

11.1 Introduction

A flora and fauna assessment of the Marulan Site was undertaken by URS.

This chapter provides a summary of the flora and fauna assessment as the impacts of the Common Shared Works are most substantial for that phase; the full assessment is presented in the *Concept Application*.

11.2 Methodology

The methodology for this assessment included the following elements:

- literature review;
- flora and fauna surveys; and
- assessment of impacts.

These methods are discussed in more detail in the *Concept Application*.

11.3 Existing Environment

11.3.1 Results of Literature Review

Flora

The results of the desktop literature review indicate that 23 threatened plant species listed under the EPBC Act and/or the TSC Act have been previously recorded within the locality. Of these species, fourteen are classified as being Vulnerable and nine as Endangered under these Acts.

A review of the specific habitat requirements of these species, and the habitat offered by the Site and its surrounds identified that 22 of the listed species are likely to occur on the Site, of which 12 are Vulnerable and eight are Endangered (Refer to *Concept Application*).

Included in this list is *Diuris lanceolata* (Snake Orchid) which was recorded on the Site during a previous survey in October 2005 (PB, 2005). This species was described by PB (2005) as listed as endangered under the EPBC Act at the time of the survey. Contrary to this the EPBC Act Threatened Species profiles database states that the threatened population of *D. lanceolata* is restricted to Tasmania. Mainland populations formerly known as *D. lanceolata* are now considered to be a separate species *D. chryseopsis* (Bishop, 2000) and are not listed under the TSC Act or EPBC Act.

The local area surrounding the Site consists of agricultural lands that have been previously cleared and used for agricultural purposes since the times of European settlement in the area. Consequently, clearing has resulted in the removal of most of the naturally occurring vegetation, which was generally representative of dry open woodlands and grasslands.

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Fauna

Results from the fauna desktop reviews indicate that 21 threatened species listed under the TSC Act and/or the EPBC Act have been previously recorded within the locality. Of these species, 17 are classified as being Vulnerable and four as Endangered under the Acts. This list of threatened fauna species is presented in the relevant appendix of the *Concept Application*. Review of the habitat requirements of these species allows the assessment of the likelihood of occurrence at the Site. A total of 12 threatened fauna species are considered likely to occur at the Site, all of which are listed as Vulnerable.

A selection of common fauna species were recorded during a previous field survey (PB, 2005) including the Common Brushtail Possum (*Trichosurus vulpecular*), Eastern Grey Kangaroo (*Macropus rufus*), Common Wallaroo (*Macropus robustus*) and a variety of generalist and woodland species of bird. Additionally, the previous survey recorded four threatened fauna species. The TSC Act listed Powerful Owl (*Ninox strenua*) was recorded by call identification within 3 km of the Marulan Site. Three microchiropteran bat species ('micro-bats') listed as Vulnerable under the TSC Act were recorded by ultrasonic call location during the PB (2005) survey. The Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Little Bent-wing Bat (*Miniopterus australis*) were recorded within 5 km of the Site, whereas the Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) was recorded on the Site. A 7-Part Test for these threatened micro-bats is included in the *Concept Application*.

11.3.2 Results of Field Survey**Flora**

A total of 91 flora species were identified from the field surveys. The species recorded on the Site are presented in the relevant appendix of the *Concept Application*. None of these species are listed as threatened under either the TSC Act or EPBC Act. One species *Diuris chryseopsis* (Syn *D. lanceolata*) was observed but is not listed under the TSC Act or EPBC Act as discussed above.

Five primary vegetation communities were recorded across the study area including:

- **Tableland Hills Grassy Woodland:** Woodland at the Site occupies approximately 57 ha and contains a well developed canopy layer, with a dense groundcover layer comprising native and exotic grasses and herbs. The shrub layer was sparse to absent. Dominant eucalypt species included *Eucalyptus cinerea*, *E. rossii* and *E. eugenioides*. This structure and suite of species is characteristic of Tableland Hills Grassy Woodland (Tindall *et al.*, 2004). The groundcover features exotic pasture species and herbs mixed with a reasonable diversity of native grasses (including *Themeda australis*, *Aristida vagans*, and *Austrostipa scabra* subs *scabra*) and herbs (including *Ajuga australis*, *Geranium spp* and *Crassula sieberiana*). The noxious pasture weed *Nasella trichotoma* (Serrated Tussock) is present, but in lower concentrations than in other communities on Site.
- **Cleared Grassland:** Cleared grassland occupies approximately 46 ha of the Site. These areas have been extensively modified by clearing, the introduction of pasture species and subsequent grazing. Patches of native grasses occur including *Themeda australis* and *Aristida vagans*, however, these are dominated by exotic pasture species including Kikuyu *Pennisetum clandestinum*, and the noxious weed Serrated Tussock. This community contains some native groundcover species including the herbs *Poranthera microphylla*, *Cheilanthes distans* and *Oxalis*

perennans though these are less abundant than herbaceous weeds such as *Plantago lanceolata* and *Hypochaeris radicata*.

