Appendix F Noise Emission Contours

JOB: 60100965 Filename: 60100965.RPT01

300000

6425000

6400000

AECOM

R11
R12
R10
R2
R1
R3
IR1
R4
R9
R8
R7
R6
R5

0 1,250 2,500 5,000
Metres

Legend

- Ash Conveyor
- Assessment and Monitoring Locations
- Assessment Locations
- Coal Conveyor

Sound Pressure Level

LAeq dB(A)

- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- 80
- 85
- 90

Bayswater B Power Station

Coal Fired
Neutral Conditions

A3 size

JOB: 60100965 Filename: 60100965.RPT01

300000

6425000

6400000

R11
R12
R10
R2
R1
R3
IR1
R4
R9
R8
R7
R6
R5

AECOM

0 1,250 2,500 5,000
Metres

Legend

- Ash Conveyor
- Assessment and Monitoring Locations
- Assessment Locations
- Coal Conveyor

Sound Pressure Level

LAeq dB(A)

- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- 80
- 85
- 90

Bayswater B Power Station

Coal Fired
3 m/s Wind All Directions

A3 size

JOB: 60100965 Filename: 60100965.RPT01

300000

6425000

6400000

AECOM

R11
R12
R10
R2
R1
R3
IR1
R4
R9
R8
R7
R6
R5

0 1,250 2,500 5,000
Metres

Legend

- Ash Conveyor
- Assessment and Monitoring Locations
- Assessment Locations
- Coal Conveyor

Sound Pressure Level

LAeq dB(A)

- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- 80
- 85
- 90

Bayswater B Power Station

Coal Fired
2 m/s Wind F Class Inversion

A3 size

JOB: 60100965 Filename: 60100965.RPT01

300000

6425000

6400000

R12
R11
R10
R2
R1
R3
IR1
R4
R9
R8
R7
R6
R5

AECOM

0 1,250 2,500 5,000
Metres

Legend

- Gas Pipeline
- Assessment and Monitoring Locations
- Assessment Locations

Sound Pressure Level

LAeq dB(A)

- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- 80
- 85
- 90

Bayswater B Power Station

Gas Fired
Neutral Conditions

A3 size

JOB: 60100965 Filename: 60100965.RPT01

300000

6425000

6400000

R12
R11
R10
R2
R1
R3
IR1
R4
R9
R7
R8
R6
R5

AECOM

0 1,250 2,500 5,000
Metres

Legend

- Gas Pipeline
- Assessment and Monitoring Locations
- Assessment Locations

Sound Pressure Level

LAeq dB(A)

- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- 80
- 85
- 90

Bayswater B Power Station

Gas Fired
3 m/s Wind All Directions

A3 size

JOB: 60100965 Filename: 60100965.RPT01

300000

6425000

6400000

AECOM

0 1,250 2,500 5,000

Metres

R12
R11
R10
R2
R1
R3
IR1
R4
R9
R7
R8
R6
R5

Legend

- Gas Pipeline
- Assessment and Monitoring Locations
- Assessment Locations

Sound Pressure Level

LAeq dB(A)

- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- 80
- 85
- 90

Bayswater B Power Station

Gas Fired
2 m/s Wind F Class Inversion

A3 size

JOB: 60100965 Filename: 60100965.RPT01

300000

6425000

6400000

R12
R11
R10
R3
R2
R1
IR1
R4
R9
R8
R7
R6
R5

AECOM

0 1,250 2,500 5,000
Metres

Legend

- Assessment and Monitoring Locations
- Assessment Locations

Sound Pressure Levels

LAeq, dB(A)

- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- 80
- 85

Bayswater B Power Station

Construction - Site Preparation
Neutral Conditions

A3 size

JOB: 60100965 Filename: 60100965.RPT01

300000

6425000

6400000

R12
R11
R10
R2
R1
R3
IR1
R4
R9
R7
R8
R6
R5

AECOM

0 1,250 2,500 5,000
Metres

Legend

- Assessment and Monitoring Locations
- Assessment Locations

Sound Pressure Levels

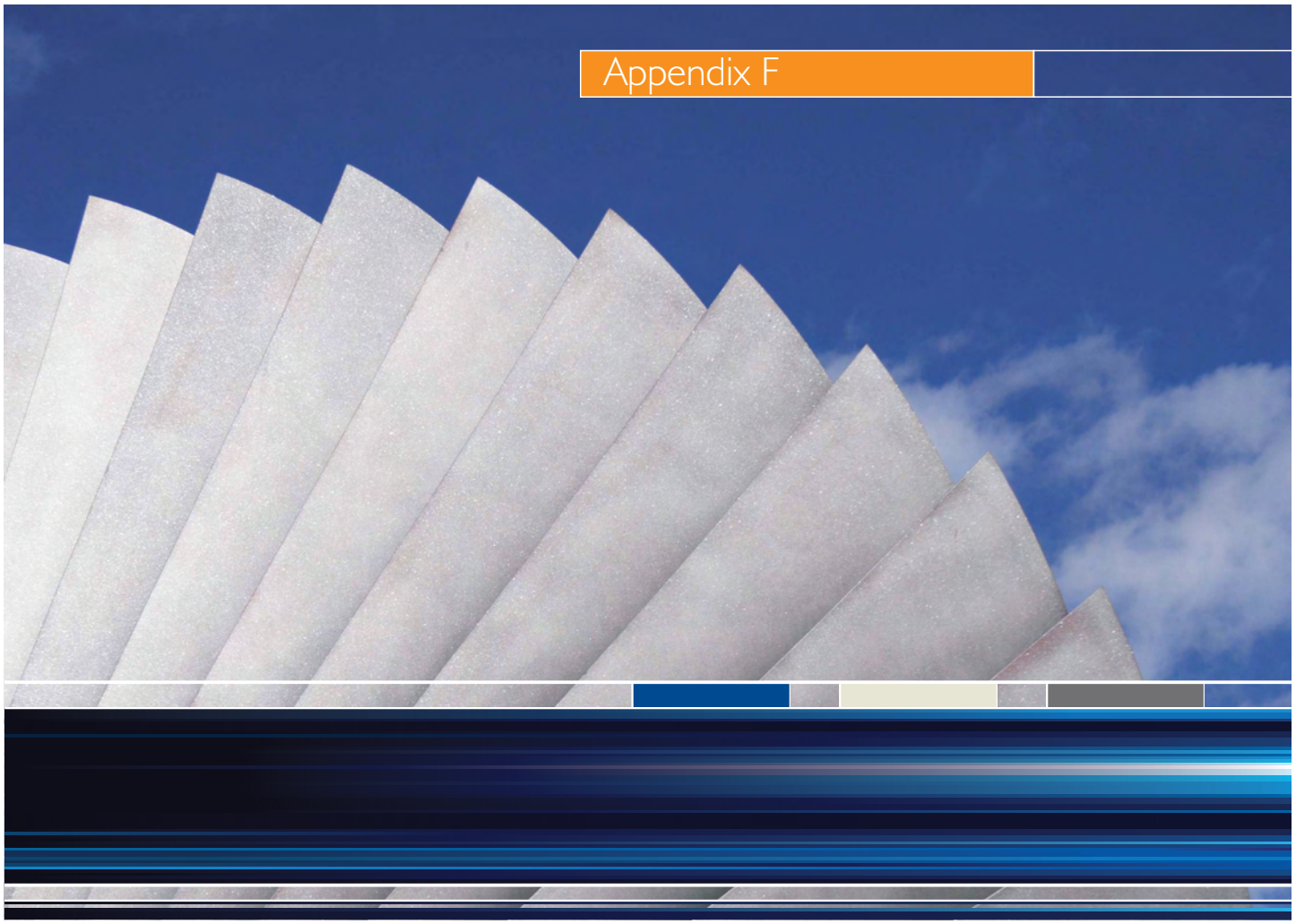
LAeq dB(A)

- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- 80
- 85

Bayswater B Power Station

Construction - Steelworks and Equipment Erection Neutral Conditions

A3 size



Flora, Fauna and Bushfire Assessment

Bayswater B Power Station

Final Part 3A Flora and Fauna Assessment

Prepared for
AECOM

18 September 2009

Proposed Bayswater B Power Station

Final Part 3A Flora and Fauna Assessment

PREPARED FOR	**AECOM**
PROJECT NO	**09NEWECO - 0014**
DATE	**18 September 2009**

DOCUMENT TRACKING

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Prepared by	JH
	ST
	BM
Approved by	AM and BM
Status	Final
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ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Ruth Baker and Michelle Keo of AECOM, and Peter Bowman of Macquarie Generation.

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Abbreviations

ABBREVIATION	DESCRIPTION
DEWHA	Department of the Environment, Water, Heritage and the Arts
DECC	Department of Environment and Climate Change (now DECCW)
DECCW	Department of Environment, Climate Change and Water (formerly DECC)
DoP	Department of Planning
EEC	Endangered Ecological Community
ELA	Eco Logical Australia
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
LEP	Local Environmental Plan
LGA	Local Government Area
MacGen	Macquarie Generation
REP	Regional Environmental Plan
SEPP	State Environmental Planning Policy
TSC Act	*Threatened Species Conservation Act 1995*

Executive Summary

The construction of a new base load power station in NSW is being considered. Eco Logical Australia was commissioned by AECOM to undertake a flora and fauna assessment of, for concept approval, the "Bayswater B" base load power station in the Upper Hunter Region of New South Wales. The proposed Bayswater Liddell Power Generation Complex (referred to as "Bayswater B") is to be powered by either coal or natural gas. Concept Plan approval is being sought for both possible operating scenarios under Part 3A of the *Environmental Planning & Assessment Act 1979* (EP&A Act) and *State Environmental Planning Policy (Major Projects) 2005*.

The objectives of this ecological study was to describe the aquatic and terrestrial environment of the proposed development site and consider the potential impacts of the two proposed development concept options on threatened flora and fauna and their habitats, and ecological communities listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth. *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) known or likely to occur within the development site.

Results (Section 4)

Field investigations were undertaken between the 6th to the 10th July 2009. No threatened flora species or endangered ecological communities were recorded. Four vegetation communities were determined as being present within the site, the majority of which was comprised of modified grassland/ pasture. Areas of native Central Hunter Box – Ironbark Woodland (preliminary EEC listing under the TSC Act), Central Hunter Ironbark – Spotted Gum – Grey Box Forest (preliminary EEC listing under the TSC Act), and; Hunter Valley River Oak Forest of moderate to good condition also occurred on site.

Threatened fauna species observed included four vulnerable woodland bird species (TSC Act); the Diamond Firetail *(Stagonopleura guttata);* Grey-crowned Babbler *(Pomatostomus temporalis temporalis);* Hooded Robin *(Melanodryas cucullata),* and the Speckled Warbler *(Pyrrholaemus sagittatus)*. No adult or tadpole Green and Golden Bell Frog (*Litoria aurea*) were recorded during targeted surveys for the species, however suitable aquatic habitat and previous records of their presence suggest that they are likely to inhabit areas of the site.

Impact Evaluation (Section 5)

The construction of the ultra-supercritical pulverised coal fired concept option would result in the removal of 7.06 ha of Central Hunter Box – Ironbark Woodland and 0.25 ha of Central Hunter Ironbark – Spotted Gum – Grey Box Forest. A total of 9.62 ha of Central Hunter Box – Ironbark Woodland, 4.53 ha of Central Hunter Ironbark – Spotted Gum – Grey Box Forest and 0.31 ha of Hunter Valley River Oak Forest would be removed for construction of the combined cycle gas turbine operating scenario.

In addition to direct vegetation removal, both concept options have the potential to impact on water quality, bank stability and aquatic habitats (including potential Green and Golden Bell Frog habitat) as a result of increased runoff and sedimentation during construction. Increased traffic during this phase of

both projects may also negatively impact fauna (including threatened woodland bird species and the vulnerable Green and Golden Bell Frog) if not appropriately managed during the construction period.

Operational impacts for both scenarios were found to be relatively similar and minor, with potential for ongoing noise disturbance, artificial lighting disturbance and increased traffic to disturb threatened woodland bird species and the Green and Golden Bell Frog. The aquatic environment may also be subject to ongoing impacts as a result of increased water use, stormwater runoff and settlement of dust emissions (coal fired option only).

Assessment against Part 3A of the EP&A Act 'Improve or Maintain Principles' determined that significant impacts to threatened species known or likely to occur in the locality are unlikely, provided the proponent undertaking the action commits to the recommendations and actions proposed to mitigate unavoidable impacts and offset remaining impacts (if required).

Recommendations and Mitigation (Section 6)

To ensure the protection of native vegetation and threatened species within the site, a number of recommendations and mitigation measures have been provided including; further surveys for vulnerable Green and Golden Bell Frog (*L. aurea*) to determine its presence or absence, development design to avoid large patches of woodland vegetation, and habitat for hollow and rough bark dependent fauna, development of a Vegetation Management Plan for management of riparian areas impacted and preparation a Sediment and Erosion Control Plan. It is further recommended that for impacts that cannot be avoided or mitigated, an Offset Strategy be developed upon finalisation of the design and calculation of total remnant vegetation loss.

1 Introduction

The construction of a new base load power station in NSW is being considered. Eco Logical Australia (ELA) was commissioned by AECOM to undertake an ecological assessment of, for concept approval, a new Bayswater B base load power station in the Upper Hunter Region of New South Wales. The proposed "Bayswater B" is to be powered by either coal (ultra-supercritical generation technology) or natural gas (combined cycle generation technology). Concept Plan approval is being sought for both possible operating scenarios under Part 3A of the *Environmental Planning & Assessment Act 1979* (EP&A Act) and *State Environmental Planning Policy (Major Projects) 2005*.

This report and accompanying technical appendices provide required supporting information with respect to the biodiversity of the site as specified by the Minister of Planning and relevant agencies in the Director General's Requirements (issued on 4th July 2009) for the Concept Plan application.

Specifically, this report describes the natural environment of the proposed development site and considers the potential impacts of the proposed development options on threatened flora and fauna and their habitats, and ecological communities. Information is provided on the ecological values of the site, current and proposed uses and proposed ecological outcomes under the Concept Plan. The report provides recommendations and mitigation measures to ameliorate or counterbalance potential impacts and an assessment of the proposal against the 'maintain or improve' principle, as required under Part 3A of the EP&A Act.

This document broadly follows a structure and indicative content set out in the *Draft Guidelines for Threatened Species Assessment* under Part 3A prepared by Department of Environment and Climate Change and Department of Primary Industries July 2005 (DECC and DPI 2005).

1.1 DESCRIPTION OF PROPOSAL

Macquarie Generation (MacGen) currently operates the Bayswater and Liddell Power Stations, located in the Central Hunter Region of New South Wales. MacGen, as proponent for this concept approval, is proposing an additional 2000 MW of generating capacity in order to meet forecast base load demands of New South Wales. The proposed new base load power plant, known as "Bayswater B", is to be situated on land west of the existing Bayswater Power Station.

The Concept Plan considers two potential operating scenarios for the new base load power plant including:

1) Coal fired (Figure 1), and;

2) Gas fired (Figure 2).

The Concept Plan design components and approximate development areas for the coal fired scenario include: a main power plant (comprised of boiler plant and turbine plant totalling 0.3 ha), transmission infrastructure including switchyard (0.1 ha) and 500 kV transmission lines (two lines totalling 6 km), coal stockpile area, water treatment and chemical storage, raw material transportation (coal and limestone)

via roads (haulage road 2.2 km) and conveyor from Antiene rail coal unloader (5.5 km), and access roads to site (3.8 km) and within the site.

The design components and approximate areas for the gas fired operating scenario include: a main power plant (comprised of five combined cycle gas turbine units), gas supply via a spur pipeline (15 km), transmission infrastructure including switchyard and lines (two lines totalling 6 km), water treatment and chemical storage, access roads to site (3.8 km) and within the site. The lay down area for the plant and switchyard components would be similar in size to the plant area (i.e. 0.4 hectares).

Development of these components will be undertaken through a staged construction approach involving site establishment, (levelling and establishment of a construction lay down area, accommodation for employees, site access), erection of components and commissioning. Construction is expected to occur over a three year period for the gas fired scenario, and a 5 year period for the coal fired scenario.

1.2 REGIONAL CONTEXT

The development site lies within the northern Hunter River Catchment, an area which covers 22, 000 hectares, on the east coast of New South Wales (Figure 3). The Hunter River Catchment encompasses 14 local government areas.

The region has a history of coal mining and agriculture and other associated infrastructure such as road and rail transport. The region further supports urban areas, including residences of approximately 80,000 people. As a result of the development history of the area, much of the pre-settlement biodiversity has been cleared in the catchment. Due to extensive clearing much of the remnant vegetation is threatened. The area still supports 116 threatened species and 13 endangered ecological communities. Vegetation of the Hunter Valley is restricted to small isolated patches, riparian vegetation and areas unsuitable for agriculture or coal mining.

1.3 STUDY SITE DESCRIPTION

The study site lies between the towns of Singleton and Muswellbrook, about 250 km north of Sydney and is located within the Local Government Areas of Muswellbrook and Singleton and covers an area of 2,000 hectares (Figure 3). East of the site is the existing Bayswater Power Station and the New England Highway. North and south of the site is relatively cleared land comprising primarily mining and agricultural enterprises. Stands of native vegetation adjoin the western boundary, and are scattered amongst native and improved pastures to the south and west.

Cattle graze the study site, however, grazing pressure is very low. Cattle can access most of the site, except for the eastern most parts of the remnant woodland. Rabbits have a localised effect, being abundant in some locations which effects local diversity and biomass. Kangaroos are also abundant in the modified grassland.

The site is currently zoned Rural 1(a) under the Singleton Local Environment Plan (LEP) 1996. Infrastructure associated with the project may be located within the adjacent Muswellbrook LGA. Infrastructure associated with the development will be located on land zoned Infrastructure SP2 “Power Station” and RU1 ”Primary Production” (for the ash conveyor only), under the provisions of Muswellbrook LEP 2009.

The predominant drainage pattern within the study area is from north to south with minor tributaries flowing into Saltwater Creek which empties into Plashett Dam. Waterways comprise both poorly defined and well defined ephemeral creeks higher in the catchment and permanent features towards

Plashett Dam. A number of aquatic features have been altered (waterways) or created (dams and channels) to cater for power plant operations.

Notable water bodies within the locality include Plashett Dam, at the southern extent of the study area and Lake Liddell a sizeable reservoir that occurs to the north-east of the site, adjacent to the New England Highway.

To enable the reader to view all the potential impacts from each scenario all figures (except for figures 1-3) include the footprint of both the coal fired and gas fired scenarios.

1.4 DIRECTOR GENERAL'S REQUIREMENTS

The Department of Planning issued Director General's Requirements (DGR's) for this project. Those sections of the DGR's pertaining to ecological matters have been addressed in this ecological report. Input from Muswellbrook Council as they related to flora and fauna issues were also received via AECOM.

Relevant sections of the DGR's are below:

> *Ecological Impacts - the Environmental Assessment must include an assessment of the impacts on native vegetation, threatened species, populations, ecological communities and their habitats (both terrestrial and aquatic as relevant).*
>
> *The Environmental Assessment must include a screening of species, populations, ecological communities and habitats based on ecological significance and the potential for impact as a consequence of the project.*
>
> *For species, populations, ecological communities and habitats with high ecological significance and significant potential for impact, include sufficient information to demonstrate the likely impacts, consistent with Guidelines for Threatened Species Assessment (DEC & DPI, July 2005).*
>
> *The Environmental Assessment must include an assessment of impacts to aquatic and riparian values where waterway crossings are proposed..*
>
> *The assessment must demonstrate a design philosophy of impact avoidance on ecological values, and in particular, ecological values of high significance and include a framework for the further consideration of ecological impacts at the project approval stage, and during detailed design of the project, including options for mitigation and/ or offset consistent with "improve or maintain" principles.*
>
> *Sufficient details must be provided to demonstrate the availability of viable and achievable options to offset the impacts of the project*

Details of the agency input, which aligns closely to the DGR's, is provided below:

> *As proposed in the PEA, the proponent should provide an assessment of the potential impacts on threatened species, populations, endangered ecological communities and their habitats as part of the EA. This assessment should include the proposed power station as well as areas required for, and potentially impacted by, the development of infrastructure off site, including but not limited to:*
>
> - *the 15km gas pipeline spur;*
> - *required railway for coal delivery;*
> - *conveyors to transfer coal to the site and ash from the site; and*

- *roadways.*

There are two assessment tools that can be used by proponents for this purpose:

- *the factors identified in the Threatened Species Assessment Guidelines - The Assessment of Significance (DECC 2007 and NSW DPI 2008); or*
- *the BioBanking Assessment Methodology. Further information can be found on the DECC website at: http://www.environment.nsw.gov.au/biobanking/assessmethodology.htm*

The EA should:

- *document all known and likely threatened species, their habitats, population and ecological communities of the site (including any adjacent areas that may be indirectly impacted upon by the proposal). The EA should provide details of survey methodologies and / or techniques utilised;*
- *provide a detailed assessment of the impacts on such species, habitats, population and ecological communities; and*
- *detail the actions that will be taken to avoid or mitigate impacts, or to compensate or offset unavoidable impacts of the project on threatened species, populations, ecological communities and their habitat.*

Any offsets proposed should comply with DECC's 'Principles for the use of Biodiversity Offsets in NSW identified in Attachment D. Justification for any area(s) proposed as compensatory habitat should include an assessment of the threatened species values impacted on by the proposed works and whether the proposed area(s) provides equivalent values.

Figure 1 : Concept Plan design of the proposed Ultra Supercritical Pulverised Coal Fired Plant, Bayswater B (supplied by AECOM).

Figure 2: Concept Plan design of the proposed Combined Cycle Gas Turbine Plant, Bayswater B (supplied by AECOM).

