipeline predominantly traverse cleared agricultural paddocks. However, from approximately KP 18 to 20 and KP 71.5 to 73.5 the pipeline route traverses the edge of remnant or regrowth vegetation and sometimes along powerline easements. The northern end of the pipeline traverses a patch of vegetation that would provide east – west stepping stone habitat for mobile and dispersing fauna and flora. Although densely vegetated links do not occur, scattered paddock trees and riparian vegetation along Karuah River, Mammy Johnsons River, creeks and other drainage lines would provide loose but adequate connections for some species between densely vegetated areas within Buckleys Range, Copper Mine Ridge and vegetation beyond. The mid section of the amended pipeline route traverses the western edge of a powerline easement which is connected to well vegetated areas to the west. Areas to the south are cleared and only minor connections would remain along riparian areas.

3.7.6 *State Environmental Planning Policy 44 - Koala Habitat Protection*

Muswellbrook and Singleton are listed as local government areas subject to the provisions of *State Environmental Planning Policy 44 - Koala Habitat Protection* (SEPP 44). A number of Koala records are known from the locality and occur close to the proposed amended pipeline route. Two species of Koala feed trees listed on Schedule 2 of SEPP 44, (i.e. Forest Red Gum (*Eucalyptus tereticornis*) and Grey Gum (*Eucalyptus punctata*) were recorded along the pipeline route. For an area to be considered as potential Core Koala Habitat, Schedule 2 tree species must occur at densities greater than 15%. Although no formal assessment was undertaken it is unlikely that Grey Gum occurs at densities greater 15%. However, it is likely that Forest Red Gum occurs at greater than 15% in the remnant patches of *Hunter Lowland Redgum Forest* from approximately KP 75.7 and 76.2 and this area could be considered to be potential core habitat for Koalas.

The proposed pipeline route traverses the Western Management Unit of the *Port Stephens Council CKPoM* (Port Stephens Council 2002) and Koala habitat has been mapped for this assessment area:

- Both *Hunter Lowland Redgum Forest* remnant patches at KP 75.7 and 76.2 are mapped as 'Marginal Koala Habitat';
- Deadmans Creek, which is located at KP 74.4 and approximately 1 km east of the most northern *Hunter Lowland Redgum Forest,* has been mapped as 'Preferred Koala Habitat' with buffers; and

- The area between the *Hunter Lowland Redgum Forest* and Deadmans Creek as 'Link over Cleared Koala Habitat'.

Preferred Koala Habitat is the most important category of Koala habitat in the Port Stephens LGA and hence should be afforded the highest level of protection. Marginal Koala Habitat is all forested areas which are neither Preferred nor Supplementary Koala Habitat. Linking habitat provides habitat for movement and dispersal of Koalas and potential areas for restoration.

Deadmans Creek will be underbored by HDD to avoid the mapped 'Preferred Koala Habitat'.

3.7.7 State Environmental Planning Policy 14 – Coastal Wetlands

The *State Environmental Planning Policy 14 – Coastal Wetlands* (SEPP 14) seeks to control development within Coastal Wetland areas for environmental and economic considerations. SEPP 14 Wetlands 830 and 831 occur at the southern end of the amended route at Tomago. Thrust boring will be used to pass under Wetland 831 and horizontal directional drilling will be used to pass under sections of Wetland 830 but also adjacent to this wetland along a section of Old Punt Road.

These two SEPP 14 wetlands have the potential to be indirectly impacted by the proposed pipeline if management measures are not implemented. SEPP 14 wetlands should not be cleared, drained or filled without consent and any development within or near listed wetlands must be considered for the impact it might have on the environment, and whether or not the development is avoidable within these areas, before consent is granted.