- **Riverbank Forest:** There is a narrow strip of vegetation along both sides of the Wollondilly River for several kilometres of its length in the vicinity of the Site which has been classified as Riverbank Forest community. In the northern portion of the study area the river features broad (50 -100 m wide) banks within steep levee banks rising to the surrounding cleared farmland. This area supports *Casuarina cunninghamiana* Forest with an understorey of herbs and grasses. No shrub layer was present apart from clumps of Blackberry (*Rubus fruticosus* sp. agg.). The understorey contains the exotic grasses Serrated Tussock and Kikuyu (*Pennisetum clandestinum*), the native grass Couch (*Cynodon dactylon*), native herbs including *Dichondra repens* and *Poranthera microphylla* and exotic pasture weeds including *Sonchus* spp. Within the river channel the exotic weed *Salix* spp. occurred as clumps of trees. *Triglochin procerum* was the most common emergent aquatic plant. Other aquatic species included *Ranunculus inundatus*, *Baumea* sp. and water lilies (Family Menyanthaceae).
- **Snow Gum Woodland:** There was a small area of Snow Gum *E. pauciflora* woodland near the eastern end of the proposed transmission line which features a moderately dense canopy and a dense grassy understorey dominated by Serrated Tussock. The vegetation is most closely aligned with the Tableland Grassy Box-Gum Woodland of Tindall *et al.* (2004). However, it is noteworthy that Snow Gum vegetation does not qualify as the Box-gum Woodland EEC. The Scientific Committee determination for this EEC states 'the Eucalyptus pauciflora grassy woodlands of the cooler parts of the southern tablelands are not covered by this Determination' (NSW Scientific Committee, 2002).

Endangered Ecological Communities

The predominant vegetation on the Site was classified following the field survey as Tableland Hills Grassy Woodland. No Endangered Ecological Communities (EECs) were identified on Site although floristically, Tableland Hills Grassy Woodland is very similar to Tableland Grassy Box-Gum Woodland, which does form part of the EEC listed under the TSC Act, whereas the former community does not. The community identified on Site is considered to be Tableland Hills Grassy Woodland for the following reasons:

- **Floristics / Canopy Trees.** Dominant eucalypt species include *Eucalyptus cinerea*, *E. rossii* and *E. eugenioides*. This structure and suite of species is characteristic of Tableland Hills Grassy Woodland (Tindall *et al.* 2004). The key characteristic canopy species of Box-Gum Woodland are white box *Eucalyptus albens*, yellow box *E. melliodora* and Blakely's gum *E. blakelyi*. These species are not present within the Tableland Hills Grassy Woodland community.
- **Existing Data / Mapping.** Reference to the most recent publicly available regional vegetation mapping and report for the area (Tindall *et al.* 2004) indicates that Tableland Hills Grassy Woodland is not part of the Box-Gum Woodland association.
- The canopy species recorded on the site that comprise the canopy of the Tableland Hills Grassy Woodland (*Eucalyptus cinerea*, *E. rossii* and *E. eugenioides*) are not listed as 'characteristic' species under the definition of Box-Gum Woodland in the *Final Determination* of the NSW Scientific Committee (2004).
- The Box-Gum Woodland *Identification Guidelines* (NPWS, undated) state that 'Whether the characteristic trees of the site are (or are likely to have been) White Box, Yellow Box or Blakely's

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Red Gum'. As noted above, these species are not the characteristic species of the site, and further, even if the woodland vegetation on the site was argued to be a degraded form of the EEC, the site would not be likely to regenerate over time (with or without management actions) to include these species.

Box Gum Woodland is also listed at a national level as 'critically endangered' under the EPBC Act. Review of the relevant guidelines and policy statements from the Commonwealth Department of Environment, Water, Heritage and the Arts indicates that the vegetation on the site does not meet the definition for White box – Yellow box – Blakely's gum woodland and derived native grassland' (referred to informally as 'Box-gum woodland and derived native grassland'). The opening paragraphs of the guideline states that 'Sites dominated by other tree species that do not have White Box, Yellow Box or Blakely's Red Gum as co-dominants are not considered to be part of the ecological community...'. Additionally, the key guide to determining whether the EEC is present on a property asks 'Is, or was previously, one of the most common overstorey species White Box, Yellow Box or Blakely's Red Gum...?'. For the vegetation recorded on the Site, this is not the case. Even if, as is common for agricultural properties of the region, the vegetation on the Site was previously or historically disturbed by grazing, clearing, shrub removal, slashing or selective logging, the three characteristic canopy species of the EEC would have regenerated in some form, as is the case with the canopy trees that exist today.

On the basis of the above, the vegetation on the site does not qualify as the 'Box-gum woodland and derived native grassland' EEC listed under the EPBC Act.