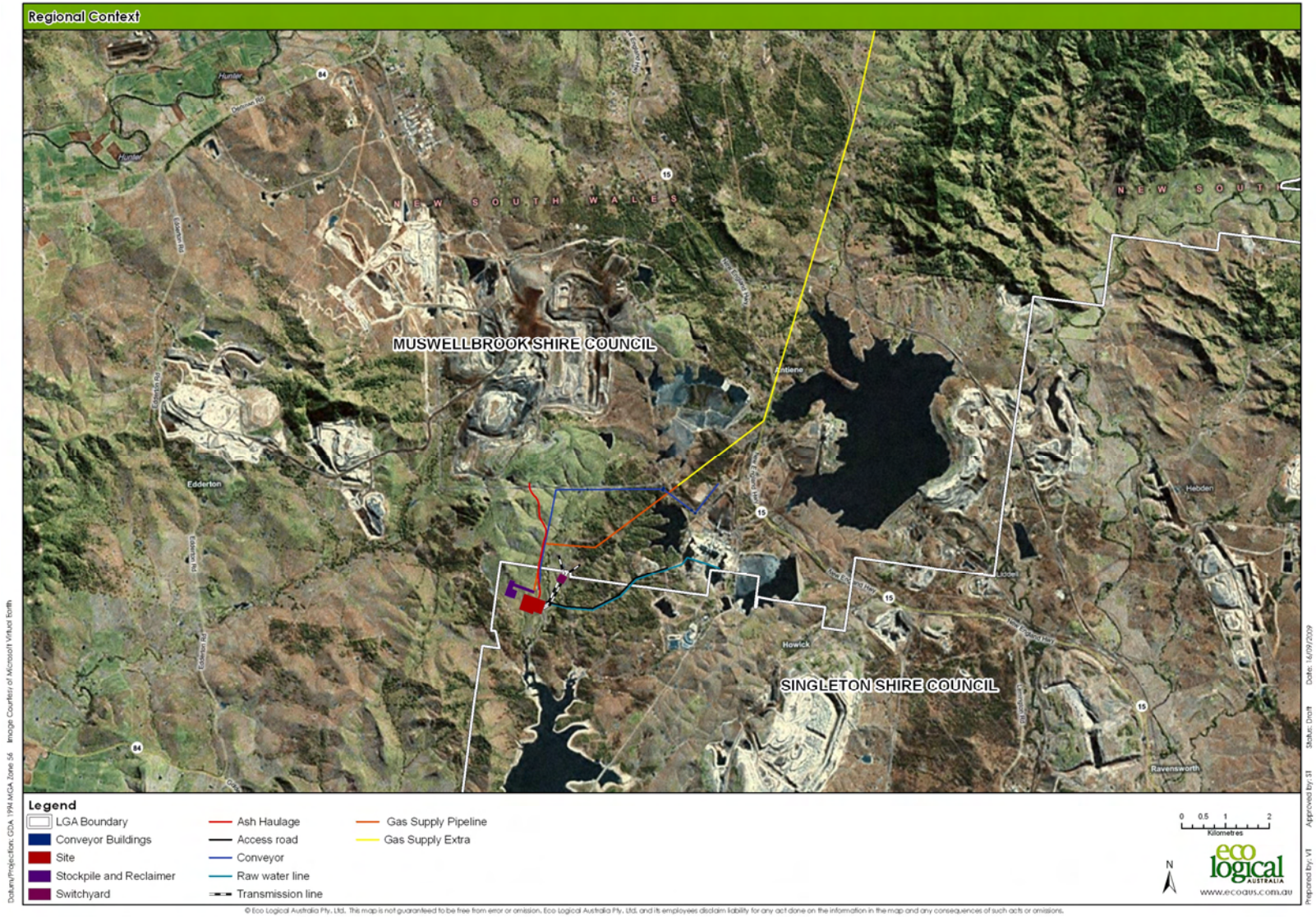

Figure 3: Regional context of the proposed Bayswater B Power Station site, also illustrating the extent of the gas pipeline required in the gas fired concept.

2 Legislative and LGA Requirements

This section provides a brief review of the legislation and policy framework relevant to the management and conservation of the biodiversity of the study site.

2.1 COMMONWEALTH LEGLISLATION

2.1.1 *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*

The Commonwealth (EPBC Act) provides a national scheme for protecting the environment and conserving biodiversity values. Approval from the Commonwealth Environment Minister is required under the EPBC Act if the action (which can include a project, development, undertaking or activity) will, or is likely to, have a significant impact on matters considered to be of national environmental significance (NES matters). NES matters relevant to this proposal include several threatened species and an Endangered Ecological Community which were identified as potentially occurring within the site. The protection of aspects of the environment that are matters of National Environmental Significance" (pursuant to the EPBC Act) are anticipated environmental outcomes of the Planning and Assessment Process under Part 3A of the EP&A Act as outlined below.

A preliminary assessment of potential impacts on threatened species determined as likely to be present within the development site, has indicated that 'significant impacts' are unlikely to occur as a result of construction and operation of either operating scenario (Appendix B).

2.2 STATE GOVERNMENT LEGISLATION

2.2.1 *Environmental Planning and Assessment Act 1979*

Development of the site will fall under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Under Part 3A, the proponent and consent authority must consider all aspects of the environment, including biological, physical, social and economic factors and the principles of ecologically sustainable development, when assessing the impacts of the project. Assessment under Part 3A of the EP&A Act includes consideration of threatened species, endangered populations and communities listed under the TSC Act and Matters of National Environmental Significance listed under the EPBC Act and consideration of assessment guidelines (S75 F(1)). The *Guidelines for Threatened Species Assessment* (DEC and DPI 2005) under Part 3A lists a number of environmental outcomes, including Maintain or Improve with respect to biodiversity values, protect high conservation value area, protect the long-term viability of local populations and communities. Part 3A of the EP&A Act negates the requirement to assess the significance of impacts on threatened species, populations and ecological communities or their habitat pursuant to Section 5A of the EP&A Act (the 7-part test).

However, an assessment of the magnitude and extent of impacts and the significance of the impacts as related to the conservation importance of the habitat, individuals and populations likely to be affected is required (DECC & DPI 2005).

2.2.2 *Part 3A Threatened Species Assessment Guidelines*

The Department of Environment and Climate Change (DECC) and the Department of Primary Industries (DPI) have prepared Draft Guidelines for the assessment of impacts on threatened species, populations or ecological communities or their habitats arising from development applications assessed under Part

3A of the EP&A Act (DECC & DPI 2005). These guidelines are provided for in section 75F in Part 3A of the EPA Act.

The Assessment Guidelines outline guiding principles for the provision of information to "enable decision makers to ensure that developments deliver the following environmental outcomes:

1. Maintain or improve biodiversity values (i.e. there is no net impact on threatened species or native vegetation);

2. Conserve biological diversity and promote ESD;

3. Protect areas of High Conservation value (including areas of critical habitat);

4. Prevent the extinction of threatened species;

5. Protect the long-term viability of local populations of a species, population or ecological community; and

6. Protect aspects of the environment that are matters of National Environmental Significance "(pursuant to the EPBC Act)".

These questions have been addressed in Section 6 of this document. Where a proposal cannot avoid or mitigate impacts on threatened species, populations and ecological communities, according to key thresholds, other measures, including undertaking a suitable and approved offset action, may need to be taken.

2.2.3 *Threatened Species Conservation Act 1995*

The *Threatened Species Conservation Act 1995* (TSC Act) aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. Four threatened species listed under the TSC Act were identified as part of this study as occurring on site as well as other threatened flora and fauna species considered as potentially occurring or likely to occur on site. Potential impacts on these communities, species and their habitats are assessed as part of the Part 3A assessment process with reference to the Assessment Guidelines (DECC & DPI 2005) described above (Appendix B).

Two of the vegetation communities on site have been proposed for listing as endangered ecological communities; Central Hunter Grey Box-Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions, and Central Hunter Ironbark - Spotted Gum - Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions. The report considers the impact of the proposal on these communities, should they be gazetted as endangered ecological communities following completion of the report and prior to approval.

2.2.4 State Environmental Planning Policy No. 44 - Koala Habitat Protection

While SEPP 44 does not apply to Part 3A major project assessments, the policy's requirements have been considered in relation to this project.

State Environmental Planning Policy 44 – Koala Habitat Protection (SEPP 44) was introduced to protect potential and core koala habitat in NSW. Under SEPP 44, developers of land with koala habitat (as defined in the SEPP) have to consider the impact of their proposals on koalas, and in certain circumstances, prepare individual koala plans of management for their land.

A number of Forest Red Gum (*Eucalyptus tereticornis*) occur on the site, a species that is listed as a 'Feed Tree Species' under the SEPP. Searches of Forest Red Gum on site for evidence of Koala activity (scratches and scats) did not suggest that Koala's are present on site, or could be considered "core" Koala habitat. Results of surveys for Koala activity are provided at Section 4.2.4.2.

2.3 REGIONAL STRATEGIES AND LOCAL GOVERNMENT PLANNING INSTRUMENTS

2.3.1 *Hunter Regional Environmental Plan 1989 (Hunter REP)*

The *Hunter Regional Environmental Plan 1989* (Hunter REP) required the Minister to give consideration to the content of the background report and the objectives, policies and principles contained in REP 1989 in the assessment of the proposed development.

The Hunter REP was repealed on the 26th June 2009 and replaced with the *State Environmental Planning Policy (Repeal of REP Provisions) 2009*. While the instruments requirements no longer apply to the site, it is noted that the proposal was considered to be generally in line with the provisions of the plan as they related to economic development and environmental protection in the region.

2.3.2 *Hunter Regional Environmental Plan 1989 (Heritage)*

The *Hunter Regional Environmental Plan 1989 (Heritage)* (Hunter REP – Heritage) applies to land that includes Muswellbrook Shire but not Singleton Shire. The aims of Hunter REP 1989 (Heritage) include:

> *a) to conserve the environmental heritage (including the historic, scientific, cultural, social, archaeological, architectural, natural and aesthetic heritage) of the Hunter Region,*
>
> *b) to promote the appreciation and understanding of the Hunter Region's distinctive variety of cultural heritage items and areas including significant buildings, structures, works, relics, towns, precincts and landscapes, and*
>
> *c) to encourage the conservation of the Region's historic townscapes which contain one or more buildings or places of heritage significance or which have a character and appearance that is desirable to conserve.*

The REP provides protection for certain heritage items and conservation areas and furthermore, sets out criteria and matters which must be taken into consideration for developments which may affect one of these listed heritage items. There are no heritage items located in the vicinity of the site that are listed in the Plan.

2.3.3 Singleton Local Environmental Plan 1996

The *Singleton Local Environmental Plan 1996* (Singleton LEP) is the principal planning document for the Singleton Local Government Area. The LEP identifies a variety of land use zones with details of objectives and permissible actions under different zones. The site is currently zoned Rural 1(a) under the Singleton LEP.

2.3.4 Muswellbrook Local Environmental Plan 2009

The *Muswellbrook Local Environmental Plan 2009* (Muswellbrook LEP) is the principal planning document for the Muswellbrook Local Government Area. Land to the west of the proposed power station site, in which infrastructure associated with the proposed power plant may be constructed, is currently zoned SP2 "Power Station" and RU1 "Primary Production".

3 Methods

This section outlines the desktop and field survey methods used in compiling and gathering information for this assessment.

3.1 DATABASE AND LITERATURE REVIEW

3.1.1 Database Search

A search of the online EPBC Protected Matters Search Tool (DEWHA 2009), and Atlas of NSW Wildlife (DEC 2007) was performed on 3rd July 2009. The search of the EPBC Protected Matters Search Tool used a radius of 10 km around the centre of the proposed Bayswater B Power Station (coordinates -32.39903, 150.92707). The search of the Atlas of NSW Wildlife covered a 10x10km area around the proposed Bayswater B Power Station (latitude, -32.44837 to -32.34837, and longitude 150.86068 to 150.96902).

Each species likely occurrence was determined by records in the area, habitat availability and knowledge of the species' ecology. Five terms for the likelihood of occurrence of species are used in this report (Appendix A). The terms for likelihood of occurrence are defined below:

- "yes" = the species was or has been observed on the site.
- "likely" = a medium to high probability that a species uses the site.
- "potential" = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur.
- "unlikely" = a very low to low probability that a species uses the site.
- "no" = habitat on site and in the vicinity is unsuitable for the species.

3.1.2 Literature Review

A literature review of the previous studies and reports relevant to the study site was undertaken to gain further knowledge of the potential flora and fauna species that may occur within the study area. Literature reviewed for the site included:

- Peake T.C. (2006) The Vegetation of the Central Hunter Valley, New South Wales. A report on the findings of the Hunter Remnant Vegetation Project. Hunter- Central Rivers Catchment Management Authority, Paterson;

- Department of Environment and Climate Change (2007) Management Plan: The Green and Golden Bell Frog Key Population in the Upper Hunter. July 2007 [DECC 2007/141];

- AECOM (June 2009) Preliminary Environmental Assessment: Proposed Power Station, Bayswater Liddell Power Generation Complex. Report prepared for Macquarie Generation.

3.2 FIELD INVESTIGATION

A five day site assessment was undertaken by Bruce Mullins, Simon Tweed and Ross Wellington of ELA from the 6th July to 10th July 2009. Assessment of the site involved diurnal traverses of the proposed development site, adjacent woodland and adjacent riparian areas to capture the sites biodiversity values including vegetation communities and condition and fauna habitat present. Targeted surveys were undertaken for a number of threatened (TSC Act and EPBC Act listed) flora (further information provided in Section 3.2.2 below) and some fauna, although the season of survey limited the confidence in the outcomes of this survey. Incidental observations of fauna were noted, along with broad habitat values across the site.

The weather conditions during the survey are outlined in Table 1 below (the closest weather station with data available online is located in Singleton). Annual rainfall for the region averages 645mm, while rainfall in May and June 2009 leading up to the survey was average to below average, respectively (source http://www.bom.gov.au).

Table 1: Weather conditions during survey of the Bayswater B Power Station Site.

Date	Min Temp (°C)	Max Temp (°C)	Rainfall (mm)
6 July 2009	-1.6	16.0	0
7 July 2009	2.5	13.2	0.1
8 July 2009	4.0	16.7	0.4
9 July 2009	0.0	16.0	0.4
10 July 2009	3.5	16.5	1.0

Weather observations were taken from Singleton STP (www.bom.gov.au)

3.2.1 Vegetation Community and Condition Assessment

25 transects (Figure 4) were undertaken on the study site to validate previous vegetation mapping (Peake 2006) and undertake a general assessment of vegetation community type and condition. The following details were recorded along each transect.

- Flora species present
- Vegetation condition
- Vegetation age structure and canopy
- Vegetation structure
- GPS locations of start and end point of each transect and habitat features
- Photographs of transect locations

An additional two traverses (traverses 26 and 27) were undertaken purely to validate vegetation mapping and vegetation condition, and target survey for threatened flora. Some site photos are presented in Appendix D.

The condition of the vegetation was assessed based on the following criteria;

- **Good:** containing a high number of indigenous species; no to few weeds present with weed invasion restricted to edges and track margins; vegetation community contains original layers of vegetation; vegetation layers (ground, shrub, canopy etc) are intact. No disturbance to the soil profile.
- **Moderate:** containing a moderate number of indigenous species; moderate level of weed invasion; weeds occurring in isolated patches or scattered throughout; one or more of the original layers of vegetation are modified; vegetation layers (ground, shrub, canopy etc) are largely intact. No disturbance to the soil profile
- **Poor:** containing a low number of indigenous species; high level of weed invasion; weeds occurring in dense patches or scattered throughout; one or more of the original layers of vegetation are highly modified; one or more original vegetation layers (ground, shrub, canopy etc) are modified or missing. Potentially severely degraded soil profile

3.2.1.1 Endangered Ecological Communities

Data recorded for each transect was used to determine the presence of any endangered ecological communities (EECs) within the study site. Species lists for each traverse were compared to characteristic species listed in the Scientific Committee Final Determinations for each of the EECs with the potential to occur within the study site.

Two EECs proposed for listing were likely to occur on site. Descriptions of each community were reviewed to determine if either were present.

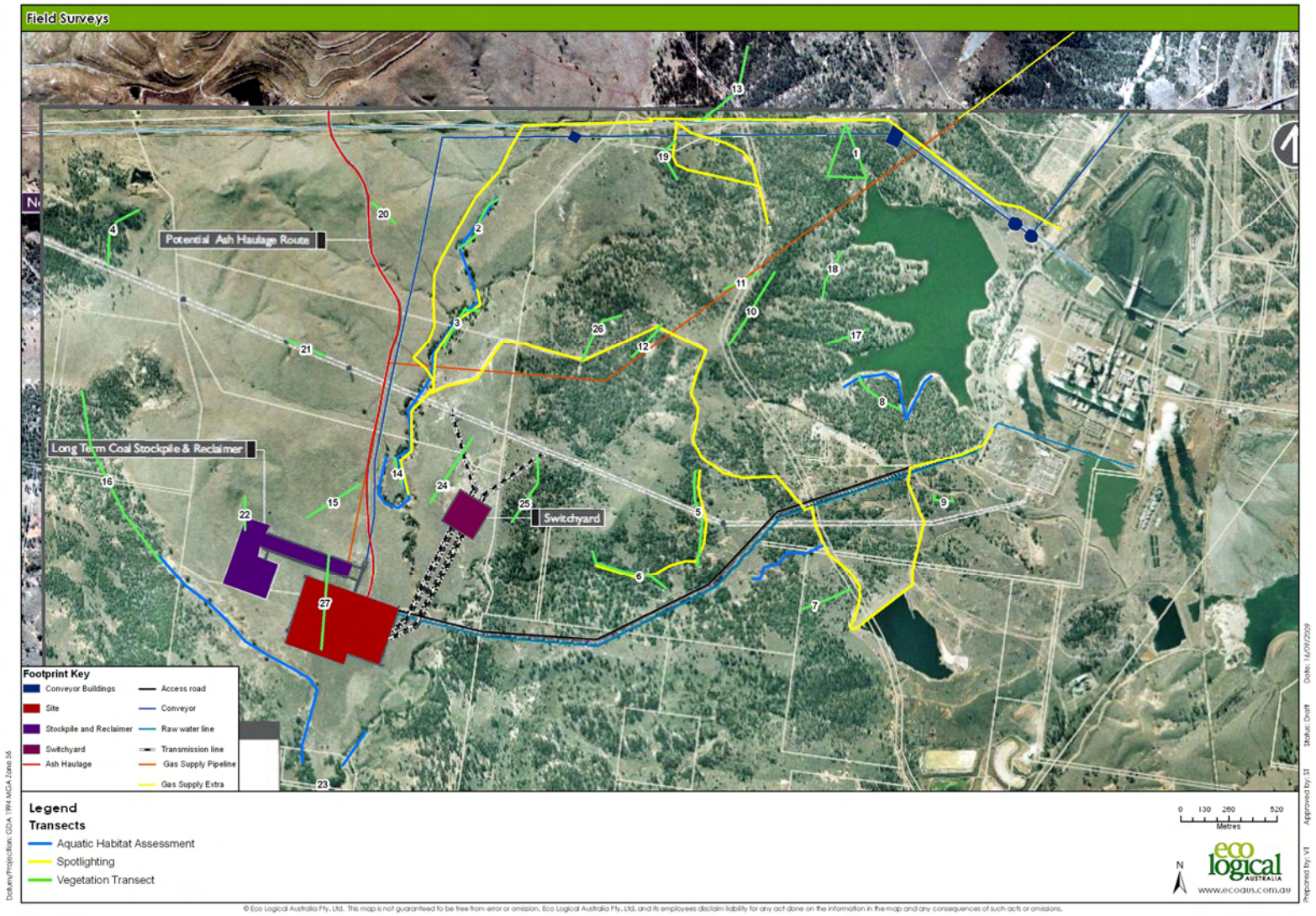

Figure 4: Field survey locations within the Bayswater B Power Station study site.

3.2.2 Threatened Species Presence and Habitat Assessment

3.2.2.1 Threatened Flora Species

Table 2 lists the species identified prior to the survey as potentially occurring within the general area of the study site through preliminary threatened species database searches undertaken (10 km x 10 km grid centred on the proposed Bayswater B project site).

Table 2: Threatened flora species returned by the threatened species database searches .

Species	Common Name	TSC ACT	EPBC ACT
Acacia pendula	*Acacia pendula* population in the Hunter Catchment	E2	
Eucalyptus camaldulensis	*Eucalyptus camaldulensis* in the Hunter Catchment	E2	
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V
Bothriochloa biloba	Lobed Blue-grass		V
Diuris tricolor (syn *D. sheaffiana*) *	Pink Donkey Orchid *Diuris tricolor* in the Muswellbrook LGA	V E2	V
Diuris pedunculata *	Small Snake Orchid	E	E
Cynanchum elegans	White Flowered Wax Plant	E	E
Digitaria porrecta	Finger Panic Grass	E	E
Eucalyptus glaucina	Slaty Red Gum	V	V
Olearia cordata		V	V
Pomaderris brunnea	Rufous Pomaderris	V	V
Thesium australe	Austral Toadflax	V	V
Wollemia nobilis	Wollemi Pine	E	E

Target surveys was undertaken for each of the species in Table 2, except for *Diuris tricolor* and *Diuris pedunculata*. Neither species was flowering during the survey period, and therefore, could not be readily detected or identified. Survey for these species should occur during an appropriate season in areas of suitable habitat affected by the development (including infrastructure corridors where appropriate).

3.2.2.2 Threatened Fauna Species

Along with the information noted in Section 3.2.1, an assessment of fauna habitat was undertaken along each transect. The assessment noted the relative abundance of hollow bearing trees, the presence of stags, rocky outcrops, litter, large wood, termite mounds and mistletoe. The occurrence of each of these habitat features was recorded as either absent (a), rare (r), occasional (o), common (c) or frequent (f).

Incidental observations of fauna were recorded during each transect. Specific assessments were undertaken to quantify the extent and quality of habitat for amphibians within the site, and a target survey for amphibians was undertaken, even though the time of year was not ideal. Searches for the endangered Green and Golden Bell Frog (*Litoria aurea*) were undertaken within and adjacent to riparian areas and water bodies within the study site. Survey techniques for identification of presence or potential presence of GGBF included:

- Diurnal searching of emergent rushes and sedges and other aquatic vegetation surrounding water bodies. This included the pooled intermittent sections of Saltwater Creek, farm dams, depressions, pits, diversion channels, canals, evaporative basins and bunded areas that had been created by drainage works or flood flow erosion in the past. Basking individuals were searched for amongst these habitats and the Green and Golden Bell Frog's call was also imitated in an effort to elicit a response from any unobserved individuals that may have been present.
- Water bodies were examined for the presence of fish or tadpoles. All suitable ground habitat in proximity to riparian areas and water bodies was searched (where it was able to be turned) including logs, rocks, building material, concrete slabs and other refuse as well as selective searching of suitable tussock vegetation. All ground cover was carefully lifted and searched for amphibians and then replaced.
- Nocturnal surveys were confined to spotlight and headlamp survey. Nocturnal call playback was not carried out as the night temperatures of less than 6^0 C made such survey methods redundant.