Fauna

A total of 86 fauna survey species have been recorded on the Site during the four URS surveys since October 2006, including six species of frog, 57 species of bird, one reptile and 22 native mammals (including 11 micro-bats). These species are listed in the relevant appendix to the *Concept Application*.

Fauna Habitats and Resources

Figure 11-1 maps the significant habitat features on Site during the current and previous surveys. The habitat types and features recorded on the Site are described below.

Tableland Hills Grassy Woodland

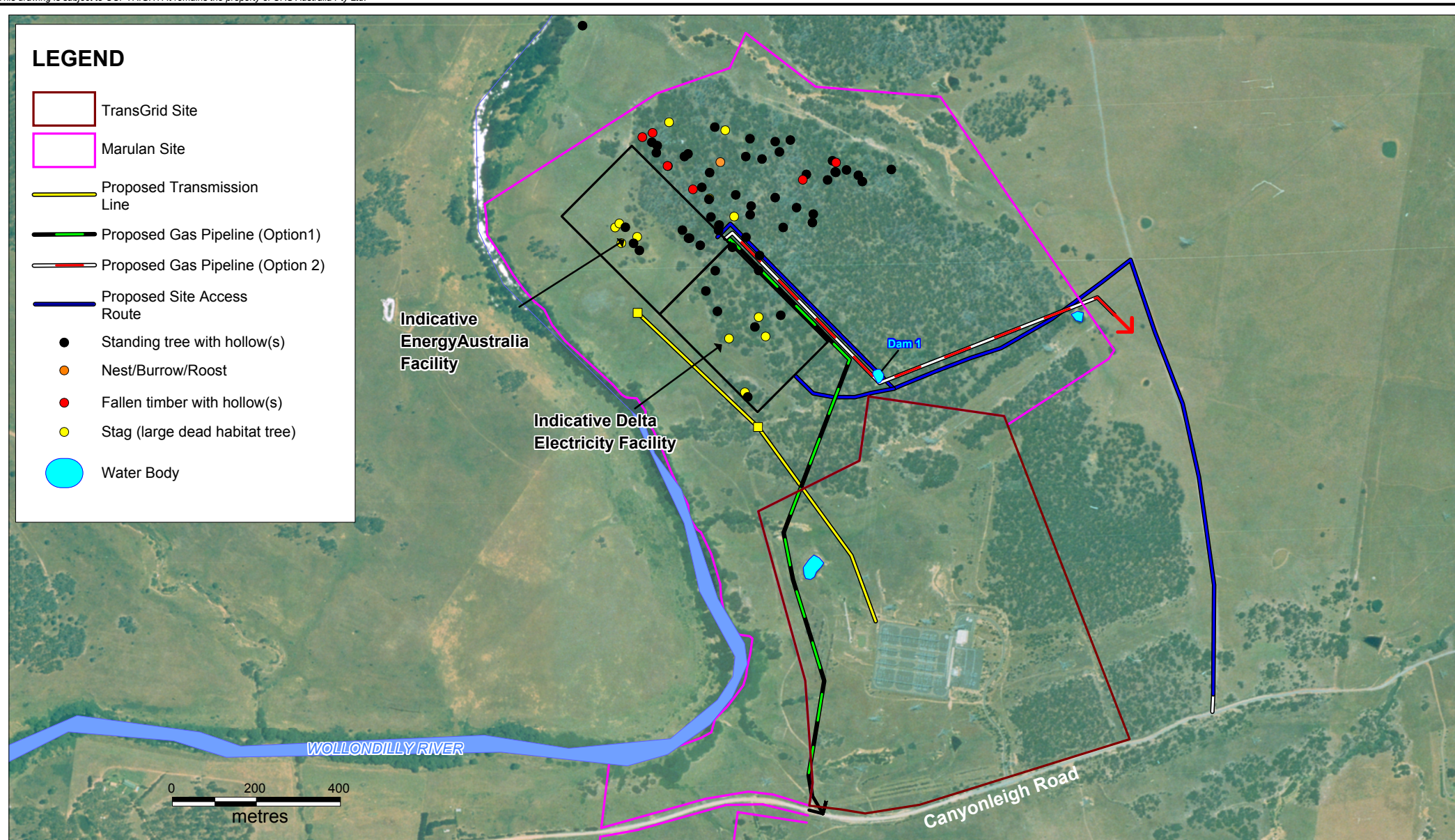
The Tableland Hills Grassy Woodland vegetation possesses a well developed canopy layer and a patchy to dense groundcover layer consisting of native and exotic grasses and herbs. The shrub layer was sparse to absent. Dominant eucalypt species included *Eucalyptus cinerea*, *E. rossii* and *E. eugenioides*. This structure and suite of species is characteristic of Tableland Hills Grassy Woodland (Tindall *et al.* 2004). In some areas (Q1, Q2, Q4, Q7) the eucalyptus species were co-dominant however *E. cinerea* dominated the woodland in the northern portion of the Site (Q3, Q5).