Recommended survey methods requires that a nearby site of known presence is surveyed for evidence of activity to validate suitability of conditions for detestability prior to commencement of each survey. No known nearby site exists where GGBF can be reliably detected at this time of year and so such validation of survey effort could be undertaken in this instance and it is already acknowledged that timing was outside the predicted activity period for the species.

Furthermore, spotlighting was undertaken on three occasions to locate Koala and arboreal mammals. The presence and density of suitable Koala feed trees and evidence for Koala activity (scratches on trees and scats) were also targeted to determine the suitability of the habitat on site for Koala and their presence on site.

3.2.3 Aquatic Ecosystem Condition and Riparian Assessment

Aquatic ecosystems were investigated to identify areas of habitat for aquatic fauna and flora, assess their condition and identify their role in contributing to ecosystem health. Instream habitats (such as pools, riffles, instream woody debris, bed and bank features, macrophyte assemblages) and riparian habitats (rocky areas, litter, sedges and tussocks and vegetation structure) were documented. Aquatic features within and adjacent to the study area were assessed for condition, by considering erosion, disturbance features and available habitat. Their role of waterways in contributing to ecosystem health was identified by considering their role within the catchment and connectivity to downstream receiving areas such as Plashett Dam.

Waypoints were taken where significant habitat features were identified and streams were categorised depending on their role in providing ecosystem function. This information was mapped and is included within Section 4.2.7.

3.3 CONSERVATION SIGNIFICANCE ASSESSMENT

Peake (2006) assessed the conservation status of the vegetation communities described. This was based on known and modelled data relating to pre-clearing extent versus extant vegetation, an "intuitive" assessment of the degree of clearing within each community, distribution of the community within his study area and more broadly, representation in conservation reserves, intuitive perception of threat to the community and application of DEWHA's (formerly DEH) criteria for nominating vegetation communities as EEC's.

Peake (2006) notes that his approach provides only a broad appraisal of the vegetation communities and that site specific information was not included. This report combines Peake (2006) conservation status with site based data to rank the conservation significance of vegetation on site.

However, the conservation significance of a patch of vegetation can also relate to:

- vegetation condition;
- patch size;
- connectivity, and;
- habitat presence.

Peake (2006) assigned patch size categories within the study area, these being:

- Category 1 – patches 0-10ha
- Category 2 – patches 10-40ha
- Category 3 – patches 40-100ha
- Category 4 – patches >100ha.

Patch size will broadly influence species diversity, resilience, ecosystem function and viability (refer to Section 4.3 and Figure 10).

3.4 SURVEY LIMITATIONS

The survey methodology was limited by project timeline constraints. Details of survey limitations are listed below:

- Extensive flora and fauna surveys were not undertaken as the season of the survey was outside of optimal survey conditions.
- Two threatened plant species with the potential to occur within the study site were unable to be detected during the survey period as the site investigation was conducted outside of their known flowering seasons (Table 3).

Table 3: Flora species unable to be detected during the site investigation due to seasonal constraints.

Species	Common Name	Expected Flowering season
Diuris pedunculata	Small Snake Orchid	August - September
Diuris tricolor (syn. sheaffiana)	Pine Donkey Orchid	September – November

- Surveys for Green and Golden Bell Frog (*L. aurea*) presence were undertaken outside of ideal seasonal and weather patterns usually required under the DECC *Green and Golden Bell Frog*

Draft Recovery Plan (DEC, 2005) and the *Green and Golden Bell Frog Environmental Impact Assessment (EIA) Guidelines* (NPWS, 2001). The survey approach did not conform to the ideal method in terms of the range of survey techniques employed. Instead, and based on prior observations in the vicinity of the proposal, a 'presumed presence' was made and habitat components for the species were instead identified and assessed as an alternative conservative approach.

- Surveys for microchiropteran bat species within the study site were not undertaken due to the season of survey, when bat activity is expected to be very low.
- The survey assessed broad areas of the site and did not survey entire infrastructure corridors (such as the gas pipeline) as the project is only in the concept stage. A desktop assessment was completed for the areas of infrastructure that were not assessed as part of field works.
- Surveys for the Barking Owl (*Ninox connivens*) identified as potentially occurring within the study area were not undertaken due to time constraints during the survey.

A number of recommendations have been made to ensure that the presence and location of these species are able to be identified as part of future ecological assessments of the site (Section 6).

4 Results

This section details the results of the database and literature review and field investigations undertaken.

4.1 DATABASE AND LITERATURE REVIEW

4.1.1 Database Search

Species and EECs from searches of the Atlas of NSW Wildlife and the EPBC Act Protected Matters Search Tool databases indicated 37 threatened species, 7 migratory species (two of which are also included as threatened species; Swift Parrot and Regent Honeyeater), and 3 endangered populations have previously been recorded or are considered likely to occur within the locality (10 km radius) of the study site.

Table 11 and Table 12 (Appendix A) list the threatened and migratory species returned by the database searches together with an assessment of the likelihood of occurrence for each species within the study site.

4.1.2 Literature Review

Three reports relevant to the biodiversity of the study site (Peake 2006; DECC 2007; AECOM 2009) were reviewed to gain an understanding of the vegetation and fauna species previously recorded within the site. The findings of each report are summarised below.

4.1.2.1 Peake (2006)

Peake's (2006) report documents the distribution, composition and conservation status of vegetation communities occurring in the Central Hunter Valley of NSW.

Vegetation communities mapped by Peake (2006) within the locality of the proposed project included;

- Central Hunter Box – Ironbark Woodland;
- Central Hunter Ironbark – Spotted Gum – Grey Box Forest;
- Narrabeen Footslopes Slaty Box Woodland;
- Central Hunter Swamp Oak Forest, and;
- Central Hunter Bulloak Regeneration.

Of these five communities, all communities but the Central Hunter Bulloak Regeneration community were recognised by Peake (2006) as being highly threatened. Peake (2006) acknowledges that the significance of these communities is largely based on their limited distribution, with the exception of Central Hunter Ironbark – Spotted Gum – Grey Box Forest which has suffered considerable clearing. As a consequence, 'Central Hunter Box – Ironbark Woodland' and 'Central Hunter Ironbark – Spotted Gum – Grey Box Forest' have been proposed for consideration as EEC's to the NSW Scientific Committee under the TSC Act.

The report further recognises the need for regional, sub-regional and local habitat linkages given much of the vegetation within the area is fragmented and variegated.

Peake (2006) acknowledges the similarities between Central Hunter Swamp Oak Forest and Hunter Valley River Oak Forest. The field survey identified the later community at the entrance to Plashett Dam. Peake also describes this community as highly threatened.

4.1.2.2 Green and Golden Bell Frog Management Plan (DECC 2007)

One of the key populations identified in the draft Green and Golden Bell Frog Recovery Plan (DECC 2005) is an Upper Hunter key population believed to be operating as a 'meta-population', with population elements transiently identified at Mount Owen, Ravensworth and Cumnock coal mines and within and surrounding the MacGen lands of Bayswater and Liddell Power Stations.

These 'satellites' are all the population elements known to remain extant in the wild of the Upper Hunter Green and Golden Bell Frog population. Historically, this population would have been widespread and more or less contiguous with other populations occurring across much of the Hunter Valley, and its various tributaries and floodplains.

As an action of the draft Recovery Plan for the species, an Upper Hunter key population Management Plan was prepared and endorsed by DECC (2007). This plan summarises the state of knowledge of the key population and identifies the locally specific actions derived from the more general actions described within the recovery plan. Some of these actions identify MacGen as an important stakeholder and recommends a series of actions be undertaken to endeavour to improve understanding of the Upper Hunter Green and Golden Bell Frog key population and secure its conservation. The Upper Hunter key population is one of only two inland populations thought to remain and therefore has this factor as a reason for its elevated conservation significance.

A number of actions were identified in the plan and specifically including:

- Systematic surveys of historic Green and Golden Bell Frog sites including the Bayswater Power Station lands;
- Monitoring of the Bayswater STP ponds and a minimal disturbance approach during maintenance of these facilities; and
- Several other relevant actions include - awareness raising amongst personnel, reporting and consideration for possible re-introduction in the future.

4.1.2.3 AECOM (2009)

AECOM (2009) prepared a preliminary environmental assessment (PEA) for the proposed project, which scoped the biological effects of the proposed project. The following ecological values of the site were identified in the report:

- A search of the Atlas of NSW Wildlife and EPBC Act Protected Matters (20km x 20km) returned a total of 21 threatened fauna species listed under the TSC Act, 13 threatened fauna species listed under the EPBC Act (4 of which are also listed under the TSC Act), 5 threatened flora listed under the TSC Act and 8 threatened flora listed under the EPBC Act. These were identified as potentially occurring on the site.
- Two critically endangered ecological communities (EPBC Act listed) were identified as potentially occurring within the area including the Weeping Myall - Coobah - Scrub Wilga Shrubland of the Hunter Valley; and the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.
- *Eucalyptus camaldulensis* was reported to occur within the riparian vegetation zones of the region. This species is protected by the provisions of the TSC Act, as it is listed as a threatened

population in the Hunter catchment. This species also has the potential to provide habitat for protected fauna, such as the Koala.

- Key threatening processes (KTP) potentially currently occurring in the area includes predation by European Fox, predation by Feral Cat. KTP associated with the project include clearing of native vegetation and human-caused climate change. It is noted that in addition to these processes recognised in the AECOM report, the following threatening processes may also currently occur in the area: invasion of native plant communities by exotic perennial grasses; competition and grazing by the feral European Rabbit; Bushrock removal; loss of hollow bearing and rough barked trees; removal of dead wood and dead trees.

Potential impacts resulting from the project were identified as being primarily related to construction of the associated infrastructure (roads, pipelines) rather than the power station site, and included associated runoff from construction and operation works.

4.2 FIELD INVESTIGATION

4.2.1 Vegetation Community and Condition Assessment

An analysis of the flora species recorded along each transect (listed in Appendix C), determined that four vegetation communities occur within the study site;

- Grassland/ pasture;
- Central Hunter Box – Ironbark Woodland;
- Central Hunter Ironbark – Spotted Gum – Grey Box Forest, and;
- Hunter Valley River Oak Forest.

The location and extent of each community is illustrated in Figure 5 below (note that the grassland/pasture community is not delineated on this map). Vegetation validation altered some of the mapping by Peake (2006), resulting in a larger area of Central Hunter Box - Ironbark Woodland and the presence of Hunter Valley River Oak Forest in place of Central Hunter Swamp Oak Forest. The survey team found no evidence of Narrabeen Footslopes Slaty Box Woodland along a transect through that mapped community, instead classifying it as Central Hunter Box - Ironbark Woodland.

Most of the woodland across the site is advanced regrowth, and it is likely that most of the regrowth has established following ownership of the land to develop the Bayswater Power Station. Therefore, most of the woodland vegetation is 30-40 years old. Amongst the advanced regrowth, there are older remnant trees that provide a good source of seed and fauna habitat.

The woodland is generally in moderate or good condition, however, there is a weedy element throughout the site, which is probably due to the use of the site for grazing in the past and present (Figure 6). The condition of the vegetation demonstrates its resilience and capacity to regenerate.

Central Hunter Box-Ironbark Woodland and Central Hunter Ironbark – Spotted Gum – Grey Box Forest have many similarities, and some of the attributes that distinguish these communities in undisturbed examples may be absent in regrowth vegetation. Many of the herb and grass species are common to both communities, with differences most apparent in the canopy and shrub layer. Using the information in Peake (2006), the list of positively correlated species and unique species for each community identified in his report, the vegetation community boundaries were drawn for this assessment. However, Peake (2006) acknowledges in his report that delineating a boundary between these two communities is difficult, suggesting that there can be broad transitional zones between each community.

This was experienced in delineating vegetation boundaries in this project. As Central Hunter Box – Ironbark Woodland and Central Hunter Ironbark – Spotted Gum – Grey Box Forest are both listed as "proposed" EECs in NSW, descriptions of the character and condition are provided under Section 4.2.1.1 below.

Eucalyptus moluccana (Grey Box) was found throughout the woodland areas. *E. tereticornis* (Forest Red Gum) was also common, being found consistently along drainage lines co-dominant with Grey Box and on some elevated ground, and *E. crebra* (Narrow-leaved Ironbark) less common and contained more in the eastern and northern parts of the surveyed area. Parts of the site were dominated by *Allocasuarina luehmannii* (Bulloak) regrowth, however, Peake (2006) notes that he has included this as Central Hunter Box-Ironbark Woodland on many occasions where such regrowth is adjacent to this community. The shrub layer was most consistent with Central Hunter Box-Ironbark Woodland with *Acacia decora, Cassinia quinquefaria* and *Notelaea macrocarpa* var *macrocarpa* dominant in this stratum.

The species richness of grassland and pasture communities comprised predominantly exotic species, with some areas containing small abundances of native grasses (20 – 40%). Grassland areas were found to be mostly disturbed as a result of cattle grazing and rabbit burrowing. There were several areas that contained larger native tussock grasses, however, the inter-tussock spaces were dominated by exotic species. Greater levels of diversity, particularly of native species, were found amongst rock outcrops in the grassland. This suggests that pasture improvement or agricultural activity in the past may have been excluded from the rock outcrops for fear of damage to farm equipment.

The Atlas of NSW Wildlife suggested that River Red Gum (*Eucalyptus camaldulensis*) may be present in the area, which is part of an endangered population in the region. Transects in riparian areas on site did not record this species.

Three noxious weeds were recorded on site, including *Lycium ferocissimum* (African Boxthorn), *Opuntia* sp. and *Echium plantagineum* (Paterson's Curse). Other environmental weeds of concern (Peake 2006) were also identified on site, include *Hyparrhenia hirta* (Coolatai Grass), *Galena pubescens* (Galena), *Juncus acutus* (Sharp Rush), *Chloris gayana* (Rhodes Grass) and *Pennisetum clandestinum* (Kikuyu). The presence and abundance of these and other exotic species influences the condition of a vegetation community and may exclude some native species from inhabiting an area.

A description of the key vegetation communities within the study site are provided below.

Grassland/pasture

The grassland community varied in composition and condition across the site. Some grasslands were dominated by native perennial species (*Austrostipa verticillata, Chloris ventricosa* and *Bothriochloa macra*), but with exotic species predominant in the inter-tussock spaces (*Lolium perenne, Medicago polymorpha, Senecio madagascariensis* and *Cirsium vulgare*).

Other patches of grassland were dominated by *Hyparrhenia hirta* (Coolatai Grass) with few native species presence. While Coolatai Grass is not declared noxious in Muswellbrook or Singleton LGA's, it is a highly invasive species and was noted by Peake (2006) as a problematic environmental weed.

While the grassland in the west of the study area was robust (ie, a dense grassland not subject to overgrazing), it does not represent a native vegetation community and, therefore, is considered to be in low condition.

Hunter Valley River Oak Forest

The woodland comprises a canopy of *Casuarina cunninghamiana* (River Oak) to 15m high. The shrub layer was scant in the area inspected with scattered *Acacia salicina*, and the ground cover comprised a mixture of native and exotic species, including *Austrodanthonia racemosa, Dichondra repens, Austrostipa verticillata, Microlaena stipoides, Einadia nutans, Anagallis arvense* and *Senecio madagascariensis.* 3.7 ha of this community was recorded within the study area.

Substantial parts of the canopy comprise regrowth forming a dense canopy with cover to 70%.

4.2.1.1 Endangered Ecological Communities

While no TSC Act or EPBC Act listed EEC's were identified on the study site, two communities, both "proposed" to be listed as EECs under the TSC Act were recorded. A description of the characteristics of both proposed communities present is provided below. Given the potential for the communities' status to be gazetted as "listed" during the development assessment process, and the regional significance of their presence on the site, a conservative approach has been adopted, and both communities will be assessed in this report as being of high biodiversity value.

Central Hunter Box - Ironbark Woodland

This woodland comprised a canopy of *Eucalyptus moluccana* (Grey Box), *E. tereticornis* (Forest Red Gum) and *E. crebra* (Narrow-leaved Ironbark). *Allocasuarina luehmannii* (Bulloak) and *Angophora floribunda* (Rough-barked Apple) were less common in the canopy. *Brachychiton populneus* (Kurrajong) occurred in a subcanopy but occurred as scattered isolated trees. The canopy was lowest on the crests but generally grew to 15 - 20m, with a few large trees in the drainage lines to 30m. Canopy cover varied greatly being quite open (5%) in parts to approximately 30%.

The shrub layer was generally sparse, comprising *Acacia decora, Cassinia quinquefaria* and *Notelaea macrocarpa* var. *macrocarpa*. The ground layer was generally grassy with *Microlaena stipoides, Austrostipa verticillata, Austrostipa scabra* and *Cymbopogon refractus* common, with the forbs *Desmodium varians, Calotis lappulacea, Lomandra multiflora, Brunoniella Australia, Opercularia* sp., *Vittadinia cuneata* and *Wahlenbergia* sp. regularly interspersed amongst the grasses.

505 ha of this community was recorded within the study area. The community was generally in moderate to good condition, influenced by the level of recovery of each stratum, abundance of weeds, and disturbance.

Central Hunter Ironbark – Spotted Gum – Grey Box Forest

This community comprised a canopy of Grey Box, Narrow-leaved Ironbark and Forest Red Gum. *Corymbia maculata* (Spotted Gum) was absent from the site. Bulloak and Rough-barked Apple were also present with Kurrajong as a scant sub canopy. The canopy reached 20 to 25m in height and canopy cover was approximately 20-30%.

The shrub layer was sparse comprising *Kunzea ambigua* (Tick Bush), *Daviesia ulicifolia* and *Pultenaea microphylla*. The ground layer was very similar to Central Hunter Box - Ironbark Woodland, with the addition of species such as *Lomandra longifolia* and *Themeda australis*.

116 ha of this community was recorded within the study area. The community was generally in moderate to good condition, and was influenced by the level of recovery of each stratum, abundance of weeds, and disturbance.

4.2.2 Flora

178 species of flora were recorded during the survey. Such a high diversity of plants is attributed to the size of the site and diversity of habitats present. Some species recorded have local significance being at the limit of their range. These species are:

- *Acacia decora*
- *Acacia falcata*
- *Aristida ramosa*
- *Cryptandra spinescens*
- *Enchylaena tomentosa*
- *Eustrephus latifolius*
- *Geijera salicifolia* var. *salicifolia*
- *Maytenus silvestris*
- *Notelaea microcarpa* var. *microcarpa*
- *Santalum lanceolatum*
- *Solanum brownii*
- *Xanthorrhoea johnsonii*

A full list of flora recorded is provided at Appendix C.

4.2.3 Fauna

Opportunistic and targeted searches for threatened fauna species revealed a number of other non target species during the diurnal and nocturnal survey efforts including birds, mammals, reptiles and amphibians (listed in Appendix C). These species were detected sheltering beneath cover, observed active during the diurnal surveys or heard calling.

The survey recorded 67 birds, 8 mammals, 9 reptiles and 4 frogs during the survey period (Appendix C). It is likely that several other species occur on site that would be recorded when undertaking a survey in a different and more appropriate season of survey.

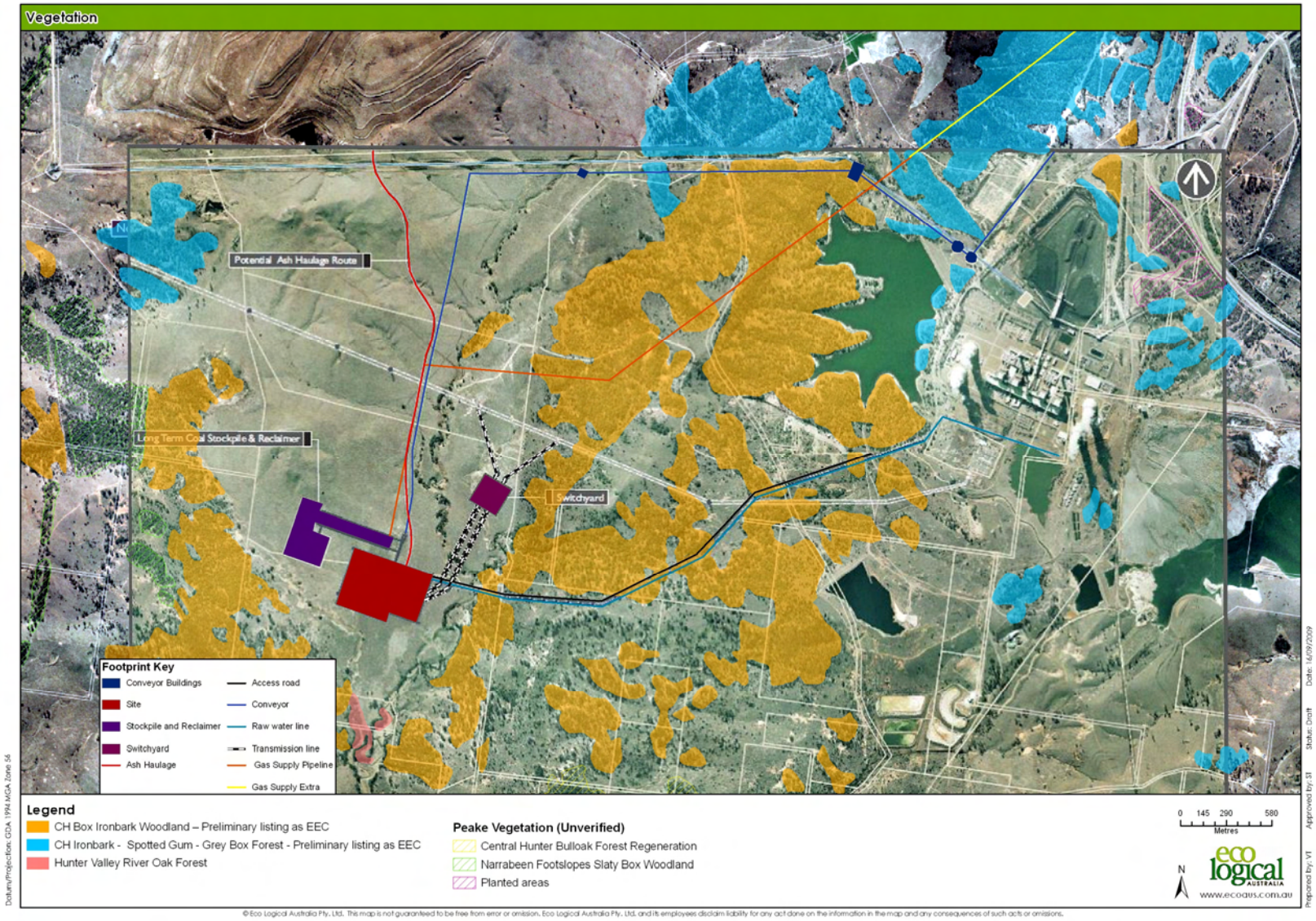

Figure 5: Vegetation communities within the study site (note that grassland has not been mapped).