The absence of a shrub layer is likely to limit the habitat value of this community for some woodland bird species. The common shrub layer foragers Superb Blue Wren and Red Browed Firetail were observed opportunistically in Wollondilly River Riparian Vegetation (see below) but were not recorded in the woodland targeted bird surveys. This may suggest that woodland on the Site does not provide suitable habitat for this guild of species (Keast *et al.*, 1985).

The groundcover featured exotic pasture species and herbs mixed with a reasonable diversity of native grasses and herbs. Native grasses and herbs are an important food source for many native species, but are reduced in many woodlands and grasslands in NSW by grazing. The woodland on the Site is likely to provide good quality foraging habitat for groundlayer foragers including the threatened species such as the Diamond Firetail.

Mature eucalyptus throughout the woodland provide foraging habitat for native birds and arboreal mammals. The TSC Act listed Gang-gang Cockatoo was observed feeding on *Eucalyptus eugenioides* fruits in the May and June 2007 surveys. Up to four adult birds were observed repeatedly through the northern portion of the Site. Evidence of feeding (chewed fruits) was observed throughout Tableland Hills Grassy Woodland on Site. This suggests that the species was targeting this food resource and that woodland in the study area is significant habitat for the species.

Fibrous barked trees such as *E. cinerea*, *E. eugenioides* throughout the woodland provide habitat for the TSC Act listed Brown Treecreeper. Other bark-foraging species, including the White Throated Treecreeper and Varied Sitella, were observed during the October 2006 and June 2007 surveys.



LEGEND

- TransGrid Site
- Marulan Site
- Proposed Transmission Line
- Proposed Gas Pipeline (Option 1)
- Proposed Gas Pipeline (Option 2)
- Proposed Site Access Route
- Standing tree with hollow(s)
- Nest/Burrow/Roost
- Fallen timber with hollow(s)
- Stag (large dead habitat tree)
- Water Body

Indicative
EnergyAustralia
Facility

Indicative Delta
Electricity Facility

Dam 1

WOLLONDILLY RIVER

0 200 400
metres

Canyonleigh Road

Client

ENERGYAUSTRALIA

Project

MARULAN
GAS TURBINE FACILITY

Title

**IMPORTANT HABITAT
FEATURES AND RESOURCES**

Source: Delta Electricity, Energy Australia

Map compiled using MapInfo StreetPro Data. © 2008 MapInfo Australia Pty Ltd. URS Australia and PDSMA Australia Ltd. URS Australia, MapInfo Australia or PDSMA Australia do not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that they accept full responsibility for any errors, omissions or consequences in the information.

URS

Drawn: AJW

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File No: 43177371-147.wor

Figure: 11-1

The woodland provides suitable breeding habitat for bird species. Four nests were observed during the October 2006 surveys, belonging to the Spotted Pardalote, Yellow Faced Honeyeater, Jacky Winter and Dusky Wood swallow. The absence of a shrub / small tree layer in this community may limit the number of species for which suitable breeding habitat is present. Suitable resources are present for canopy nesters (including the Jacky Winter observed), trunk nesters (including the Dusky Woodswallow observed) or earth bank nesters (including the Spotted Pardalote observed) (Simpson and Day, 1993; Keast *et al.*, 1985). However, there are very limited opportunities for species which require dense undergrowth for nesting, including the TSC Act listed Diamond Firetail.

A number of standing and fallen hollow-bearing trees were recorded throughout the Tableland Hills Grassy Woodland (**Figure 11-1**). The density of hollows for the area surveyed is approximately 3.6 hollows per hectare. These may provide roosting or nesting habitat for the Gang-gang Cockatoo, native parrot species including the Superb Parrot, arboreal mammals and micro-bat species. Four threatened micro-bats have been recorded in the vicinity of the study area, and may utilise these hollows as diurnal roosts.

A number of stags (large, dead trees with hollows) were recorded during the October 2005 surveys (PB 2005). A Wedge-tailed Eagle was observed roosting in a stag adjacent to the Wollondilly River. No white wash or regurgitated pellets were detected beneath stags through the remainder of the Site.

There are large amounts of intact fallen timber and intact leaf litter throughout the woodland. These are likely to support a healthy and diverse invertebrate assemblage, which in turn provides good quality foraging habit for birds, reptiles and mammals. Hollow logs can provide shelter for ground-dwelling native reptiles and mammals.

There are also stands of remnant grassy woodland that feature a highly disturbed understorey with little intact leaf litter and small amounts of fallen timber. The habitat value of these areas for small woodland birds, reptiles and native mammals is likely to be much lower than intact areas of grassy woodland. However these areas did contain large isolated paddock trees, including trees with hollows. These may provide significant habitat for native parrots, woodland birds, arboreal mammals and micro bats. Hollow-bearing trees can provide highly significant roosting habitat when located in extensively cleared landscapes, however in this context it is unlikely that they play this role considering the availability of hollow-bearing trees in intact woodland and forest habitat in close proximity.

Cleared Grassland

Areas of cleared grassland on Site are likely to provide moderate foraging habit for native mammals particularly given the shelter provided by adjacent woodland and riparian vegetation. However the moderate to severe Serrated Tussock infestation across the Site limits its value as Serrated Tussock is poor quality feed. The habitat value of this area for native species is likely to increase if cattle are excluded from the Site as this may favour the regeneration of native herbs and grasses.

Cleared areas contain isolated hollow-bearing paddock trees and stags. These are likely to contain habitat for birds, and potentially for micro-bats but may have less value than equivalent habitat located within vegetated areas on Site. Cleared grassland areas are most likely to favour generalist open country bird species, which are typically common.

Serrated Tussock forms thick tussocks and resists grazing by cattle, so may provide shelter for native invertebrates, reptiles and small mammals. Granitic rock outcrops occur in the south and western portions of the Site. These have weathered to form a diverse substrate of boulders and platey fragments which would provide quality shelter greatly increasing the habitat value of grassland in this area.

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Clumps of the exotic weeds Blackberry and Hawthorn provide limited areas of shelter, foraging and breeding habitat for woodland bird species, including the Chestnut-rumped Thornbill which was observed nesting.

Woodland margins in the southern portion of the Site feature a greater diversity of native grasses and herbs than found elsewhere in this community. This may increase the value of these areas as habitat for native fauna assemblages, including the TSC Act listed Diamond Firetail, which selectively forages on native grass species.

Riverbank Forest

The Riverbank Forest in the northern portion of the riparian zone occupies a broad area (50-100m wide) on the river banks. This area may provide significant grazing habitat for large native mammals due to the presence of shelter, water and comparatively succulent grass species including Couch and Kikuyu. The shrub layer was absent apart from clumps of Blackberry (*Rubus fruticosus*). This community may provide foraging habitat for the threatened species the Gang-gang Cockatoo (*Callocephalon fimbriatum*) and Glossy Black Cockatoo (*Calyptorhynchus lathamii*). The Glossy Black Cockatoo is less likely to occur on Site as it typically favours larger-fruited, forest and woodland Casuarinaceae species including *Allocasuarina torulosa* and *A. littoralis*.

Through the central and southern portion of the riparian zone steep levee banks adjoin the river and support a narrower strip of vegetation. The dense small tree-shrub layer in this area provides shelter for species which utilise adjacent areas of grassland and woodland for foraging. The presence of shelter makes this area better foraging habitat than the Tableland Hills Grassy Woodland. Opportunistic sampling during random meanders through this area recorded large numbers and diversity of bird species. These included the shrub layer foragers, such as the Superb Blue Wren and Red Browed Firetail, which were largely absent from the woodland. Dense vegetation within this community provides quality foraging and breeding habitat for declining woodland birds and may support threatened bird species.

The strip of Riparian vegetation is significant in a regional context due to the connectivity that it provides between other patches of native vegetation along the Wollondilly River.

Snow Gum Woodland

The Snow Gum *E. pauciflora* woodland in the southern edge of the Site features a moderate to dense canopy cover which would provide shelter and foraging habitat for native birds and possibly micro bats. The small size of the patch and absence of a shrubby understorey probably limit its habitat value for declining woodland birds and other threatened species. It is likely to favour common generalist species.

The ground layer was sparse and lacking in leaf litter, rock outcrop and dead wood which may limit its value as habitat for native invertebrates, reptiles and small mammals.

Waterbodies and drainage lines

There are three dams located on the Site: two small dams within the woodland close to the proposed access road and a larger dam downslope from the substation. There are drainage lines downslope of both dams which were dry at the time of the surveys. Both watercourses appear to only carry water immediately after rainfall events and are unlikely to provide significant aquatic habitat. The dams provide significant habitat for wetland birds but are unlikely to support the threatened Blue-billed Duck or Australian Painted Snipe due to their limited size and absence of fringing vegetation. The dams may provide habitat for many frog species due to the presence of macrophytes and natural vegetation in the surrounding area; however, they may not contain specific habitat requirements for the Giant Burrowing Frog, Littlejohns Tree Frog or other threatened frog species.

The locations of significant areas of habitat were recorded with a handheld GPS unit and are presented in **Figure 11-2**.

11.4 Impact Assessment – EnergyAustralia Facility

It is expected that the construction of the EnergyAustralia Facility footprint is up to approximately 12.8 ha. The EnergyAustralia Facility will also share a large amount of infrastructure and Laydown Area with the Delta Electricity Facility. As a result, for the purposes of assessment the impacts of the construction of the Delta Electricity and EnergyAustralia Facilities have been considered in detail in the *Concept Application* addressing the Common Shared Works (bulk earthworks, access road and transmission line).

11.4.1 Construction Impacts

It is assumed that further clearing would not be required as the Facility pad would have been created in the bulk earthworks phase. Further potential impacts during construction of the Facility itself (beyond bulk earthworks) includes the potential for impacts from sediment and runoff, site management and night time lighting.