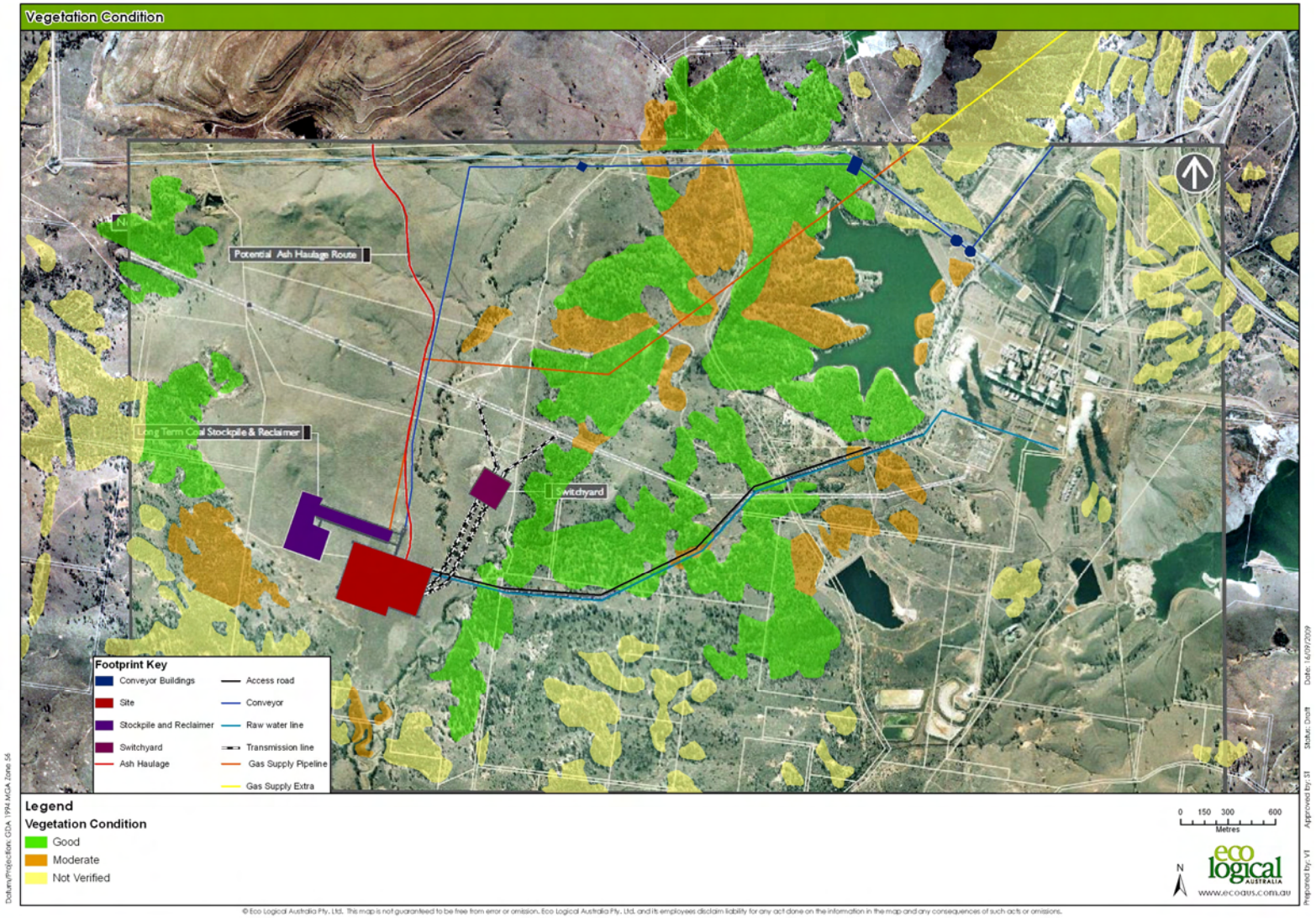

Figure 6: Vegetation condition within the study site.

4.2.4 Threatened Species Presence and Habitat Assessment

4.2.4.1 Threatened Flora Species

No threatened flora species were recorded during field investigations.

As discussed within Section 3.4, two threatened orchid species (*Diuris pedunculata* (Small Snake Orchid) and *Diuris tricolor* (Pine Donkey Orchid)) may potentially occur on the site but could not be detected given the survey was conducted outside of their flowering season. Further investigations are recommended within the optimal survey season to determine the presence of such species within the proposed development footprint.

It is unlikely that the site would provide suitable habitat for any other threatened flora species listed in Appendix A.

4.2.4.2 Threatened Fauna Species

Appendix A lists those species recorded within 10km of the site, and species returned by the EPBC protected matters search tool and indicates the likelihood of each species occurring on site based on available habitat. A number of species are considered likely to, or may potentially occur on site.

The Green and Golden Bell Frog (*Litoria aurea*), although not recorded during the survey, is considered likely to occur on site. More detail on this species is provided below. The Grey-headed Flying Fox (*Pteropus poliocephalus*), is also considered likely to occur on the site, given the availability of foraging resources. No critical habitats for this species are known to occur within the site.

Four vulnerable bird species (TSC Act) were observed during field investigations:

- Diamond Firetail *(Stagonopleura guttata);*
- Grey-crowned Babbler *(Pomatostomus temporalis temporalis)*
- Hooded Robin *(Melanodryas cucullata),* and
- Speckled Warbler *(Pyrrholaemus sagittatus).*

Five bird species listed under 'Other Protected Matters' as '*listed – overfly marine*' under the EPBC Act were also observed during field investigations (Appendix C):

- Intermediate Egret (*Ardea intermedia*)
- Fan-tailed Cuckoo (*Cacomantis flabelliformis*)
- Black-faced Cuckoo-shrike (*Coracina novaehollandiae)*
- Nankeen Kestrel (*Falco cenchroides*)
- Black-winged Stilt (*Himantopus himantopus*)

These species are wide-ranging and expected to use the site on a transient basis.

The remnant and regrowth woodland and forest on site represent suitable habitat for woodland bird species known or considered likely, or potentially occurring on site. While no critical habitat for these species is known to be present within the locality, the woodland vegetation is likely to provide sufficient

resources for them to complete their life cycle (foraging, roosting, breeding habitat). Regrowth woodlands can also have a relatively dense mid layer, provided by regenerating canopy species rather than shrub species. This regeneration can provide an ideal structure for woodland birds, particularly those that typically seek refuge in the shrub strata.

Several threatened or migratory species were identified as potentially occurring within the development site (Brown Treecreeper (*Climacteris picumnus victoriae*), White-throated Needletail (*Hirundapus caudacutus*), Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*), Rainbow Bee-eater (*Merops ornatus*), Black-faced Monarch (*Monarcha melanopsis*), and Regent Honeyeater (*Xanthomyza phrygia*)). Individuals of these species may transit through the site, however, the site is not known to provide critical habitat for important lifecycle components such as breeding and roosting activities. The impact of the proposal on migratory species is discussed in Section 5 and summarised in Section 5.3.

Habitat features recorded along the woodland traverses included small, medium and large hollows and spouts (Figure 9). Hollows were not common on site but these features may potentially provide roosting habitat for bird, bat and owl species. The vulnerable Barking Owl (*Ninox connivens*), considered likely to occur within the study site, is known to lay eggs in the hollows of large, old eucalypt trees (DECC 2009a). Vulnerable bat species considered to potentially occur within the site (Large-eared Pied Bat (*Chalinolobus dwyeri*), Eastern Bentwing-bat (*Miniopterus orianae oceanensis*), Large-footed Myotis (*Myotis macropus*), East-coast Freetail-bat (*Mormopterus norfolkensis*), Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*), Greater Broad-nosed Bat (*Scoteanax rueppellii*)) are also known to roost in tree hollows. The site is, however, not known to provide critical habitat for these species. Habitat used by these species is considered to be common throughout the landscape. The impact of the proposal on threatened species is discussed in Section 5 and summarised in Section 5.3.

Green and Golden Bell Frog presence and habitat

No adult or tadpole Green and Golden Bell Frog (*Litoria aurea*) were recorded during targeted surveys for the species. Although individuals were not detected, the Green and Golden Bell Frog should be assumed as being present given the unsuitable survey conditions, the extent of suitable habitat, previous records and the propensity of the species to move significant distances to periodically utilise habitat components to fulfil lifecycle requirements.

Extensive areas of interconnecting potential habitat for this species were observed during the survey (Figure 10). This habitat is linked to areas where the species has been detected previously.

No tadpoles were observed in the larger water bodies within the study site (e.g. 'farm' dams and reservoirs). Some water bodies were observed to contain fish species including eels and *Gambusia* sp., indicating factors that these areas are unlikely to be suitable Green and Golden Bell Frog habitat. Water quality in one of the reservoirs appeared to experiencing a cyano-bacterial bloom.

Koala presence and habitat

No Koala (*Phascolarctos cinereus*) have been recorded on the site since the 1950's. The site contains a number of high quality feed trees (Forest Red Gum) at densities conducive to support Koala. However, there is poor connectivity off site to suitable habitat, and low cumulative areas of suitable habitat that suggests the site would most likely be a movement corridor.

Searches of Forest Red Gum on site for evidence of Koala activity (scratches and scats) did not suggest that Koala were present on site.

4.2.5 Fauna Habitat Features

A range of habitat features occur across the site, but some of these are quite limited given the age of the vegetation communities (ie advanced regrowth) (Figure 9).

Fauna habitat included in the table below.

Table 4: Habitat diversity on site and whether it would be used by threatened species known, likely or potentially present.

Habitat Feature	Generalised occurrence on site	Threatened species habitat on site
A diversity of vegetation types (woodland, forest and grassland) and ecotones between these types.	Common	Yes – woodland birds, owls
Hollow bearing trees	Occasional	Yes – bats, owls
Winter flowering eucalypts	Frequent	Yes – Swift parrot and some woodland birds
Eucalypts with a range of bark types	Common	Yes – bats
Suitable Koala feed trees	Common	Yes – koala (but unlikely to be on site)
Rock outcrops and surface rock	Rare	No
Woody debris and litter	Occasional	Yes – frogs
Riparian vegetation	Occasional (in riparian areas)	Yes – frogs, woodland birds, migratory birds
Ephemeral creeks containing pools and adjacent swales with instream vegetation	Occasional	Yes – frogs, some migratory birds
Permanent sources of water (dams and lakes)	Occasional	Yes – frogs, some migratory birds
Termite mounds	Rare	No
Mistletoe	Common	Yes – woodland birds

This assemblage of fauna habitat creates an environment suitable to a wide range of fauna. This included woodland species, species typically associated with rural environments, reptiles and amphibians. Many more fauna would be identified during a more intensive survey of the site. However, the history of disturbance at the site and age of most trees may mean that some species may not occur and have not occurred on site for some time.

Connectivity between other remnants is also key to the suitability of habitat for particular species. This is discussed below.

4.2.6 Connectivity and Corridors

The study site is located in a landscape in which the remnant vegetation is fragmented. Many of the remnants beyond the study site appear from aerial photographs to be of a similar size making the landscape a fairly good series of islands or stepping stones for more mobile species to move across the landscape. More sedentary or less mobile fauna would be less likely to thrive in this landscape.

Peake (2006) in his report on remnant vegetation in the Central Hunter Valley includes the study site as part of a broad regional corridor (Figure 7). The regional corridors include north – south and east – west linkages, incorporating the large patches of extant remnant vegetation in the region. Gaps between patches of vegetation can be greater than 1km, so to improve the effectiveness and function of the corridors, regeneration or revegetation would be required on a broad scale. While being limited, to a certain degree, in the diversity of species that may utilise the site as a corridor, the mosaic of vegetation on and off site would be likely to perform some corridor (or stepping stone) function.

Although disjunct, Peake also illustrates potential corridors at a local scale that may be utilised by fauna (Figure 7). This includes a north-south linkage that passes through the study site, east of Saltwater Creek. Maintaining the functions of these corridors is key to the long term health of local fauna. Retaining the diversity of fauna habitat identified above, along with large patches are key elements to achieving this on a local and regional scale.

The suggested corridors by Peake (2006) fit more broadly into interstate objectives to provide connectivity along the Great Dividing Range. Considering the limitations of the corridor and fragmented landscape, retaining and enhancing remnant vegetation on site would help to realise this corridor (refer to Section 5.1.1 (c) for potential impacts to corridors.

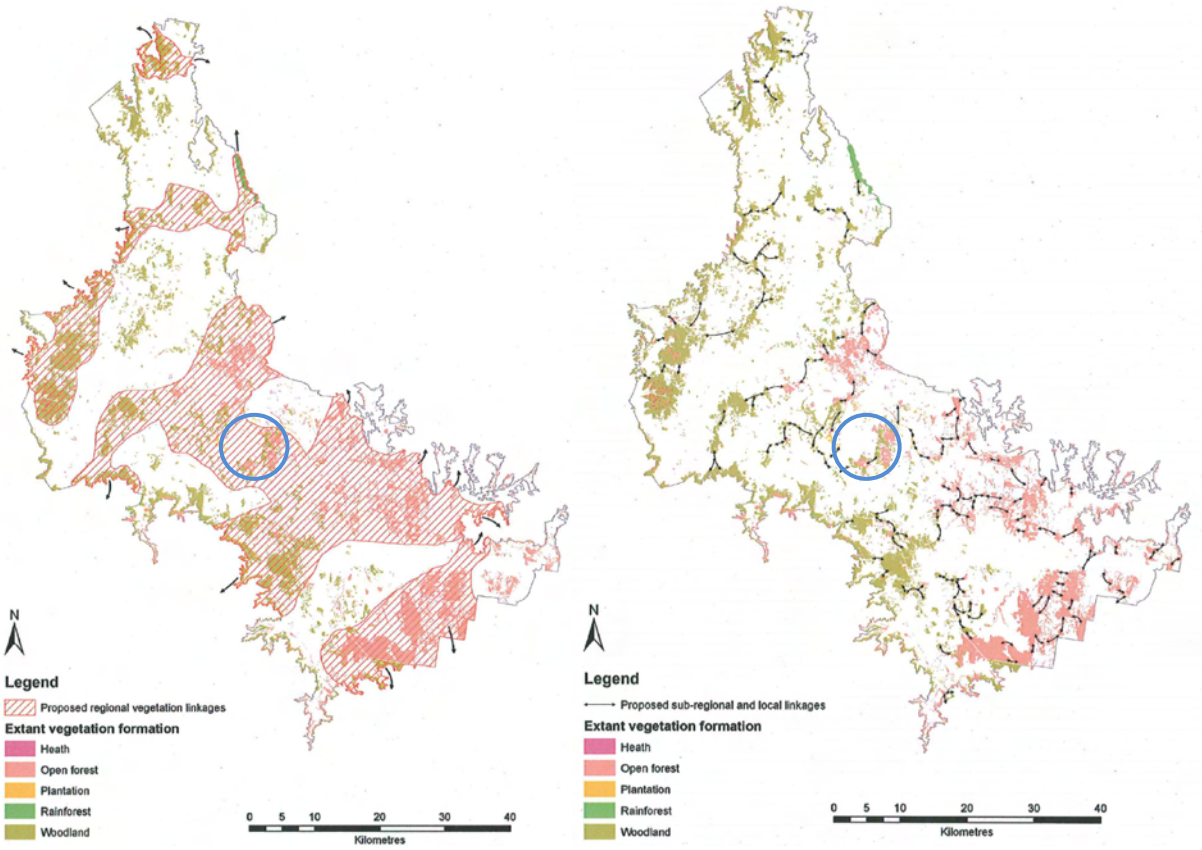

Figure 7: Regional corridors (left and local corridors (right) identified by Peake (2006). The study site is circled in blue on each map (source Peake 2006).

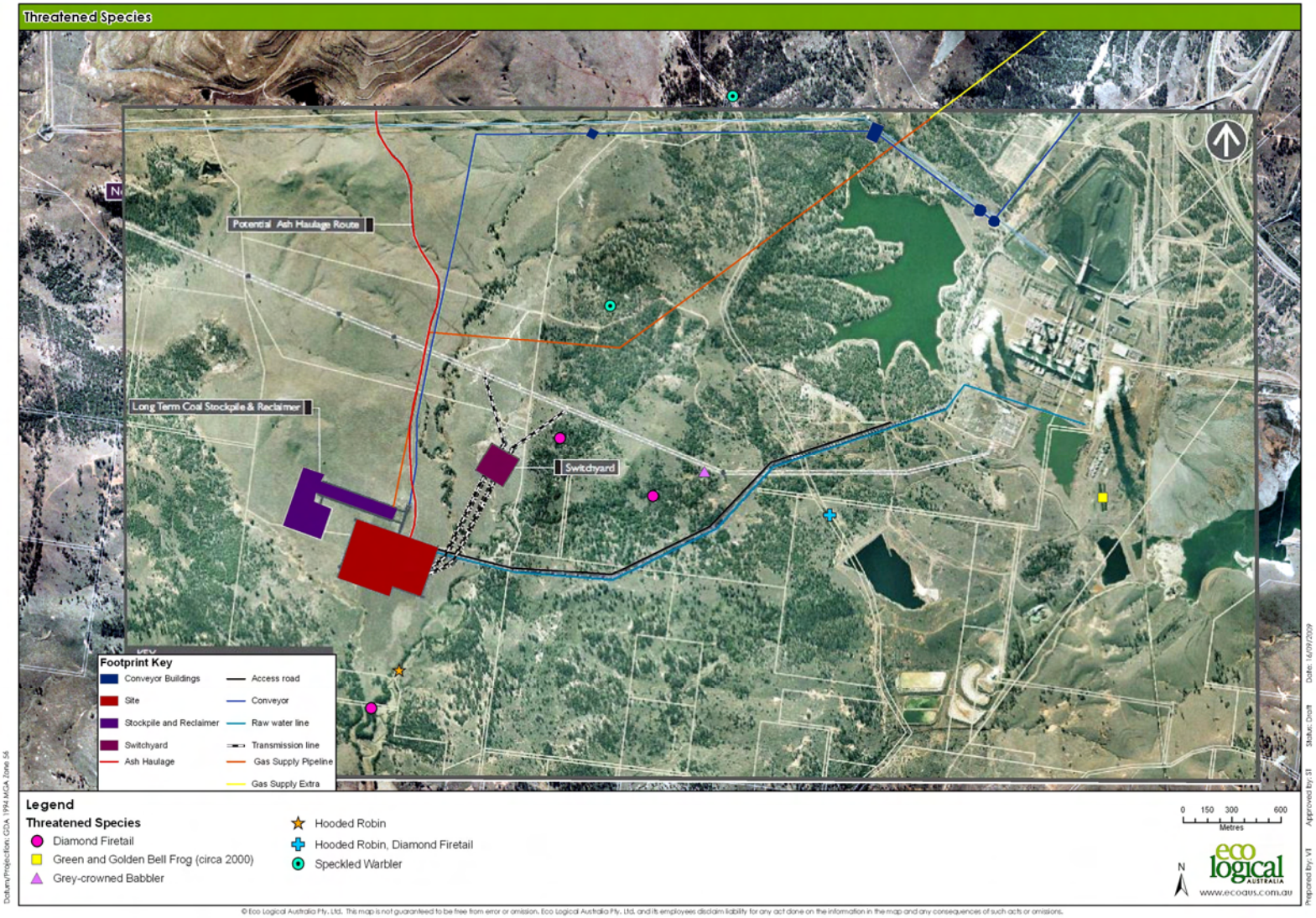

Figure 8: Threatened species recorded during field surveys of the study site, along with a former Green and Golden Bell Frog record.

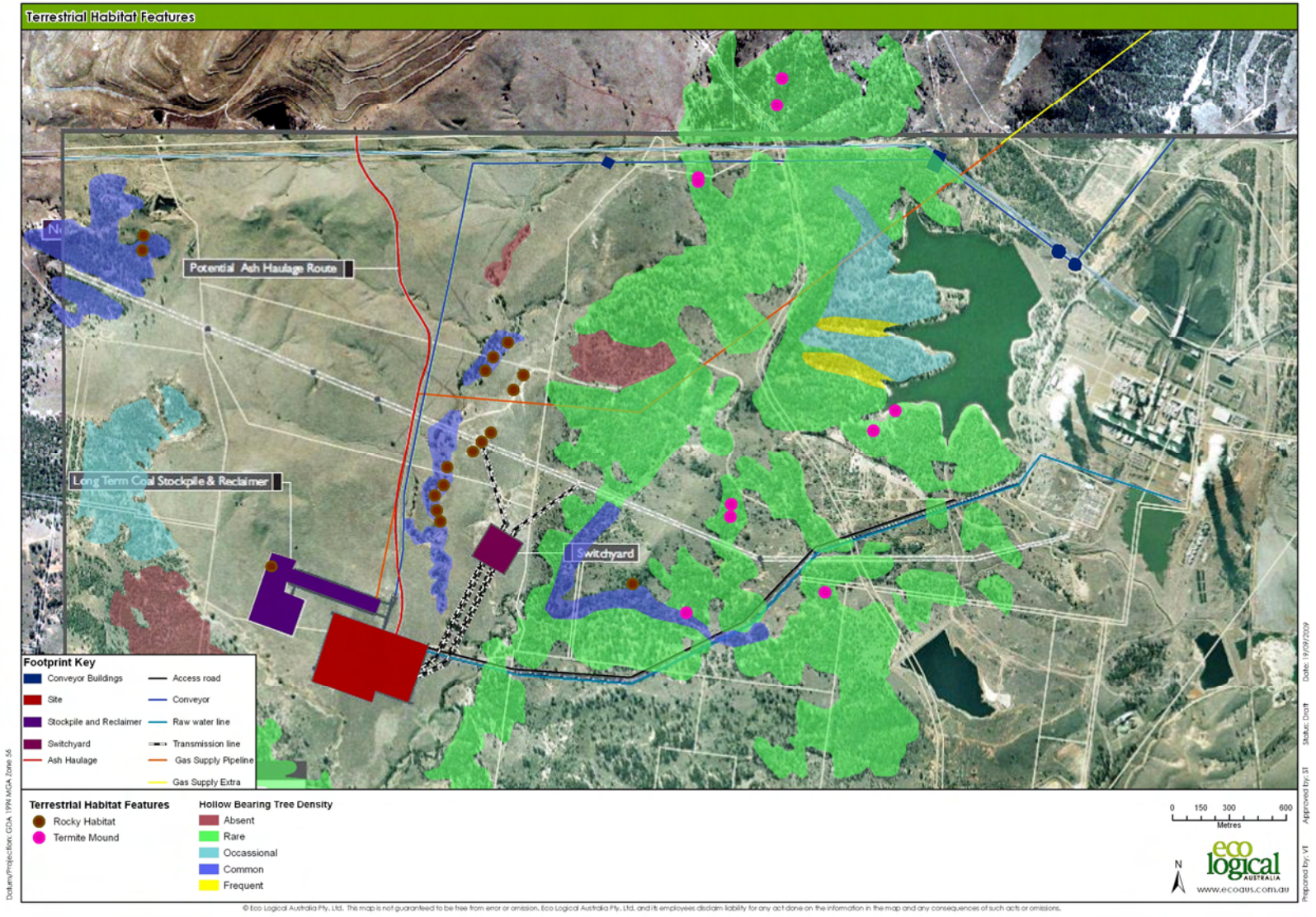

Figure 9: Fauna habitat features within the study site

4.2.7 Aquatic Ecosystem and Riparian Habitat Assessment

The predominant drainage pattern within the study area is south with minor tributaries flowing into Saltwater Creek which empties into Plashett Dam. Waterways comprise both poorly defined and well defined ephemeral creeks higher in the catchment and permanent features towards Plashett Dam. A number of aquatic features have been altered (waterways) or created (dams and channels) to cater for power plant operations.