The Wollondilly River and associated riparian vegetation lie in close proximity and downslope of the Facility footprint. The EMP would include safeguards and mitigation measures to minimise potential impacts from additional runoff, erosion and transported sediments (**Section 11.6**). The erosion and sediment controls and other mitigation measures outlined in the EMP will ensure that the proposal is unlikely to result in significant impacts on these areas.

The sediment and erosion controls employed during the construction of the pad would be maintained during the construction of the Facilities, particularly in and around areas of high traffic. If this is carried out according to the CEMP then the proposal is unlikely to result in significant impacts on these areas.

Night time lighting can potentially discourage habitat use where diffuse light penetrates into adjoining areas of vegetation. Nocturnal foraging regimes could be disrupted and may advantage predators such as cats, dogs and foxes as they are not strictly nocturnal foragers. Nocturnal species' (such as owls, gliders and possums) eyesight is hindered by bright lights, and where they are affected by this, they become more susceptible to predation.

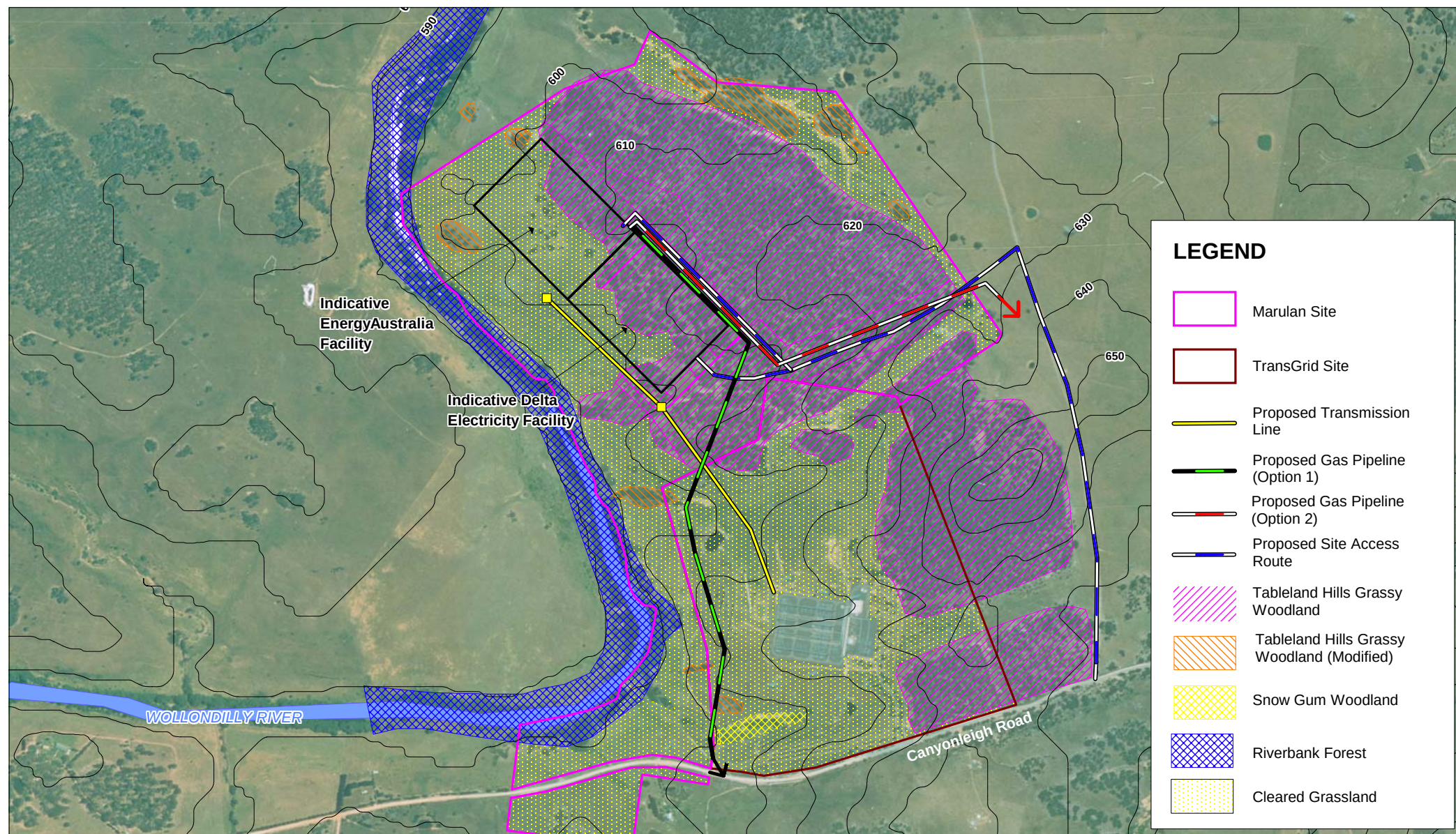
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Construction would only occur during daylight hours and so it is unlikely that large floodlights would be required during the construction phase. It is likely that some lighting may be required for emergencies, maintenance or security. This lighting would be designed as 'down lights' and not spill outside the area directly disturbed by the development footprint.