The condition of natural drainage features within the study area have been degraded in most areas through clearing of riparian and adjacent vegetation which has resulted in erosion of bed and bank features, deposition of sediment and reduced water quality. Additionally, cattle grazing has promoted erosion, limited regeneration of riparian vegetation, and contributed to high nutrient loads in certain reaches.

Despite previous disturbance within the catchment sections of waterways within the study area (particularly those that have been less disturbed) offer important habitat for native flora and fauna and act to protect important ecosystems downstream such as Plashett Dam. Similarly, modified aquatic habitats within the study area provide habitat for some aquatic flora and fauna, and may be of particular importance to Green and Golden Bell Frog.

Notes of aquatic habitat features examined during the survey are mapped (Figure 10) and tabled below (Table 5). A detailed survey of the assemblage of aquatic fauna on site was not undertaken, rather the survey focused on identifying habitat complexity and condition which influences species diversity and ecosystem function within the study site

Table 5: Aquatic habitat features within the study site

Feature no.	Aquatic Habitat Description
1	Improved Habitat with aquatic macrophytes (*Typha orientalis, Juncus acutus*) in pools present, along with fringing tussock grasses and occasional streamside vegetation canopy components.
2	Improved habitat quality downstream due to increased cover of vegetation. Good selection of habitat features including instream vegetation, instream woody debris and improvements in bed and bank condition.
3	Better quality streamside vegetation and associated woody debris instream and on floodplain or adjacent to banks. Some pools with *Typha orientalis* (Cumbungi) present but poor water quality due to disturbance factors. Embedded/outcropping rock in riparian zone.
4	Some rocky habitat, macrophytes, and improved water quality.
5	Potential Green and Golden Bell Frog breeding habitat.
6	Sparse canopy vegetation including stags providing woody debris on floodplain and instream. Aquatic macrophyte and sedge habitat present. Bed and bank features such as benches and bars present. Improved water quality.
7	Dense cover of *Typha orientalis* and *Juncus acutus*, in permanent constructed channel. Provision of secondary habitat for Green and Golden Bell Frog and potentially valuable movement corridor.
8	Cover of *Typha orientalis* and *Juncus acutus* instream and woody debris and litter in riparian areas.

Feature no.	Aquatic Habitat Description
9	Potential Green and Golden Bell Frog breeding habitat - Large feature with soaks offline from main channel with good habitat.
10	Permanent stream flow with pools connected by shallow riffles. Sand and gravel deposits in beds. Macrophytes present dominated by *Typha orientalis* and *Juncus acutus*. Good canopy cover and streamside vegetation structural components. Instream and streamside woody debris.
11	Shallow dam with good aquatic habitat provided by abundant macrophyte growth including *Potamogeton sp.* and *Eleocharis sphacelata.* Good water quality and no *Gambusia holbrooki.*
12	Spillway with cover of aquatic macrophytes. Potential breeding habitat for Green and Golden Bell Frog (though poor water quality).
13	Potential Green and Golden Bell Frog breeding habitat.
14	Potential Green and Golden Bell Frog secondary habitat.
15	Potential Green and Golden Bell Frog breeding habitat. Large dam with shallow margins supporting macrophyte growth (*Typha orientalis* and *Phragmites australis*).
16	Previous known occurrence of Green and Golden Bell Frog.
17	Sandy evaporative pond with fringing grasses and possibly salty margins.
18	Holding ponds with better water quality than those to north and more fringing vegetation. Potential habitat for Green and Golden Bell Frog.

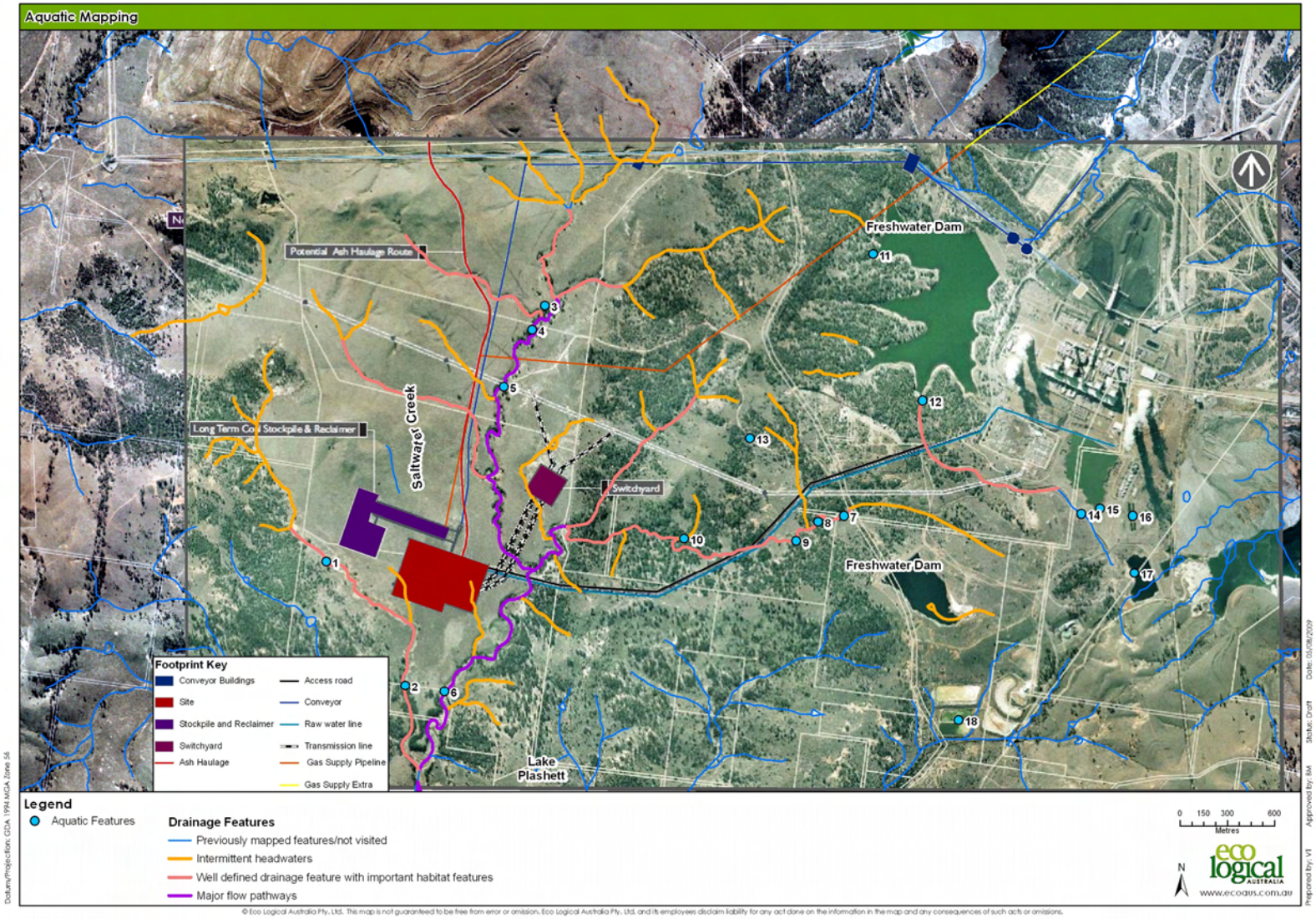

Figure 10: Aquatic habitat features within the study site (note that the numbered habitat features are described in Table 5)

4.3 CONSERVATION SIGNIFICANCE ASSESSMENT

Three remnant native vegetation communities occur on the study site:

- Central Hunter Box-Ironbark Woodland;
- Central Hunter Ironbark – Spotted Gum – Grey Box Forest, and;
- Hunter Valley River Oak Forest.

Peake (2006) identifies the following conservation significance criteria for each of these communities.

Table 6: Threatened remnant native vegetation communities (Peake 2006) and the basis for their conservation status.

Community	Area pre clearing (ha)	Area extant (ha)	Area cleared (%)	Level of reservation (intuitive)	Regional level of threat (intuitive)	DEWHA criteria
Central Hunter Box-Ironbark Woodland	46,920	14,818	68.4%	None	High	Limited distribution and vulnerable
Central Hunter Ironbark – Spotted Gum – Grey Box Forest	46,753	18,306	60.9	Very poor	High	Restricted distribution, mostly small remnant 10-100ha
Hunter Valley River Oak Forest	41,142	955	98.9	Poor to none	Very high	Restricted distribution, severe decline, endangered

The remnant vegetation likely to be affected by either of the proposed operating scenarios is of high conservation value as it is the subject of a preliminary determination of an EEC and is known habitat for threatened species (ie Brown Treecreeper, Diamond Firetail, Grey-crowned Babbler and Hooded Robin identified during the survey). Within the matrix that contributes to conservation significance, patch size is the lone distinguishing variable that differs across the site and that may direct where impacts should be located. Figure 11 illustrates Peake's (2006) patch size categories for remnant vegetation on site.

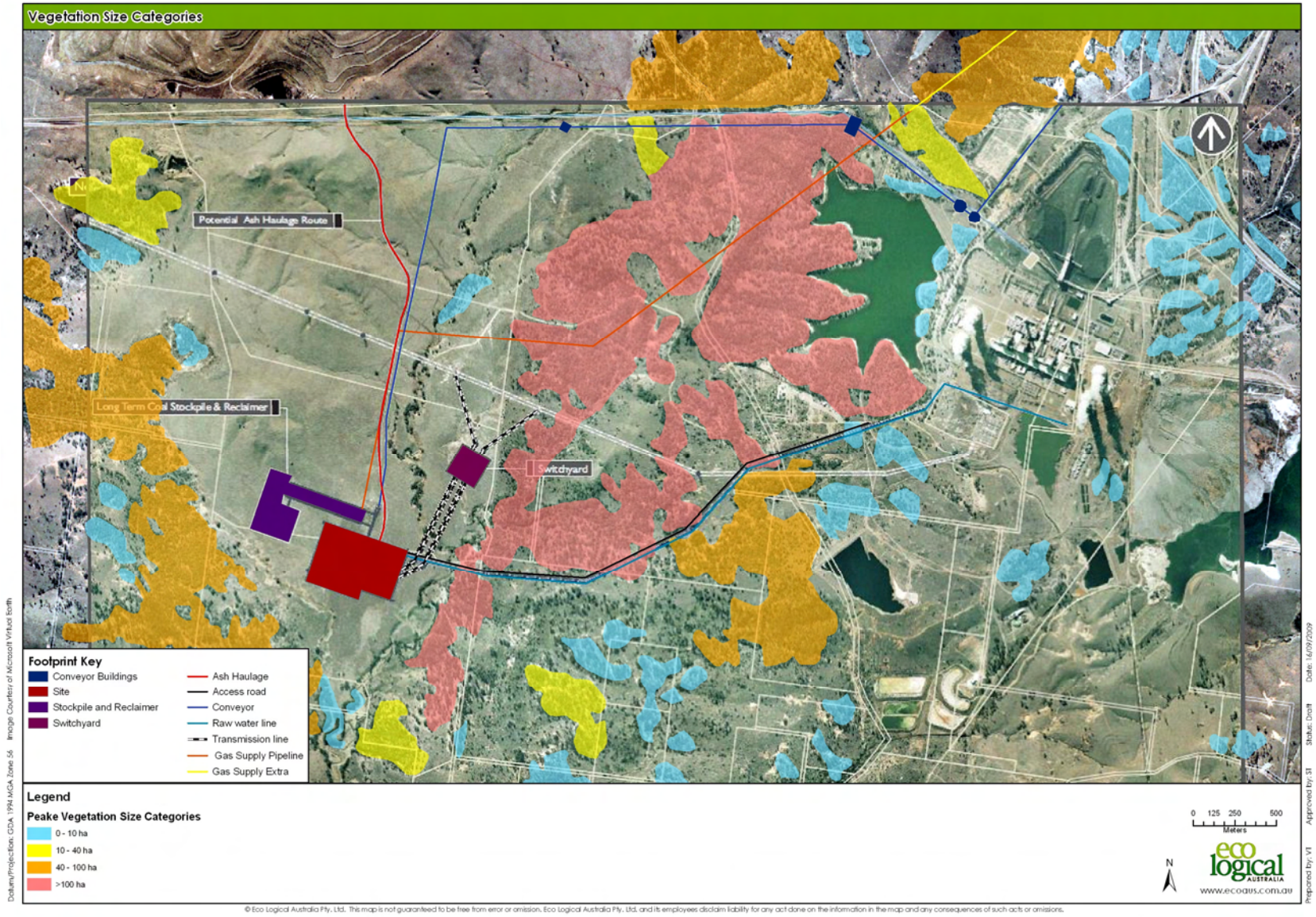

Figure 11: Patch size classification of vegetation on the study site.

5 Impact Evaluation

The following section evaluates the nature and extent of environmental impacts likely to result from the proposed construction and operation of the Bayswater B Power Station. The environmental impacts considered in this report are confined to the terrestrial and aquatic environments, and the biota contained therein.

The Department of the Environment and Climate Change (DECC) environmental assessment guidelines for the proposed power station require that an assessment be made for each operating scenario option (coal fired and gas fired generation) (DECC 2009b). In accordance with this requirement, potential impacts resulting from the project are addressed below against each of the two possible scenarios.

5.1 COAL FIRED PLANT

A brief description of this concept option for the Bayswater B Power Station site is provided in Section 1.1. Figure 1 illustrates the location of infrastructure, roads and conveyors to be developed as part of this plan.

5.1.1 Construction Impacts

Direct and indirect impacts potentially resulting from the construction phase of the proposed coal fired include:

a) *Impact area of the process units*: The process units form the main plant. Process units will be constructed on relatively flat land west of Saltwater Creek. The vegetation comprises modified grassland which has few biodiversity values. An area of 18.75 ha will be impacted. It is likely that the final footprint will be larger that incorporates car parks, outside storage and landscaping, thereby increasing the area of modified grassland impacted.

b) *Impact area of construction works*: Construction works will involve levelling of building sites. The activity would be located on relatively flat land and result in the removal of modified grassland of low biodiversity value (approximately 56.25ha). The impact of the lay down area has not been addressed as the final size and location will be determined as part of the design phase.

c) *Impact area of roads*: Roads will be constructed to access the Bayswater B Power Station. These will include a sealed road from Bayswater River Road. The access road which will extend east from the Bayswater B site and impact some native vegetation (an area of 2.57 ha of Central Hunter Box - Ironbark Woodland in moderate to good condition), grassland (4.88 ha), habitat for threatened woodland birds, and will cross semi permanent streams on site, some of which represent potential habitat for the endangered Green and Golden Bell Frog.
The development of the access road has the potential to limit the movement of small ground mammals, frogs and reptiles, due to areas of vegetation becoming fragmented. Such impacts are less likely to affect listed woodland birds, migratory birds, bats and larger mammals which

are more mobile and broad ranging species. The loss of habitat for woodland birds, migratory birds, bats and larger mammals is, therefore, unlikely to compromise their existence and use of the site.

d) *Impact area of raw water line*: The coal fired will require the supply of either treated or untreated raw water via a pipeline between the power plant and either the existing Bayswater Freshwater Dam (if treated) or a new softening plant supplied from the Bayswater Cooling Tower Make-Up Dam (if untreated). Construction of the raw water line will require removal of native vegetation (2.82 ha of Central Hunter Box - Ironbark Woodland in moderate to good condition), 7.83 ha of modified grassland, and will cross Saltwater Creek and other drainage features and intermittent headwaters. Impacts in woodland areas may remove hollow bearing trees and native vegetation that is suitable habitat for threatened woodland birds, bats and owls, while crossing linear riparian areas may impact Green and Golden Bell Frog if not appropriately managed.

e) *Impact area of transmission infrastructure*: In addition to the transformer yard and switchyard to be constructed (3.65 ha), a total of 6 km of transmission lines will be built to join with existing power lines. It is expected that this will include clearing of a mown linear corridor 50 metres wide within modified grasslands (11.43 ha), a small area of Central Hunter Box – Ironbark Woodland will also be cleared (0.04 ha) while a portion of which will cross Saltwater Creek. Impacts in woodland areas may remove hollow bearing trees and native vegetation that is suitable habitat for threatened woodland birds, bats and owls, while crossing linear riparian areas may impact Green and Golden Bell Frog if not appropriately managed.

f) *Increased traffic movements*: Construction supplies are expected to be delivered by road. As a result, traffic movements will increase. It is expected that the majority of this traffic will include heavy vehicles. There is an increased risk to ground dwelling fauna of vehicle strike as a result of increased traffic movements in the area.

g) Increased runoff and sedimentation: Construction works will involve some degree of excavation of lands on the site. Such excavation is likely to result in increased rates of runoff and sedimentation into surrounding water courses. The area is particularly prone to increased soil erosion due to soils being highly sodic (sodium attached to clay soils). Sedimentation of waterbodies has the potential to decrease water quality and negatively impact aquatic habitats. The extent to which sedimentation will occur as a result of construction activities, is likely to depend on several factors including climatic conditions, degree of excavation required, level of disturbance to soils and the distance of construction activities to waterways. Impacts to water quality may affect Green and Golden Bell Frog and its habitat, should they occur.

h) *Impact area of conveyor*: A conveyor will be constructed to connect the rail lines, and deliver coal to coal bunkers at the proposed main plant site for the coal fired operating scenario. The new conveyor and associated buildings will remove some modified grassland (5.09 ha), and very limited areas of Central Hunter Box – Ironbark Woodland (1.11 ha) and Central Hunter Spotted Gum – Grey Box Forest (.25 ha) with an impact area of approximately 10m in width. Impact in woodland may remove hollow bearing trees and native vegetation that is suitable habitat for threatened woodland birds, bats and owls.

i) *Impact area of dry storage stockpile*: A fully covered dry storage stockpile will be required in order to provide 10 days coal supply in the event of maintenance operations, plant failures or interruptions in supply of coal by rail. The stockpile requires removal of an area of approximately 10.94 hectares of modified grassland.

Table 7: Impact summary for threatened and migratory fauna species and two threatened flora species that may potentially occur on site.

Species Name	EPBC Status	TSC Act Status	Likelihood of occurrence within study area (based on desk based review)	Impact (based on survey and assessment)
Diuris tricolor	V	V, E2	Potential	Potential habitat is present on site. Surveys are required in an appropriate season to determine if the species is present.
Diuris pedunculata	E	E	Potential	Potential habitat is present on site. Surveys are required in an appropriate season to determine if the species is present.
Brown Treecreeper *Climacteris picumnus victoriae*	-	V	Potential	Habitat is present in and around the project site, most of which will be retained. Several areas of preferred habitat are located in the surrounding areas. Impact likely to be low or negligible and acceptable
White-bellied Sea Eagle *Haliaeetus leucogaster*	M	-	Unlikely	The project is not located along the coast or on a large River / inland waterbody that would be considered suitable for the White Bellied Sea Eagle. Impact likely to be nil.
White-throated Needletail *Hirundapus caudacutus*	M	-	Potential	Species may transit through the site. No known critical habitat or lifecycle components at the site. Impact likely to be negligible and acceptable
Swift Parrot *Lathamus discolor*	E	E	Potential	Species may transit through the site foraging. No known critical habitat or lifecycle components at the site. Impact likely to be low or negligible and acceptable.
Hooded Robin *Melanodryas cucullata cucullata*	-	V	Yes	Identified at the project site. Woodland habitat may be removed, however only to a small extent. Linear impacts are not likely to restrict their movement across the landscape. Habitat will remain on site and surrounds. Impact likely to be low and acceptable.
Black-chinned Honeyeater (eastern subspecies) *Melithreptus gularis gularis*	-	V	Potential	Habitat is present in and around the site most of which will be retained. Several areas of preferred habitat are located in the surrounding areas. Impact likely to be low or negligible and acceptable.

Species Name	EPBC Status	TSC Act Status	Likelihood of occurrence within study area (based on desk based review)	Impact (based on survey and assessment)
Rainbow Bee-eater *Merops ornatus*	M	-	Potential	Species may transit through the site. Potential breeding sites occur along eroded stream banks on site. However, only a small area of this habitat will be affected. Impact likely to be low or negligible and acceptable.
Black-faced Monarch *Monarcha melanopsis*	M	-	Potential	Species may transit through the site. No known critical habitat or lifecycle components at the site. Impact likely to be nil.
Satin Flycatcher *Myiagra cyanoleuca*	M	-	Unlikely	Species may transit through the site. No known critical habitat or lifecycle components at the site. Impact likely to be nil.
Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis*	-	V	Yes	Identified at the project site. Woodland habitat may be removed, however only to a small extent. Linear impacts are not likely to restrict their movement across the landscape. Habitat will remain on site and surrounds. Impact likely to be low and acceptable.
Speckled Warbler *Pyrrholaemus sagittatus*	-	V	Yes	Identified at the project site. Woodland habitat may be removed, however only to a small extent. Linear impacts are not likely to restrict their movement across the landscape. Habitat will remain on site and surrounds. Impact likely to be low and acceptable.
Australian Painted Snipe *Rostratula australis*	M	V	Unlikely	No wetlands are located in the vicinity of the Proposal site. Impact likely to be nil.
Diamond Firetail *Stagonopleura guttata*	-	V	Yes	Identified at the project site. Woodland habitat may be removed, however only to a small extent. Habitat will remain on site and surrounds. Impact likely to be low and acceptable.
Regent Honeyeater *Xanthomyza phrygia*	E	E	Potential	Species may transit through the site. No known critical habitat or lifecycle components at the site. Impact likely to be nil.

Species Name	EPBC Status	TSC Act Status	Likelihood of occurrence within study area (based on desk based review)	Impact (based on survey and assessment)
Barking Owl *Ninox connivens*	-	V	Likely	Preferred habitat identified at the project site in the form of hollow bearing trees and foraging areas. It is unknown whether the species utilizes these resources on site, but avoidance of hollow bearing trees and a suitable buffer around nest sites will substantially reduce impacts. It is recommended that a hollow bearing tree survey be undertaken along the impact area and 50m either side. The likely level of impact cannot be determined at this stage, but by avoiding hollow bearing trees and buffering accordingly, impact is likely to be low and acceptable.
Large-eared Pied Bat *Chalinolobus dwyeri*	V	V	Potential	Habitat is present in the vicinity of the Proposal site. It is unknown whether the species utilizes hollow bearing trees on site, but avoiding hollow bearing trees will substantially reduce impacts. It is recommended that a hollow bearing tree survey be undertaken along the impact area. By avoiding hollow bearing trees and buffering accordingly, impact is likely to be low and acceptable.
Eastern Bentwing-bat *Miniopterus orianae oceanensis*		V	Potential	Foraging habitat is present in the vicinity of the Proposal site. The proposal is unlikely to affect any potential roosting habitat. The impact of the proposal is considered to be negligible and acceptable.
East-coast Freetail-bat *Mormopterus norfolkensis*	-	V	Potential	Habitat is present in and around the Proposal site. Several areas of preferred habitat are located in the surrounding areas. By avoiding hollow bearing trees and buffering accordingly, impact is likely to be low and acceptable.
Large-footed Myotis *Myotis macropus*	-	V	Potential	Habitat is present in the vicinity of the Proposal site. Foraging and potential roosting habitat is present (waterways and hollow bearing trees). Minor impact to foraging habitat may occur. By avoiding hollow bearing trees and buffering accordingly, impact is likely to be low and acceptable.
Eastern Long-eared Bat *Nyctophilus bifax*	-	V	Unlikely	Preferred habitat is not located in the locality of the Proposal site.
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	Likely	Preferred foraging habitat identified at the project site. Impact likely to be negligible and acceptable

Species Name	EPBC Status	TSC Act Status	Likelihood of occurrence within study area (based on desk based review)	Impact (based on survey and assessment)
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	-	V	Potential	Habitat is present in and around the Proposal site. Several areas of preferred habitat are located in the surrounding areas. Impact likely to be negligible and acceptable
Greater Broad-nosed Bat *Scoteanax rueppellii*	-	V	Potential	Habitat is present in and around the Proposal site. Several areas of preferred habitat are located in the surrounding areas. By avoiding hollow bearing trees and buffering accordingly, impact is likely to be low and acceptable.
Koala *Phascolarctos cinereus*	-	V	Unlikely	Characteristic food trees are located on site but a lack of records in recent times indicates that the site is not “core” Koala habitat. Impact of the proposal is likely to be nil.
Squirrel Glider *Petaurus norfolcensis*	-	V	Unlikely	Preferred habitat is not located in the locality of the Proposal site. Impact likely to be negligible and acceptable
Brush-tailed Rock-wallaby *Petrogale penicillata*	V	E	No	Preferred habitat is not located in the locality of the Proposal site. Impact likely to be nil.
Booroolong Frog *Litoria booroolongensis*	E	E	Unlikely	Preferred habitat is not located in the locality of the Proposal site. Impact likely to be nil.
Green and Golden Bell Frog *Litoria aurea*	V	E	Likely (Suitable habitat recorded within the study site)	Preferred habitat identified at the project site. Further survey is required to better understand, evaluate and manage potential impacts.

5.1.2 Operational Impacts

Operational impacts which may result from the coal fired option comprise direct and indirect impacts, and include:

a) *Increased noise disturbance*: The coal fired scenario will operate 24 hours/day, 365 days a year. Noise levels of this operating scenario have not yet been determined. It is expected that noise disturbance would be confined to a small area of woodland habitat surrounding the main power plant operations. Noise has the potential to impact breeding frogs, with females unable to hear the calls of males. This flows on to reduce spawning activity, recruitment and population size. The proximity of the proposed Power Station to a breeding site for Green and Golden Bell could be significant. Further survey is required.

b) *Increased water use:* Water will be required for operational use for the life of the project. Raw water will be sourced from Bayswater Fresh Water Dam (treated) or the Bayswater Cooling Tower Make-Up Dam (untreated). These waterbodies are considered to be moderate to good condition aquatic habitat. 2.4 GL/yr of water will be used for operational purposes which is within MacGen's current water entitlements and purchases. Therefore, the impact on habitat within these waterbodies, and the affect on hydrological process within the local area in relation to increased water use are expected to be insignificant.

c) *Increased light disturbance*: Lighting will be required along roads and within the main plant areas during the night. The impact area of light spill for the site is yet to be determined, however, is likely to affect tracts of woodland habitat adjacent to roads. The impact of light on terrestrial fauna is poorly understood but most likely to affect nocturnal fauna, such as frogs, bats and mammals. Many frogs species are sensitive to light, including the Green and Golden Bell Frog. Male frogs may not call in areas illuminated at night, which will affect breeding, recruitment of frogs and eventually population size. By not aiming lighting towards remnant bush or water bodies, the impact can be substantially reduced to an acceptable level.

d) *Impacts on water quality*: While the majority of water used within the site will be recycled for operational purposes on-site, drainage systems will be required for this option primarily for stormwater runoff. Stormwater will be directed into Plashett Dam, natural overland stormwater flow paths and detention ponds. The majority of drainage water will be treated (as part of the water cycle management) prior to its release into waterways. Drains from sources potentially containing contaminants will be primarily used for ash conditioning or be directed to the existing Bayswater power plant for treatment. Poor water quality has the potential to affect frogs and their prey items. With appropriate management, the impact is considered to e minor and acceptable.

e) *Increased traffic movements:* The vehicles of staff travelling to and from work will be introduced into the area. Increased traffic movements have the potential to impact all fauna with an increased risk of vehicle strike. However, it is unlikely that this represents a significant threat to local fauna.

f) *Increased railway (Antiene Rail Coal Unloader) use*: The existing rail line will be required to transport coal to the conveyor system in order to deliver coal to the storage area for the coal fired operating scenario. Increases in deliveries of coal using the railway are not likely to result in any impacts to surrounding habitat, vegetation or species present in the area.

g) *Increased dust emissions:* Increased dust emissions may result from the coal fired operating scenario. Potential sources of such emissions include fly ash emitted from the main plant. Volumes of such emissions have not yet been determined for this scenario. Dust management is required to sustain a health environment.

5.1.3 Decommissioning Impacts

The extent of impacts resulting from decommissioning of the plant in a few decades time is unable to be determined at this stage of the project. It is, therefore, recommended that a detailed environmental assessment be undertaken prior to this phase being implemented.

5.2 GAS FIRED PLANT

A brief description of this concept option for the Bayswater B Power Station is provided in Section 1.1. Figure 2 illustrates the location of infrastructure, roads and gas pipeline to be developed as part of this plan.

5.2.1 Construction Impacts

The majority of direct and indirect construction impacts for the gas fired option will be the same as those described for the coal fired scenario above (refer to Table 7), with some exceptions. The total impact area of roads will be less in this scenario and there will be no railway, conveyor, or dry storage stockpile required. Impacts differing from those described for the coal fired option, or specific to the gas fired scenario, are as follows:

a) *Impact area of the process units:* This is discussed above under Section 5.1.1 which describes the impact of the coal fired power station process units. The impact area of the gas fired process units will be approximately 11.77 ha. It is likely that the final footprint will be larger that incorporates car parks, outside storage and landscaping, thereby increasing the area of modified grassland impacted.

b) *Impact area of the construction works:* This is discussed above under Section 5.1.1, which describes the impact of the coal fired power station. An area of 35.37 ha of modified grassland would be required for lay-down of construction materials for the gas fired option.

c) *Impact area of roads:* One access road will be required for the gas fired operating scenario, and will be located alongside the raw water supply pipeline. The road will require a cleared corridor of 25 metres, and will impact both Central Hunter Box - Ironbark Woodland in moderate to good condition (2.55 ha), grassland (5.77 ha) and will cross semi permanent streams on site, some of which represent potential habitat for the endangered Green and Golden Bell Frog.
The development of the access road has the potential to limit the movement of small ground mammals, frogs and reptiles, due to areas of vegetation becoming fragmented. Such impacts are less likely to affect listed woodland birds, migratory birds, bats and larger mammals which are more mobile and broad ranging species. The loss of habitat for woodland birds, migratory birds, bats and larger mammals is, therefore, unlikely to compromise their existence or use of the site.

d) *Impact area of raw water line:* Impacts relating to the construction of a raw water line on the site are discussed above in Section 5.1.1. Development of the raw water line will require the clearance of 2.24 ha of Central Hunter Box – Ironbark Woodland, and 5.18 ha of low biodiversity grassland. Impacts to the native vegetation community will affect the habitat of threatened woodland birds.

e) *Impact area of transmission infrastructure*: This is discussed above under Section 5.1.1. The impact area of the gas fired transmission infrastructure will be 0.10 ha of Central Hunter Box – Ironbark Woodland, and 7.37 ha of modified grassland. Impact in woodland may remove hollow bearing trees and native vegetation that is suitable habitat for threatened woodland birds, bats and owl.

f) *Increased traffic movements:* The impacts are considered to be similar to the coal fired scenario. These are discussed above under Section 5.1.1.

g) *Increased sedimentation and runoff:* The impacts are considered to be similar to the coal fired scenario. These are discussed above under Section 5.1.1.

h) *Impact area of gas pipeline*: A 15 km spur pipeline, 25 m in width, will be constructed from the approved Queensland to Newcastle gas pipeline which runs to the north of the proposed Bayswater B Power Station site for the gas fired option. No storage of gas will be required on site. The construction of the pipeline will require clearance of a 25 m corridor of a mix of modified grasslands (34.22 ha) and native vegetation (5.04 ha of Central Hunter Box - Ironbark Woodland; 5.74 ha of Central Hunter Ironbark – Spotted Gum – Grey Box Forest and 0.31 ha of Hunter Valley River Oak Forest). The pipeline will cross several ephemeral streams, in addition to crossing of Saltwater Creek.

5.2.2 Operational Impacts

Impacts potentially resulting from the operation of the gas fired scenario are described below:

a) *Increased noise disturbance*: The gas fired option will operate 24 hours/day, 365 days a year. Noise levels of this operating scenario have not yet been determined. It is expected that noise disturbance would be confined to a small area of woodland habitat surrounding the main power plant operations. Noise has the potential to impact breeding frogs, with females unable to hear the calls of males. This flows on to reduce spawning activity, recruitment and population size. The proximity of the proposed Power Station to a breeding site for Green and Golden Bell could be significant. Further survey is required to determine the likely significance of the impact.

b) *Increased water use:* Water will be required for operational use for the life of the project. Raw water will be sourced from Bayswater Fresh Water Dam (treated) or the Bayswater Cooling Tower Make-Up Dam (untreated). These waterbodies are considered to be moderate to good condition aquatic habitat. The volume of water to be extracted from these waterbodies for the gas fired has not yet been determined, but it is less that the water used in the coal fired scenario. The water used is within MacGen's current water entitlements and purchases. Therefore, the impact on habitat within these waterbodies, and the affect on hydrological process within the local area in relation to increased water use are expected to be insignificant.

c) *Increased light disturbance*: Artificial lighting will be required along the access road and within the main plant areas during night operations. The impact area of light spill for the site is yet to be determined, however, is likely to affect a tract of woodland habitat adjacent to the access road. The impact of light on terrestrial fauna is poorly understood but most likely to affect nocturnal fauna, such as frogs, bats and mammals. Many frogs species are sensitive to light, including the Green and Golden Bell Frog. Male frogs may not call in areas illuminated at night, which will affect breeding, recruitment of frogs and eventually population size. By not aiming lighting towards remnant bush or water bodies, the impact can be substantially reduced to an acceptable level.

   The response of bats to light can be mixed. While bats are not attracted to light, many of their prey items are (eg moths). The abundance of prey items around a light may attract bats on warm nights.

d) *Impacts on water quality*: While the majority of water used within the site will be recycled for operational purposes, drainage systems will be required for this option primarily for stormwater

runoff. Stormwater will be directed into Plashett Dam, natural overland stormwater flow paths and detention ponds. The majority of drainage water will be treated (as part of the water cycle management) prior to its release into waterways. Stormwater entering Plashett Dam and other waterways within the site have the potential to impact on the water quality of aquatic habitats in the area.

Drains from sources potentially containing contaminants will be transferred by either pipeline or tanker truck to the existing Bayswater water treatment plant for water recovery in brine concentrator for this option. Poor water quality has the potential to affect frogs and their prey items. With appropriate management, the impact is considered to be minor and acceptable.

h) *Increased traffic movements*: Heavy vehicles may regularly use the main access road to the Bayswater B Power Station for transport of wastes from the site. The vehicles of staff travelling to and from work will also be introduced into the area. Increased traffic movements have the potential to impact all fauna with an increased risk of vehicle strike. However, it is unlikely that this represents a significant threat to local fauna.

5.2.3 Decommissioning Impacts

The extent of impacts resulting from decommissioning of the plant in a few decades time is unable to be determined at this stage of the project. It is, therefore, recommended that a detailed environmental assessment be undertaken prior to this phase being implemented.

5.3 SUMMARY OF LIKELY IMPACTS

Impacts likely to result from the development of each concept have been considered as part of the impact evaluation and are summarised below in relation to each phase of the project (construction, operation and decommissioning). Impacts specific to each scenario are identified separately for each phase.

5.3.1 Construction Impacts

The following tables summarises total areas (hectares) of vegetation within the site which may be cleared for either the coal fired or gas fired operating scenarios. These calculations have been made on the assumption that each scenario will have a footprint as depicted in Figure 1 and Figure 2. Clearance of these amounts of vegetation is likely to cause a low level of impact to wide ranging woodland bird, bat and other migratory species known or considered likely to occur within the area, as the vegetation proposed to be removed is small in area and the area of remaining habitat is sufficient to sustain local populations of these species.

The level of impact of *Diuris tricolor* and *D. pedunculata* could not be determined during the survey.

In addition to direct clearing of vegetation, indirect impacts resulting from construction works of both operational scenarios are likely to include:

- Potential impacts to water quality, bank stability and aquatic habitats (including Green and Golden Bell Frog Habitat) as a result of increased runoff and sedimentation.
- Potential impacts to fauna (including threatened woodland bird species, bats and Green and Golden Bell Frog) may result from increased traffic movement within the site.

5.3.2 Operational Impacts

Operational impacts of both scenarios comprise both direct and indirect impacts and include:

- Potential impacts to fauna (including threatened woodland bird species, bats and Green and Golden Bell Frog) as a result of noise disturbance, artificial light disturbance and increased traffic movements.

- Potential of low impacts to aquatic habitats as a result of increased water use, stormwater runoff and increased dust emissions (coal fired only).

5.3.1 Decommissioning Impacts

It is recommended that an assessment of environmental impacts potentially resulting from the removal of infrastructure equipment be undertaken nearer to the time of decommissioning.

5.3.2 Bushfire – Asset Protection Zones

A bushfire report has been prepared for the site. It advises on bushfire risk and recommends asset protection zones around key infrastructure. The report recommends the development of a Bushfire Management Plan that describes the bushfire hazard, special provisions and standards that must be followed for a development of this nature, and incorporates ecological objectives, such as inter-fire intervals between burn periods, the use of mosaic burn, with broader fire management objectives.

As the final footprint has not been determined, the impact of the APZ on native vegetation has not been calculated, but should be included in the final determination of vegetation loss in later stages of the project.

5.3.3 Significance of the Impacts

Each scenario is unlikely to result in a significant impact on woodland birds, microchiropteran bats, megachiropteran bats and owls provided that the following recommendations and mitigation measure (Section 6) are followed.

The impact on Green and Golden Bell Frog requires further survey to determine the presence and extent of this species on site. However, as the proposal includes creek crossing and the risk that untreated flow from roads and other surfaces may enter the local water ways, and increases in noise levels and light, there is potential for the species to be impacted.

The impact of the proposal on *Diuris pedunculata* and *Diuris tricolor* could not be determined at the time of the survey and report.

The recommendations and mitigation measures provided (Section 6) assist in reducing the impact of the proposal on the environment.

Table 8: Vegetation impacts resulting from development of the Ultra Supercritical Pulverised Coal Fired operating scenario

	Process Units	Stockpile and Reclaimer	Access Road	Ash Conveyor	Conveyor & Buildings	Raw Water Line	Switchyard	Transmission line	Lay down Area	Grand Total (ha)
Central Hunter Box - Ironbark Woodland			2.57		1.63	2.82		0.04		**7.06**
Central Hunter Ironbark - Spotted Gum - Grey Box Forest					0.25					**0.25**
Grassland	18.75	10.94	4.88	6.91	6.33	7.83	3.65	11.43	56.25	**126.97**
Grand Total (ha)	**18.75**	**10.94**	**7.45**	**6.91**	**8.21**	**10.64**	**3.65**	**11.48**	**56.25**	**134.28**

Note: the coal fired scenario does not require a gas pipeline.

Table 9: Vegetation impacts resulting from development of the Combined Cycle Gas Turbine operating scenario

	Process Units	Access Road	Gas Supply Pipeline	Raw Water Line	Switchyard	Transmission Line	Lay down Area	Grand Total (ha)
Central Hunter Box - Ironbark Woodland		2.55	5.04	2.24		0.10		**9. 93**
Central Hunter Ironbark - Spotted Gum - Grey Box Forest			5.74					**5.74**
Central Hunter Swamp Oak Forest			0.31					**0.31**
Grassland	11.77	5.77	34.22	5.18	3.92	7.37	35.37	**103.60**
Grand Total (ha)	**11.77**	**8.32**	**43.8**	**7.41**	**3.92**	**7.47**	**35.37**	**119.58**

Note: the gas fired scenario does not require stockpile and reclaimer areas, ash and coal conveyors.

5.4 ASSESSMENT OF PROPOSAL AGAINST MAINTAIN OR IMPROVE PRINCIPLES

To satisfy the 'improve or maintain' test the proposed loss of native vegetation must be offset by actions that enhance the conservation values of remnant vegetation that is of equal or higher conservation value.

The development of either a coal fired option or gas fired option operating power plant at the Bayswater B Power Station site will involve the loss of ecological values, remnant vegetation, threatened species habitat and biodiversity. Both concept design footprints have been designed to minimise the loss of biodiversity and other ecological values. In calculating the loss of remnant vegetation by each scenario, it is assumed that all vegetation in areas marked for development will be removed.

Specific impacts resulting from either of the scenarios is presented in the table below.

Table 10: Summary of remnant vegetation loss for each scenario.

	Coal fired option vegetation loss (ha)	Gas fired option vegetation loss (ha)
Central Hunter Box Ironbark Woodland	7.06	9.62
Central Hunter Ironbark – Spotted Gum- Grey Box Forest	0.25	4.53
Central Hunter Swamp Oak Forest	0	0.31

The majority of the remnant vegetation within the site will be retained. The coal fired scenario would remove 1.2% of Central Hunter Box Ironbark Woodland and <1% of Central Hunter Ironbark - Spotted Gum – Grey Box Woodland within the study area (this equates to <0.001% of Central Hunter Box Ironbark Woodland in the Central Hunter region and even less Central Hunter Ironbark - Spotted Gum – Grey Box Woodland). The gas fired scenario would remove 1.7% of Central Hunter Box Ironbark Woodland, 1.9% of Central Hunter Ironbark - Spotted Gum – Grey Box Woodland and 2% of Central Hunter Swamp Oak Forest within the study area (this equates to <0.001% of Central Hunter Box Ironbark Woodland and central Hunter Swamp Oak Forest in the Central Hunter region and even less Central Hunter Ironbark - Spotted Gum – Grey Box Woodland). These amounts are considered to be insignificant.

Each scenario must be designed to avoid impact to areas of conservation significance and the recommendations and actions to mitigate unavoidable impacts, and offset the remaining impacts have been recommended accordingly. Rehabilitation of good and moderate condition vegetation, re-establishing connectivity between patches, enhancing the value of the retained vegetation are actions that will lead to satisfying the maintain and improve test. With a low amount of direct disturbance to remnant native vegetation and a considerable area in which to implement actions to improve native vegetation condition, it would appear that there is opportunity for the proposal to meet the "maintain or improve" test.

Detailed vegetation management plans have not been prepared at this concept stage, but are recommended to create a management framework for vegetation on site.

6 Recommendations and Mitigation

The following recommendations and mitigation measures can be applied to either scenario. Consequently, this section does not discuss scenario specific measures.

The purpose of the recommendations and mitigation measures is to provide a framework by which impacts on the environment and the sites values can be avoided or minimised. These recommendations and mitigation measures may form part of a statement of commitments by those undertaking the development.

6.1 MINIMISING IMPACTS

The following basic principles of impact minimisation must be followed throughout the project design:

- **Avoid** impacts wherever possible, particularly to areas of high conservation value, such as remnant vegetation in good condition, endangered ecological communities, threatened species and their habitat;
- **Mitigate** those impacts that cannot be avoided; and
- **Offset** those impacts which cannot be mitigated.