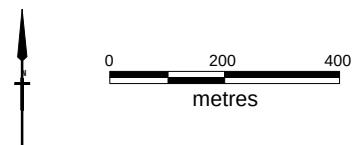
Internal roads would be constructed on the site to facilitate the movement of construction traffic to the Facility. Predicted traffic volumes during the construction phase are presented in the **Chapter 10**.

Construction may increase the risk of vehicle collisions with fauna utilising habitats along the entrance road and Canyonleigh Road. Collisions within this area are unlikely as ongoing disturbance from construction activities are likely to discourage fauna from using this area. Construction would only occur during daylight hours and so vehicle collisions with macro- fauna are unlikely to correspond to travel periods for species present in the area. Large native animals at risk of collision are predominantly nocturnal or crepuscular (most active at dawn and dusk).



LEGEND

- Marulan Site
- TransGrid Site
- Proposed Transmission Line
- Proposed Gas Pipeline (Option 1)
- Proposed Gas Pipeline (Option 2)
- Proposed Site Access Route
- Tableland Hills Grassy Woodland
- Tableland Hills Grassy Woodland (Modified)
- Snow Gum Woodland
- Riverbank Forest
- Cleared Grassland



Client ENERGYAUSTRALIA	Project MARULAN GAS TURBINE FACILITY		Title VEGETATION COMMUNITIES
	Drawn: AJW	Approved: NB	Date: 14.03.08
	Job No: 43177371	File No: 43177371-186.wor	

Figure: 11-2

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11.4.2 Operational Impacts

It is assumed that operational impacts of the two Facilities are equivalent and so they are assessed together.

During the operational phase the proposed Facilities will operate as zero-discharge sites.

Roads and Access

Access to the Marulan Site would be via Canyonleigh Road. Internal roads would be constructed on the site to facilitate the movement of operations traffic. Predicted traffic volumes during the operations phase are presented in **Chapter 10**.

This may increase the risk of vehicle collisions with fauna utilising habitats along the entrance road and Canyonleigh Road; however, during the operational phase, staff levels will be low and will result in only a minor increase in the risk of collisions. A maximum vehicle speed would be set in the OEMP to minimise the risk of fauna collisions.

11.5 Impact Assessment – Cumulative Impact

11.5.1 Construction Impacts

The cumulative impacts of the Facilities relate predominantly to the areas of clearing undertaken for the Common Shared Works addressed in detail in the *Concept Application*.

The assessment recommended a number of mitigation measures and also included a package of Biodiversity Offsets. Refer to **Section 11.6.8** for more detail on biodiversity offsets.

11.5.2 Operational Impacts

As noted above, operational lighting can potentially discourage habitat use.

It is likely that some lighting may be required for emergencies, maintenance or security. This lighting would be designed as 'down lights' and not spill outside the area directly disturbed by the development footprint.

Ongoing management of the Marulan Site will need to be jointly managed between Delta Electricity and EnergyAustralia. An EMP would be developed for the Site describing the responsibilities of each party. The EMP would address issues such as:

- excluding grazing from the Site;
- weed and pest management;
- bush fire management;
- general Site management; and
- management of areas of revegetation and rehabilitation.

The assessment for the Common Shared Works (refer to the *Concept Application*) recommended a number of mitigation measures and also included a package of Biodiversity Offsets (refer to **Section 11.6.8**).

11.6 Mitigation Measures

The following mitigation measures are identified in order to avoid or minimise potential impacts on flora and fauna species from the proposed Facility.

11.6.1 Environmental Management Plan

An Environmental Management Plan (EMP) would be developed for the construction and operational phases of the proposal and would include measures for the minimisation or avoidance of impacts on native flora and fauna. An overview of the impact mitigation and environmental management measures recommended for flora and fauna is provided below. The EMP would contain further details regarding these measures, including performance indicators, timing and responsibilities.

11.6.2 Tree Fauna Management

Construction of the Facilities would require the removal of potential habitat trees (>40 cms diameter or any trees with hollows). Further, nesting birds were observed in the development footprint during field surveys and would potentially occupy the Site during construction. Due care during clearing is recommended to reduce direct impacts to any tree dwelling fauna species which may be utilising the area. The CEMP should detail procedures for a pre-clearance survey and fauna management including the following points:

- trees should be monitored for fauna before and during clearing operations;
- trees with resident fauna should be avoided as far as is practicable;
- hollow-bearing trunks and branches should be carefully sawn and placed intact in adjacent areas of native vegetation; and
- replacement habitat, such as nest boxes, should be provided where habitat trees are to be removed.