The concept design of both options has, to date, taken into consideration a number of environmental values of the site including the presence of vegetation and riparian corridors. The footprint of the power station was originally further to the east. This allowed adequate space for laydown areas for construction (for concrete batching plant, storage areas and stockpiles etc) which would be constrained by the topography on the western side of the site. While that location was preferable from a construction management perspective, the footprint in this location directly impacted on Saltwater Creek. The footprint was subsequently moved to avoid the creek lines completely and provide a 50m buffer but with the consequence of a reduced area for construction laydown.

The switch yard has similarly been moved to a location that is clear of the creek lines and in an area devoid of vegetation in order to reduce the environmental effects of its construction. The preferred location provides a beneficial environmental outcome together with a consistent and viable engineering outcome.

Similarly, the associated infrastructure for the site (raw water supply line and access road) were originally sited based on the shortest distance between two points. The access road and raw water pipeline have also been moved to best utilise areas of cleared land to minimise impacts on vegetation where possible. In addition, the gas pipeline has been sited to take advantage of rail and road easements as much as possible so as to avoid potential impacts to vegetation.

As further detailed design is undertaken, it will include consideration of this assessment, and any further surveys, in order to locate infrastructure (including the gas pipeline if the gas fired option is chosen) as far as possible, in a manner that avoids impacts. If impacts cannot be avoided, the residual impacts

can be quantified on the basis of the detailed design and offset development adopted. Impacts which are unable to be avoided as a result of the proposed project should follow these mitigation measures.

6.2 VEGETATION COMMUNITIES

Where removal of vegetation communities cannot be avoided, the following measures should be considered:

- Limit the impact of fragmentation by avoiding impacts in larger patches of remnant vegetation (refer to Figure 11);
- Minimise vegetation clearing and, ideally, avoid impacts to remnant vegetation in good condition and adjoining moderate (refer to Figure 6), and endangered ecological communities (refer to Figure 5);
- Avoid any loss of hollow bearing trees (refer to Figure 9);
- Prepare a Vegetation Management Plan (VMP) as per the *Guidelines for Controlled Activities – Vegetation Management Plans* (DWE 2008). The VMP would be prepared prior to construction, for use during construction and for a maintenance period of at least 5 years. The VMP should include (but not limited to):
    - Measures to control grazing herbivores to protect regenerating vegetation or damage of planted seedlings (if required);
    - Weed removal and control protocols, including an initial assessment of weed prevalence in retained vegetation areas;
    - Details of appropriate plant species and planting densities to be utilised in the revegetation sectors;
    - Use of seed and vegetative material of local provenance which is representative of the surrounding indigenous vegetation communities;
    - Measures to integrate fauna habitat enhancement with vegetation management (diversity of tree species, establishment of corridors, habitat enhancement for threatened species);
    - Compliance with legislative and regulatory requirements when collecting native seed;
    - Identification of seed collection protocols: identification of optimal collection zones, sampling regime and quantities required;
    - Planting in corridor areas to provide appropriate vegetation structure for native fauna passage and linkage between vegetation patches;
    - Measures to protect retained vegetation from operational activities where possible, including use of existing access tracks, parking of vehicles and location of equipment and stockpiles in existing cleared areas; and
    - A monitoring program with performance criteria and measures for restitution of damaged or supplementary plantings, if necessary.

6.3 THREATENED FLORA SPECIES

- Undertake a survey around preferred or likely routes for roads, conveyors, pipelines and other disturbance areas in likely habitat on site for the threatened flora species, *Diuris pedunculata* (Small Snake Orchid) and *Diuris tricolour* (Pine Donkey Orchid) that may potentially occur on the site.

- Should either species occur on site, avoiding impact to either species should be the first priority. Alternative designs should be considered, and where avoidance is not possible, offsetting would be required. This would require negotiation with DECCW and DoP in the final approval stage of the development.

- If necessary, monitor the impact of the proposal on threatened orchids.

6.4 THREATENED FAUNA SPECIES

- Retain hollow bearing and rough barked trees and retain large, consolidated areas of remnants. By avoiding hollow bearing and rough barked trees and large, consolidated remnants, much of the habitat for birds, bats and owls will be retained.

- Where loss of hollow bearing and rough barked trees is unavoidable then it is recommended that survey be undertaken for threatened bats and owl species.

- Undertake survey of Green and Golden Bell Frog in an appropriate season (warmer months, ideally mid to late spring) to ascertain their presence or absence and level of activity. Should the species be found then infrastructure should seek to avoid their habitat, introduce water quality controls that specifically consider this species and seek habitat enhancement.

- Threatened species surveys (Two orchid species and possibly bats and owls) should adhere to the DEC (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities*. Surveys for Green and Golden Bell Frog should adhere to the DECC (2009) *Threatened Species Survey and Assessment Guidelines: field survey methods for fauna – Amphibians.*

- Threatened species monitoring should be undertaken depending on the species present and likely impact.

- Employ dust suppression initiatives during construction to ensure that it does not impact flora and fauna.

6.4.1 Green and Golden Bell Frog

Where disturbance of Green and Golden Bell Frog habitat cannot be avoided, the following mitigation measures should be considered:

- Infrastructure and roads that cross creeks may require works to protect and enhance Green and Golden Bell Frog habitat. Any restored or created habitat should include habitat enrichment, supplementation and remediation actions as well as the maintenance of connectivity as indicated in *Best Practice Guidelines Green and Golden Bell Frog Habitat* (DECC, 2008). These Guidelines provide specific advice regarding habitat components required by the species and how these may be provided or enhanced to satisfy its various life cycle stages.

- Prepare a Soil and Water Management Plan (as described in Section 6.5) to control sediment runoff into potential Green and Golden Bell Frog habitat.

- Consider alternative road alignment to avoid creek crossings in areas of habitat during the detailed design process. This may require the road to remain on the southern side of the east-west flowing creek along, or close to, the ridge line.

- Direct lights away from water bodies.

6.4.2 Woodland Birds and Grey-headed Flying Fox

While the impact of the proposal on woodland birds and Grey-headed Flying Fox is likely to be low, minimising impacts to their habitat is advised.

- Maximise the use of existing cleared areas for infrastructure. Relocate roads and the gas pipeline to align with gaps between patches of vegetation, avoiding larger consolidated patches wherever possible.

- Minimise vegetation clearing, or if required avoid larger patches in good condition.

- Revegetate along linear infrastructure to promote connectivity (this can be included in the vegetation management plan). Revegetation must be consistent with the local vegetation communities and consider the vegetation structural needs of woodland birds.

- Maintain and enhance connectivity between patches. Ensure that corridors within the site and to habitat offsite are not compromised.

- Direct lights away from woodland patches.

6.4.3 Microchiropteran Bats

Survey for microchiropteran bats was not undertaken as part of this study. General principles on maximising the potential habitat for microchiropteran bats at the site would include:

- Protect hollow bearing and rough barked trees. The site contains relatively few hollow bearing trees and it is not known how common they are on neighbouring properties or in the region more broadly. Peake (2006) notes that much of the vegetation in the Central Hunter is regrowth, suggesting that hollow bearing trees may be scant throughout the landscape. No survey or assessment of the abundance of rough-barked trees within the development footprint has been undertaken, however, there is potential for mature trees to provide such habitat. The concept plan for the gas fired scenario places the gas pipeline through remnant woodland. Locating this and other infrastructure in cleared areas will avoid hollow bearing and rough barked trees.

- Protect the diversity of tree species on site. A diverse canopy may help to attract prey species for bats in a variety of seasons, depending upon the season in which each species flowers. Some bats roost under different bark types. A diversity of canopy species may also provide a diversity of bark types.

6.4.4 Barking Owl

- Survey for Barking Owl to determine their presence and the presence of nest trees should be undertaken if hollow bearing trees are to be removed in the provision of the associated linear

infrastructure. Surveys should occur at least 100m either side of the linear infrastructure to locate significant habitat features and to assist in prescribing any buffers around this habitat.

6.4.5 Migratory Birds

- Actions for migratory birds align with woodland birds (Section 6.4.2)

6.5 AQUATIC AND RIPARIAN HABITATS

Where waterway crossings of roads and transmission lines cannot be avoided, the following mitigation measures should be considered during construction of the proposed project:

- A Vegetation Management Plan would be prepared per the *Guidelines for Controlled Activities – Vegetation Management Plans* (DWE 2008). The VMP would be prepared prior to construction, for use during construction and for a maintenance period of at least 5 years. The VMP would address (but not be limited to) the following:
    - The edge of the vegetation clearing (and edge of permanent maintenance zone) would be clearly marked with flagging tape to deter access beyond this point. Construction personnel would be trained to avoid unnecessary disturbance of these areas and creek banks;
    - Hygiene protocols for riparian vegetation removal activities to minimise weed spread;
    - Progressive slope stabilisation in accordance with the Blue Book and Soil and Water Management Plan;
    - Once stabilised, planting of local native plants would be undertaken to assist in the restoration of the function of the riparian zone;
    - Local regeneration to facilitate enhancement of sites environmental values as part of an integrated offset package
    - Pests would be controlled on an as needs basis.
- Preparation of a Soil and Water Management Plan prior to construction which would address (but not be limited to) the following:
    - Temporary sediment control devices would be installed where necessary to control sediment (i.e. upstream of any existing drain inlets, downslope of steep slopes) and would be maintained regularly. Care would be taken to ensure sediment control devices are in place during shut down periods and over weekends.

6.6 OFFSETTING

Offsetting the loss of native vegetation should be used once all possible impacts have been avoided or all possible options for impact mitigation have been considered. This should be developed in an Offset Strategy, in consultation with DECCW, for the development. The Offset Strategy would be developed once the location of infrastructure is finalised and, therefore, the extent of native vegetation lost has been determined.

The site presents a number of options for offsetting and managing a large portion of the site for conservation purposes.

The following biodiversity offsetting principles apply when developing offsets for the site:

- Impacts must be avoided first by using prevention and mitigation measures;
- All regulatory requirements must be met;
- Offsets must never reward ongoing poor performance;
- Offsets will complement other government programs;
- Offsets must be underpinned by sound ecological principles;
- Offsets should aim to result in a net improvement in biodiversity over time;
- Offsets must be enduring and they must offset the impact of the development for the period that impact occurs;
- Offsets should be agreed prior to the impact occurring;
- Offsets must be quantifiable and the impacts and benefits reliably estimated;
- Offsets must be targeted;
- Offsets must be located appropriately;
- Offsets must be supplementary, and;
- Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or contacts.

It is recommended that the range of options for securing these offsets be investigated, refined and ranked according to whether each option is available, practical, realistic and likely to meet the Maintain or Improve outcome test required, as part of the approval process.

The Maintain or Improve test under the Part 3A guidelines does not provide guidance on how to assess if this criterion is met. Although there is no agreed process there are a number of ways this can be achieved. Firstly, it can develop a negotiated offset strategy that seeks to demonstrate an improvement or maintenance in area, condition, security and/or connectivity of biodiversity values. This lacks any certainty in the calculation of what 'credit' positive outcomes can generate to offset biodiversity losses. The second approach is to use the 'biodiversity banking' tools developed for an alternative statutory process to give clarity to the extent/amount of biodiversity offset actions required. Although this is a voluntary, it does give some framework to providing offsets.

7 Conclusion

The proposed Bayswater B Power Station site has been subject to human activity for a number of years. Prior to the development of the existing power station, the site would have been subject to agricultural activities, and is currently subject to light grazing over much of the proposal site. Despite this, remnant vegetation on the site is in moderate and good condition, and the area supports habitat for at least 4 threatened species. Two vegetation communities, proposed for listing as EECs under the TSC Act were present on the site; Central Hunter Box – Ironbark Woodland and Central Hunter ironbark - Spotted Gum - Grey Box Forest.

Each scenario will directly impact the environment. While the proposed power station has been located in modified grassland, the installation of roads, transmission lines, gas pipelines, conveyors and coal storage areas will affect some remnant vegetation and habitat for threatened species. However, the area of impact is considered to be manageable and not significant for the threatened species and endangered communities recorded on site. The proposal is not likely to significantly impact other threatened flora and fauna, and migratory species considered to potentially occur or likely to occur on site, however, the impact on the Green and Golden Bell Frog, *Diuris tricolor* and *D. pedunculata* could not be determined at the time of survey. Further survey is required for Green and Golden Bell Frog, *D. tricolor* and *D. pedunculata* to provide greater certainty of the potential impact of the proposal and to develop appropriate mitigation strategies.

A number of recommendations and mitigation measures have been provided to understand and minimise environmental impacts:

- Undertake additional survey for Green and Golden Bell Frog to identify the presence/absence of the species and develop appropriate mitigation strategies;
- Undertake additional survey for *Diuris pedunculata* and *Diuris tricolor* to determine their presence and the likely impact of the proposal (including infrastructure corridors);
- Minimise the removal of native vegetation, and where possible avoid large patches of remnant woodland in good condition that are known habitat for threatened woodland birds and likely bat species;
- Maintain and enhance connectivity across the site for fauna, utilising opportunities to revegetate along linear infrastructure and consolidate remnant patches.
- Avoid hollow bearing and rough barked trees that could provide habitat for hollow dependant fauna, such as owls and microchiropteran bats which can utilise both hollows are rough bark are habitat. If hollow bearing or rough barked trees will be removed, then additional survey would be required for threatened owls and microchiropteran bats;
- Development of a Vegetation Management Plan for riparian areas, revegetation areas and additional offset actions sought on site;

- Where roads and other linear infrastructure cross creeks, key habitat for Green and Golden Bell Frog requires protection and enhancement. Water quality and vegetation management planning is required to management, rehabilitate and enhance disturbed areas;
- A Soil and Water Management Plan (SWMP) must be prepared for the construction and operation of the site. This may for part of the Construction Environmental Management Plan. Frog species are susceptible to changes in water quality. Maintaining water quality in potential Green and Golden Bell frog habitat is paramount; and
- Once the design has been finalised and the area of remnant vegetation loss has been calculated, an Offset Strategy can be developed.

The report recommends that all impact on native vegetation be avoided. Those impacts that cannot be avoided must be mitigated (including non significant impacts), and any remaining impacts that cannot be mitigated must be offset. Offsetting should be considered as a last resort, once all other options have been exhausted.

By implementing the recommendations and mitigation measures in this report and based on the layout presented in this report, the 'Improve or Maintain' assessment has concluded that the proposed development is unlikely to have a substantial adverse impact on threatened species, endangered ecological communities or their habitat.

8 References

Department of Environment and Conservation (DEC 2005) Green and Golden Bell Frog *Litoria aurea* (Lesson, 1829) Recovery Plan (draft). DEC Hurstville, NSW - February 2005.

Department of Environment and Conservation and Department of Primary Industries (2005) *Draft Guidelines for Threatened Species Assessment.*

Department of the Environment and Climate Change and Department of Primary Industries (2005) *Draft Guidelines for Threatened Species Assessment.*

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Appendix A: Likelihood of Occurrence

An assessment of likelihood of occurrence was made for threatened and migratory species identified from the database search (Table 11 and Table 12). Five terms for the likelihood of occurrence of species and endangered ecological communities are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the field survey and professional judgement. The terms for likelihood of occurrence are defined below:

- "yes" = the species was or has been observed on the site
- "likely" = a medium to high probability that a species uses the site
- "potential" = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- "unlikely" = a very low to low probability that a species uses the site
- "no" = habitat on site and in the vicinity is unsuitable for the species.

Table 11: Likelihood of occurrence of fauna species within the Bayswater B Power Station site, Muswellbrook

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat	Likelihood of occurrence within study area
Diurnal Birds					
Climacteris picumnus victoriae	Brown Treecreeper	V	-	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub	Potential

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat	Likelihood of occurrence within study area
				species. Usually not found in woodlands with a dense shrub layer	
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	Mar, CAMBA	Found along the coastline of Australia and also inhabits large river systems and permanent inland water bodies.	Unlikely
Hirundapus caudacutus	White-throated Needletail	-	M, Mar JAMBA / CAMBA / ROKAMBA	Arrive in Australia from their breeding grounds in the northern hemisphere in about October each year and leave somewhere between May and August. Birds usually feed in rising thermal currents associated with storm fronts and bushfires and they are commonly seen moving with wind fronts. Feeds on flying insects, such as termites, ants beetles and flies.	Potential
Lathamus discolor	Swift Parrot	E	E, M	Migrates to the Australian south-east mainland between March and October. Areas where eucalypts are flowering profusely or where there are abundant lerp infestations.	Potential
Melanodryas cucullata cucullata	Hooded Robin	V	-	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas.	**Yes**
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Grey Box (*E. microcarpa*), Yellow Box (*E.*	Potential

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat	Likelihood of occurrence within study area
				melliodora) and Forest Red Gum (*E. tereticornis*)	
Merops ornatus	Rainbow Bee-eater	-	M, Mar JAMBA / CAMBA	Open forests, woodlands and shrublands, and cleared areas, usually near water. It will be found on farmland with remnant vegetation and in orchards and vineyards. It will use disturbed sites.	Potential
Monarcha melanopsis	Black-faced Monarch	-	M, Mar	Rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating.	Potential
Myiagra cyanoleuca	Satin Flycatcher	-	M, Mar	Tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests.	Unlikely
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	Open woodlands dominated by mature eucalypts with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs. This species avoids very wet areas.	**Yes**
Pyrrholaemus sagittatus	Speckled Warbler	V	-	Lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are	**Yes**

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat	Likelihood of occurrence within study area
				required for the species to persist in an area.	
Rostratula australis	Australian Painted Snipe	V	V	Well vegetated margins of wetlands	Unlikely
Stagonopleura guttata	Diamond Firetail	V	-	Found in grassy eucalypt woodlands, open forests, mallee, Natural Temperate Grasslands, riparian areas and sometimes lightly wooded farmlands.	**Yes**
Xanthomyza phrygia	Regent Honeyeater	E	E, M, JAMBA / CAMBA	Dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.	Potential
Nocturnal Birds					
Ninox connivens	Barking Owl	V	-	Eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting.	**Likely**
Mammals (Bats)					

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat	Likelihood of occurrence within study area
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Hirundo ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features.	Potential
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	Roosting – caves, derelict mines, stormwater tunnels, buildings. Foraging - forested areas.	Potential
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	Dry sclerophyll forest & woodland. Roosts - hollows & under bark or man-made structures.	Potential
Myotis adversus	Large-footed Myotis	V	-	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, 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
Nyctophilus bifax	Eastern Long-eared Bat	V	-	This species prefers wetter habitats, ranging from rainforest and monsoon forest to riverine forests of paperbark, but may be found in open woodland, tall open forest and dry sclerophyll woodland. These forest bats have been recorded roosting under peeling bark, among epiphytes, in tree hollows and in foliage.	Unlikely

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat	Likelihood of occurrence within study area
				Individuals are likely to change roost sites nightly.	
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Subtropical & temperate rainforests, tall sclerophyll forests & woodlands, heaths & swamps.	**Likely**
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	Potential
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Woodland, moist & dry eucalypt forest & rainforest but prefers tall wet forest. Roosts - tree hollows but also buildings.	Potential
Mammals (excluding bats)					
Phascolarctos cinereus	Koala	V	-	Eucalypt woodlands & forests. Has preferred species.	Unlikely
Petaurus norfolcensis	Squirrel Glider	V		Mature and old growth sclerophyll forests and woodlands, with a acacia shrub layer. Requires hollows for denning.	Unlikely

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat	Likelihood of occurrence within study area
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Rocky escarpments, outcrops, steep slopes or cliffs – especially those with caves, ledges or overhangs & shrub cover.	No
Amphibians					
Litoria booroolongensis	Booroolong Frog	E	E	Permanent cobbled streams with overhanging and fringing vegetation.	Unlikely
Litoria aurea	Green and Golden Bell Frog	V	E	Marshes, dams & stream-sides particularly those containing *Typha* or *Eleocharis*. Need waterbodies unshaded, free of predatory fish and that have a grassy area nearby.	**Likely** (Suitable habitat recorded within the study site)

Note*:* TSC Act = *Threatened Species Conservation Act 1995*; EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*,

V = Vulnerable, E = Endangered, EP = Endangered Population, M = Migratory, Mar = Marine, JAMBA = Japan-Australia Migratory Bird Agreement, CAMBA = China-Australia Migratory Bird Agreement, ROKAMBA = Republic of Korea–Australia Migratory Bird Agreement.

Source: DECC (2008), DEWHA (2008)

Table 12: Likelihood of occurrence of flora species within the Bayswater B Power Station site, Muswellbrook

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat	Likelihood of occurring within study site
Acacia pendula	Myall	E2		Endangered population in the area	No
Eucalyptus camaldulensis	River Red Gum	E2		Endangered population in the area	No
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	Dry grassy woodlands on shallow infertile soils	No
Bothriochloa biloba			V	Woodlands on poor soils	Unlikely
Cynanchum elegans	White-flowered Wax Plant	E	E	Typically grows on the margin of rainforest amongst vegetation that can include Spotted Gum and Forest Red Gum	Unlikely
Pomaderris brunnea	Brown Pomaderris	V	V	Grows in moist woodland and forest on clay soils. Also grows along creeks on alluvial soils	No
Wollemia nobilis	Wollemi Pine	E	E	Grows in warm temperate rainforest and rainforest margins	No
Olearia cordata		V	V	Grows in dry open sclerophyll forest and open shrubland, on sandstone ridges	No
Thesium australe	Austral Toadflax, Toadflax	V	V	Found in grassland or grassy woodland, often in damp sites with Kangaroo Grass (*Themeda australis).* Flowers in spring–summer. Widespread but rare.	Unlikely

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat	Likelihood of occurring within study site
Digitaria porrecta	Finger Panic Grass	E	E	Native grassland, woodlands or open forest with a grassy understorey, on richer soils (DECC 2007). Often found along roadsides and travelling stock routes where there is light grazing and occasional fire (DECC 2007).	Unlikely
Diuris tricolor *Diuris sheaffiana*	Pine Donkey Orchid Tricolor Diuris	V, E2	V	Grows in sclerophyll forest among grass, often with *Callitris* spp. It is found in sandy soils, either on flats or small rises. Also recorded from a red earth soil in a Bimble Box community in western NSW. Soils include gritty orange-brown loam on granite, shallow red loamy sand on stony porphyry, skeletal lateritic soil and alluvial grey silty loam. Flowers from September to November or generally spring.	Unlikely
Eucalyptus glaucina	Slaty Red Gum	V	V	Associated with grassy woodland on deep, moderately fertile and well-watered soil.	No
	Weeping Myall - Coobah - Scrub Wilga Shrubland of the Hunter Valley.		CEEC		No

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat	Likelihood of occurring within study site
	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	EEC	CEEC		No

Note*:* TSC Act = *Threatened Species Conservation Act 1995*; EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*,

EEC = Endangered Ecological Community, CEEC = Critically Endangered Ecological Community, V = Vulnerable, E = Endangered, EP = Endangered Population, M = Migratory, Mar = Marine, JAMBA = Japan-Australia Migratory Bird Agreement, CAMBA = China-Australia Migratory Bird Agreement, ROKAMBA = Republic of Korea–Australia Migratory Bird Agreement.

Source: DECC (2008), DEWHA (2008)

Appendix B: Potential Effects of the Proposal on Threatened Species, Populations or Ecological Communities or their Habitats

NSW State Requirements

The following table addresses requirements of the draft Part 3A *Guidelines for Threatened Species Assessment* (DECC & DPI, 2005). Appendix 3 of the Guidelines list six key questions required to be considered when addressing potential effects of the proposal on threatened species, populations or ecological communities or their habitats. A brief answer to each question for each threatened species, population or community known or potentially occurring on the site is provided below.

	How is the proposal likely to affect the lifecycle of a threatened species and/or population?	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Threatened Species						
Green and Golden Bell Frog (*Litoria aurea*)	The proposal is unlikely to effect the life cycle of this species as potential breeding areas and other habitat areas will be avoided. The health of the habitat of the species is to be maintained, and enhanced, where possible.	The proposal is likely to involve the construction of access roads across Saltwater Creek, a major flow pathway. Measures will be taken to reduce indirect impacts caused by such construction on the habitat of this species.	The Upper Hunter Valley population is one of only two inland populations of this species. For this reason, a number of management and mitigation measures will be undertaken in order to ensure the conservation of this population. The proponent has been involved in ongoing management of the population within their owned lands since 2007.	The proposal is unlikely to negatively affect any current disturbance regimes. Mitigation measures will ensure that disturbance caused by cattle and other species is reduced to aid in improvement of remnant vegetation condition within the site.	The proposal is unlikely to affect habitat connectivity of the species. While there may be some impacts on potential habitat, the overall habitat health and connectivity of Green and Golden Bell Frog habitat on the site will be maintained and enhanced.	There is no critical habitat known to occur on the site for any of the threatened species occurring on the site.
Hooded Robin (*Melanodryas cucullata cucullata*)	The proposal is unlikely to affect the life cycle of these threatened woodland birds. Vegetation removal is unlikely to result in significant impacts to resources (feeding, breeding, roosting), as they are highly mobile species.	A small area of woodland habitat will be removed as a result of construction of access roads and transmission lines. It is unlikely that such impacts will impact on the inhabitancy of these species within the site.	These species are not at the limit of their distribution. These species have scattered distributions throughout NSW.		Linear impacts resulting from the proposal are unlikely to impact these species, given they are highly mobile.	
Speckled Warbler (*Pyrrholaemus sagittatus*)						
Diamond Firetail						

	How is the proposal likely to affect the lifecycle of a threatened species and/or population?	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
(*Stagonopleura guttata*)						
Grey-crowned Babbler (*Pomatostomus temporalis temporalis*)						
Preliminary Listed Endangered Ecological Communities (TSC Act)						
Central Hunter Box – Ironbark Woodland	The proposal is unlikely to disrupt the dispersal ability; pollination cycle; seed banks or interactions with other species. The area of vegetation to be removed not be on a scale to cause such impacts. Mitigation measures will be in place to maintain and improve the remnant vegetation on the site.	The proposal will remove up to 7.5 hectares of these communities. Measures will be in place to improve the health of remaining vegetation. Key habitat features, including hollow bearing trees, will be avoided in the final footprint design.	These communities are not at the limit of their distribution in the locality of the proposed project.	The proposal will not likely affect current disturbance regimes. Measures will be in place to reduce disturbance of these vegetation communities.	The proposal will remove areas of remnant vegetation. It is unlikely that the amount of vegetation to be removed will result in impacts to habitat connectivity within the site.	This vegetation is not known to be critical habitat for any species.
Central Hunter Ironbark – Spotted Gum – Grey Box Forest						

Commonwealth Requirements

DEWHA GUIDELINES FOR ASSESSMENT OF IMPACTS ON THREATENED AND MIGRATORY SPECIES

The EPBC Act Administrative Guidelines on Significance set out 'Significant Impact Criteria' that are to be used to assist in determining whether a proposed action is likely to have a significant impact on matters of national environmental significance. Matters listed under the EPBC Act as being of national environmental significance include:

- Listed threatened species and ecological communities
- Listed Migratory species
- Wetlands of International Importance
- The Commonwealth marine environment
- World Heritage properties
- National Heritage places
- Nuclear actions

Specific 'Significant Impact Criteria' are provided for each matter of national environmental significance except for threatened species and ecological communities in which case separate criteria are provided for species listed as endangered and vulnerable under the EPBC Act.

Threatened and migratory species listed under the EPBC Act that are considered likely or potentially to occur within the study area are given in Appendix A of the Report. The relevant Significant Impact Criteria have been applied to these threatened and migratory species to determine the significance of impact of the project (Table 13). The Significant Impact Criteria should be applied once again at the project approval stage.

Table 13: Assessment of Significant Impact Criteria for matters of National Environmental Significance (*EPBC Act*)

Matters to be addressed	Nature and Extent of Impact
(a) any environmental impact on a World Heritage Property;	No impacts will occur on World Heritage values. There are no World Heritage Listed properties within 10 km of the proposed action. The nearest World Heritage Area is the Greater Blue Mountains which is approximately 16.7 km from the development site.
(b) any environmental impact on National Heritage Property	No impacts will occur on National Heritage values. There are no National Heritage properties within 10 km of the proposed action.
(c) any environmental impact on Wetlands of International Importance;	No impacts will occur on Wetlands of International Importance. The nearest Ramsar wetland is located 61 km south east of the proposed action.
(d) any environmental impact on threatened species	The guidelines in terms of the vulnerable species; Green and Golden Bell Frog are discussed below:

Matters to be addressed	Nature and Extent of Impact
or endangered ecological communities	*a. lead to a long-term decrease in the size of an important population of a species, or* The location of GGBF on site is poorly understood with few individuals being observed in recent years. Impacts to the drainage lines and poor water quality may lead to decreases in abundance on site if appropriate strategies are not implemented to manage these potential impacts. *b. reduce the area of occupancy of an important population, or* A management plan has been prepared by the DECC. The Central Hunter population is one of two BBGF populations that are not located on the NSW Coast. The proposal may impact water quality and riparian habitat for GGBF. Adherence to the mitigation measures should manage these risks to the persistence of the population in the area. *c. fragment an existing important population into two or more populations, or* The installation of roads and other linear infrastructure may fragment the habitat of GGBF. However, the species is highly mobile and unlikely to be fragmented by these works in the long term *d. adversely affect habitat critical to the survival of a species, or* Critical habitat for this species has not been declared *e. disrupt the breeding cycle of an important population, or* Timing of the works should be outside of the breeding season. Permanent disruptions to the breeding cycle are unlikely to eventuate with effective water management actions in place. *f. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or* The proposal will removal potential habitat for the species, but this is unlikely to result in a long term decline. *g. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*, or* No *h. interferes substantially with the recovery of the species.* No
(e) any environmental impact on Commonwealth Listed Migratory	No listed migratory species are considered likely to occur at the study area:

Matters to be addressed	Nature and Extent of Impact
Species;	
(f) does any part of the Proposal involve a Nuclear Action;	No. The project does not involve a Nuclear Action.
(g) any environmental impact on a Commonwealth Marine Area;	No. There are no Commonwealth Marine Areas within the location of the proposed action.
(h) In addition, any direct or indirect effect on Commonwealth land.	No. The proposed project does not directly or indirectly affect Commonwealth land.

Appendix C: Flora and Fauna Species List

The following tables list the flora and fauna species which were observed during the field survey period. An indication of whether they are listed as threatened, vulnerable or endangered is also provided.

Table 14: Flora species observed during field surveys at Bayswater Power Station, Muswellbrook during the week of 6th – 10th July 2009.

Scientific Name	Common Name	Status	
		TSC Act	EPBC Act
Acacia deanei subsp *deanei*	Deane's Wattle		
Acacia decora	Western Golden Wattle		
Acacia falcata	Sickle Wattle		
Acacia gunnii	Ploughshare Wattle		
Acacia implexa	Hickory		
Acacia paradoxa	Kangaroo Thorn		
Acacia salicina	Willow Wattle		
Ajuga australis	Austral Bugle		
Allocasuarina luehmannii	Bulloak		
Allocasuarina littoralis	Black She-oak		
Allocasuarina sp.			
Alternanthera denticulata			
Amyema cambagei			
Amyema miquelii	Box Mistletoe		
Anagallis arvense *	Scarlet Pimpernel		
Angophora floribunda	Rough-barked Apple		
Arctotheca calendula *	Capeweed		
Aristida ramosa	Purple Wiregrass		
Aristida vagans	Three-awned Speargrass		
Asperula conferta	Common Woodruff		
Austrodanthonia eriantha			
Austrodanthonia racemosa			
Austrodanthonia tenuior			
Austrostipa bigeniculata			
Austrostipa scabra	Speargrass		
Austrostipa verticillata	Slender Bamboo Grass		
Axonopus affinis *	Carpet Grass		
Bidens pilosa *	Cobbler's Peg		
Bothriochloa macra	Bluegrass		
Brachychiton populneus	Kurrajong		
Brachyscome aculeata	Hill Daisy		
Breynia obtusifolia	Coffee Bush		
Brunoniella australis	Blue Trumpet		
Bursaria spinosa	Blackthorn		
Calotis cuneifolia	Purple Burr-daisy		

Scientific Name	Common Name	Status	
		TSC Act	EPBC Act
Calotis lappulacea	Yellow Burr-daisy		
Calytrix tetragona	Fringe-myrtle		
Carex inversa			
Carthamus lanatus *	Saffron Thistle		
Cassinia arcuata	Dolly Bush		
Cassinia quinquefaria			
Casuarina cunninghamiana	River Oak		
Cheilanthes sieberi	Rock Fern		
Chloris gayana *	Rhodes Grass		
Chloris ventricosa	Plumb Windmill Grass		
Chrysocephalum apiculatum	Clustered Everlasting		
Cirsium vulgare *	Spear Thistle		
Clematis sp.			
Clerodendrum tomentosum	Hairy Clerodendrum		
Convolvulus erubescens	Austral Bindweed		
Conyza sp.	Fleabane		
Coronidium scorpioides	Button Everlasting		
Cotula australis	Common Cotula		
Crassula sieberi	Australian Stonecrop		
Cryptandra spinescens	Spiny Cryptandra		
Cynoglossum australe	Austral Hounds Tongue		
Cymbonotus lawsonianus	Bears Ear		
Cymbopogon refractus	Barbed-wire Grass		
Cynodon dactylon	Couch		
Cyperus sp.			
Datura sp. *			
Daucus glochidiatus	Australian Carrot		
Daviesia genistifolia	Broom Bitter Pea		
Daviesia ulicifolia	Gorse Bitter Pea		
Desmodium brachypodum	Large Tick-trefoil		
Desmodium varians	Small Tick-trefoil		
Dianella revoluta	Blueberry Flax-lily		
Dianella longifolia	Blueberry Flax-lily		
Dichanthium sericeum	Queensland Bluegrass		
Dichondra repens	Kidney Weed		
Dodonaea viscosa	Sticky Hopbush		
Echinopogon caespitosa	Tufted Hedgehog Grass		
Einadia hastata	Berry Saltbush		
Einadia nutans	Climbing Saltbush		
Eleocharis sp.			
Enchylaena tomentosa	Ruby Saltbush		
Enteropogon acicularis	Curly Windmill Grass		
Eragrostis brownii	Browns Lovegrass		
Eragrostis sp.			
Eremophila debilis	Amulla		
Eucalyptus crebra	Narrow-leaf Ironbark		
Eucalyptus moluccana	Grey Box		
Eucalyptus tereticornis	Forest Red Gum		
Euchiton sphaericus			
Eustrephus latifolia	Wombat Berry		
Exocarpos strictus	Dwarf Cherry		

Scientific Name	Common Name	Status	
		TSC Act	EPBC Act
Exocarpos cupressiformis	Native Cherry		
Fimbristylis dichotoma	Common Fringe-sedge		
Gahnia aspera	Rough Saw-sedge		
*Galenia pubescens**	Galenia		
Galium sp.			
Geijera salicifolia var. *salicifolia*	Brush Wilga		
Geranium solanderi	Australian Cranesbill		
Glycine clandestina	Twining Glycine		
Gomphocarpus physocarpus *	Cottony Balloon Bush		
Goodenia bellidifolia			
Hardenbergia violacea	False Sarsaparilla		
Hibbertia obtusifolia	Hoary Guinea Flower		
Hydrocotyle laxiflora	Stinking Pennywort		
Hyparrhenia hirta *	Coolatai Grass		
Hypericum gramineum	Small St Johns Wort		
Hypochaeris radicata *	Flatweed		
Indigofera australis	Australian Indigo		
Juncus acutus *	Spiky Rush		
Kunzea ambigua	Tick Bush		
Laxmannia gracilis	Slender Wire Lily		
Lepidium africanum *			
Lolium perenne *	Perennial Ryegrass		
Lomandra filiformis	Wattle Mat-rush		
Lomandra longifolia	Spiny-headed Mat-rush		
Lomandra multiflora	Many-flowered Mat-rush		
Lycium ferocissimum *	African Boxthorn		
Maireana microphylla	Small-leaf Bluebush		
Malva parviflora *	Marshmallow		
Maytenus silvestris	Orange Bush		
Medicago polymorpha *	Burr Medic		
Melinus repens	Red Natal Grass		
Microlaena stipoides	Weeping Ryegrass		
Modiola caroliniana *	Red-flowered Mallow		
Myoporum montanum	Western Boobialla		
*Nicotiana glauca**	Tree Tobacco		
Notelaea microcarpa var. *microcarpa*	Velvet Mock Olive		
Olearia elliptica	Sticky Daisy Bush		
Oncinocalyx betchei			
Opercularia diphylla			
Opuntia stricta *	Prickly Pear		
Oxalis perennans	Woodsorrel		
Ozothamnus diosmifolius	White Dogwood		
Panicum simile	Two-colour Panic		
Paronychia brasiliana *	Chilean Wort		
Paspalum dilatatum *	Paspalum		
Pennisetum clandestina *	Kikuyu		
Phyllanthus sp.			
Phytolacca octandra *	Inkweed		
Pimelea curviflora var. *divergens*			

Scientific Name	Common Name	Status	
		TSC Act	EPBC Act
Pimelea curviflora var. *sericea*			
Pimelea linifolia	Slender Rice-flower		
Plantago lanceolata *	Plantain		
Plantago varia			
Plectranthus parviflorus			
Polygonum aviculare *	Wireweed		
Psydrax oleifolia			
Pultenaea microphylla			
Rumex sp.			
Santalum lanceolatum	Sandalwood		
Sclerolaena muricata	Black Roly Poly		
Senecio madagascariensis *	Fireweed		
Senecio prenanthoides	Senecio Sp E		
Senecio quadridentatus	Cottony Fireweed		
Sida rhombifolia *	Paddy's Lucerne		
Sigesbeckia orientalis	Indian Weed		
Silybum marianum *	Variegated Thistle		
Solanum brownii	Violet Nightshade		
Solanum nigrum *	Blackberry Nightshade		
Solanum prinophyllum	Spiny Solanum		
Solanum sp.			
Sonchus aspera *	Prickly Sowthistle		
Sonchus oleraceus *	Common Sowthistle		
Spartothamnella juncea	Bead Bush		
Sporobolus creber	Western Rat-tail Grass		
Stachys arvense *	Stagger Weed		
Stellaria media *	Chickweed		
Stypandra glauca	Nodding Blue Lily		
Swainsona galegifolia	Smooth Darling Pea		
Tagetes minuta *	Stinking Roger		
Themeda australis	Kangaroo Grass		
Trifolium sp. *			
Trifolium subterraneum *	Subterraneum Clover		
Typha domingensis	Cumbungi		
Typha orientalis	Cumbungi		
Urtica urens *	Stinging Nettle		
Verbascum virgatum *	Twiggy Mullein		
Verbena officinalis *	Common Verbena		
Veronica plebeia	Creeping Speedwell		
Vittadinia cuneata	Fuzzweed		
Wahlenbergia sp.			
Wurmbea biglandulosa			
Xanthorrhoea johnsonii			

Table 15: Fauna species observed during field surveys at Bayswater Power Station, Muswellbrook during the week of 6th – 10th July 2009.

Scientific Name	Common Name	Status	
		TSC Act	EPBC Act
Acanthiza chrysorrhoa	Yellow-rumped Thornbill		
Acanthiza nana	Yellow Thornbill		
Acanthiza pusilla	Brown Thornbill		
Acridotheres tristis	Common Myna		
Alisterus scapularis	Australian King-Parrot		
Anas gracilis	Grey Teal		
Anas superciliosa	Pacific Black Duck		
Anthus australis	Australian Pipit		
Aquila audax	Wedge-tailed Eagle		
Ardea intermedia	Intermediate Egret		Listed – overfly marine area
Cacatua galerita	Sulphur-crested Cockatoo		
Cacomantis flabelliformis	Fan-tailed Cuckoo		Listed – overfly marine area
Chenonetta jubata	Australian Wood Duck		
Colluricincla harmonica	Grey Shrike-thrush		
Coracina novaehollandiae	Black-faced Cuckoo-shrike		Listed – overfly marine area
Corcorax melanorhamphos	White-winged Chough		
Corvus coronoides	Australian Raven		
Coturnix pectoralis	Stubble Quail		
Coturnix ypsilophora	Brown Quail		
Cracticus nigrogularis	Pied Butcherbird		
Cracticus torquatus	Grey Butcherbird		
Cygnus atratus	Black Swan		
Dacelo novaeguineae	Laughing Kookaburra		
Dicaeum hirundinaceum	Mistletoebird		
Egretta novaehollandiae	White-faced Heron		
Elanus axillaris	Black-shouldered Kite		
Elseyornis melanops	Black-fronted Plover		
Eolophus roseicapillus	Galah		
Falco berigora	Brown Falcon		
Falco cenchroides	Nankeen Kestrel		Listed – overfly marine area
Falco peregrinus	Peregrine Falcon		
Geopelia humeralis	Bar-shouldered Dove		
Grallina cyanoleuca	Magpie-lark		
Gymnorhina tibicen	Australian Magpie		
Himantopus himantopus	Black-winged Stilt		Listed – overfly marine area
Hirundo neoxena	Welcome Swallow		
Lichenostomus penicillatus	White-plumed Honeyeater		
Malurus cyaneus	Superb Fairy-wren		

Scientific Name	Common Name	Status	
		TSC Act	EPBC Act
Manorina melanocephala	Noisy Miner		
Melanodryas cucullata	Hooded Robin	Vulnerable	
Microeca fascinans	Jacky Winter		
Mirafra javanica	Horsfield's Bushlark		
Mirafra javanica	Singing Bushlark		
Neochmia temporalis	Red-browed Finch		
Ocyphaps lophotes	Crested Pigeon		
Pardalotus punctatus	Spotted Pardalote		
Pardalotus striatus	Striated Pardalote		
Pelecanus conspicillatus	Australian Pelican		
Petroica boodang	Scarlet Robin		
Petroica goodenovii	Red-capped Robin		
Petroica rosea	Rose Robin		
Phalacrocorax carbo	Great Cormorant		
Phalacrocorax melanoleucos	Little Pied Cormorant		
Phaps chalcoptera	Common Bronzewing		
Platycercus adscitus eximius	Eastern Rosella		
Plectorhyncha lanceolata	Striped Honeyeater		
Poliocephalus poliocephalus	Hoary-headed Grebe		
Pomatostomus temporalis	Grey-crowned Babbler	Vulnerable	
Pyrrholaemus sagittatus	Speckled Warbler	Vulnerable	
Rhipidura albiscapa	Grey Fantail		
Rhipidura leucophrys	Willie Wagtail		
Stagonopleura guttata	Diamond Firetail	Vulnerable	
Strepera graculina	Pied Currawong		
Tachybaptus novaehollandiae	Australasian Grebe		
Taeniopygia bichenovii	Double-barred Finch		
Vanellus miles	Masked Lapwing		
Zosterops lateralis	Silvereye		
Mammals			
Bos Taurus	European Cattle		
Canis familiaris	Wild Dog		
Macropus giganteus	Eastern Grey Kangaroo		
Macropus rufogriseus	Red-necked Wallaby		
Oryctolagus cuniculus	Rabbit		
Trichosurus vulpecula	Common Brushtail Possum		
Vombatus ursinus	Common Wombat		
Vulpes vulpes	European Red Fox		
Reptiles			
Anomalopus leuckartii	Burrowing Worm Skink		
Carlia tetradactyla	Four-fingered Harlequin Skink		
Ctenotus robustus	Striped Skink		
Diplodactylus vittatus	Stone Gecko		
Egernia striolata	Tree Skink		
Eulamprus quoyii	Eastern Water Skink		
Morethia boulengeri	Boulenger's Skink		
Pseudechis porphyriacus	Red-bellied Black Snake		
Tiliqua scincoides	Eastern Blue-tongue Lizard		
Amphibians			

Scientific Name	Common Name	Status	
		TSC Act	EPBC Act
Crinia signifera	Brown Toadlet		
Limnodynastes tasmaniensis	Spotted Marsh Frog		
Litoria latopalmata	Broad-palmed Rocket Frog		
Pseudophryne bibronii	Brown Brood Frog		

Appendix D: Site Photos

The location of these photos relates to field survey locations in Figure 4, unless otherwise stated.

Figure 12: Site 26 (left) and Site 1 (right)

Figure 13: Site 2 (left) and Site 3 (right)

Figure 14: Site 5 (left) and Site 6 creekline western end (right).

Figure 15: Site 6 central portion of creekline (left) and Site 10 (right).

Figure 16: Site 8 on edge of lake (left) and Aquatic Habitat Feature Site 15 (Figure 9, right).

Figure 17: Drainage line south of Site 9 (left) and Site 20 (right).

Figure 18: Site 22 with good rocky habitat (left) and Site 23 (right).

Figure 19: Site 24 (left) and Site 25 (right).

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