A detailed pre-clearance survey by qualified ecologists would be required prior to development of the Site. This would involve:

- diurnal searches for birds, nests and roosts;
- active searches for reptiles, including checking of woody debris within the development footprint,
- active searches for micro bats, including checking under exfoliating bark; and
- nocturnal surveys, including stag-watching of identified habitat trees, specifically focusing on observing use of trees by micro bats.

This survey would focus on locating individuals, and especially roosts of threatened species.

If nests or nestlings of threatened species are observed within, or close to, the development footprint then construction should be postponed until the nestlings have hatched and fully-fledged. If construction constraints mean that this delay is not practicable then DECC should be consulted to determine if relocating the species is acceptable.

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11.6.3 Groundcover Clearance Protocol

Groundcover substrate and especially large woody debris provides important habitat for native fauna, including threatened species. It is recommended that a groundcover clearance protocol be incorporated into the CEMP. It is recommended that the protocol involve the following steps:

- remove large woody debris using excavator grabs or manual handling if practicable (raking);
- place intact large woody debris within adjacent areas of intact vegetation;
- scrape and stockpile leaf litter and topsoil separately from deeper fill material; and
- reuse leaf litter and topsoil in rehabilitation works.

11.6.4 Site Management

The following mitigation measures are recommended in order to minimise potential impacts on native fauna associated with the operation of the proposed Facilities:

- set maximum speed limits during construction and operation traffic onsite to reduce fauna road fatalities;
- limit vehicular and personnel entry into retained vegetation (including offset areas) during construction and operation through temporary exclusion fencing during construction, locating access roads and paths to avoid biodiversity areas and use of signage where necessary; and
- employing down-lights and motion sensor lighting in order to reduce light spill and the associated secondary impact on nocturnal fauna species potentially utilising the adjoining vegetation.

11.6.5 Exclusion of Grazing

Fencing would be installed to exclude grazing by cattle as a partial offset against impacts from development at the Site and associated clearing of natural vegetation. This is likely to increase the habitat value of intact vegetation and may aid the regeneration of cleared areas and degraded remnants. Exclusion of grazing improves the growth of many native herbs and grass species which are important feed species for woodland birds and other native animals.

11.6.6 Weed and Pest Management

A weed and pest management plan would be undertaken as part of the EMP for the Site. Active control of feral animals, such as the Red Fox and European Rabbit, and noxious weeds, such as Blackberry and Serrated Tussock, would be required during and after construction.

To limit the spread of weeds into remnant vegetation during construction intact areas would be fenced. This would be done prior to construction, restricting access by construction crew and machinery to remnant vegetation. Additionally, stockpiles of fill should not be placed in areas of remnant vegetation but instead in adjacent cleared grassland.

11.6.7 Bush fire Management

Where practicable, an Asset Protection Zone would be included in the detailed design, approximately 10 m to 15 m wide depending on the applicable site boundary. This would assist in infrastructure protection but may also play a mitigation role by minimising the risk that the Project would increase the natural fire regime.

A Bushfire Management Plan would be prepared. This would consider the natural fire regimes and ecological values of surrounding vegetation and balance this with the need for Hazard Reduction burns. Further assessment of the bush fire management is provided in **Chapter 16**.

11.6.8 Soil Erosion / Runoff

The CEMP would formulate safeguard measures to reduce soil erosion and pollutant run-off during both the construction and operation phases. Particular areas of concern are: Dam 1 and the drainage line downslope of the proposed access road; the dam and drainage line east of the TransGrid switchyard; and the west-facing slope adjacent to the proposed Facility footprint, which drains to the Wollondilly River.

11.6.9 Biodiversity Offsets

The proposed offset strategy recognises the scale and importance of the impact on the woodland and adopts the DECC principles for offsets. The key features of the strategy include:

- a woodland offset area, involving permanent conservation of a 32.3 ha portion of land that contains Tableland Hills Grassy Woodland; and
- a riparian rehabilitation area of 9ha, located along a degraded drainage line in the northern parts of the Site.

Proposed offset areas are presented on **Figure 11-3**.

Woodland Offset Area

The proposed woodland offset area contains 32.3 ha of Tableland Hills Grassy Woodland (**Figure 11-3**). The woodland within the proposed offset adjoins and is contiguous with woodland within the development footprint. Hence, the structure, species composition, density of trees with hollows and condition of the offset area are equivalent to woodland within the proposed construction footprint. The offset area also contains equivalent quantities of habitat resources such as feed trees, hollow bearing trees, standing and fallen dead timber, leaf litter and woody debris. It is likely to provide habitat for the threatened fauna species recorded on the Site and surrounding areas.

The understorey vegetation within the proposed offset area is patchy and of low density, probably due to historic grazing of the Site. It is likely that the condition of the vegetation would improve with the exclusion of grazing. Accordingly fencing and conservation of this area as a biodiversity offset is likely to improve the biodiversity value of the area over time. Additional management actions may achieve further conservation gains (see below).

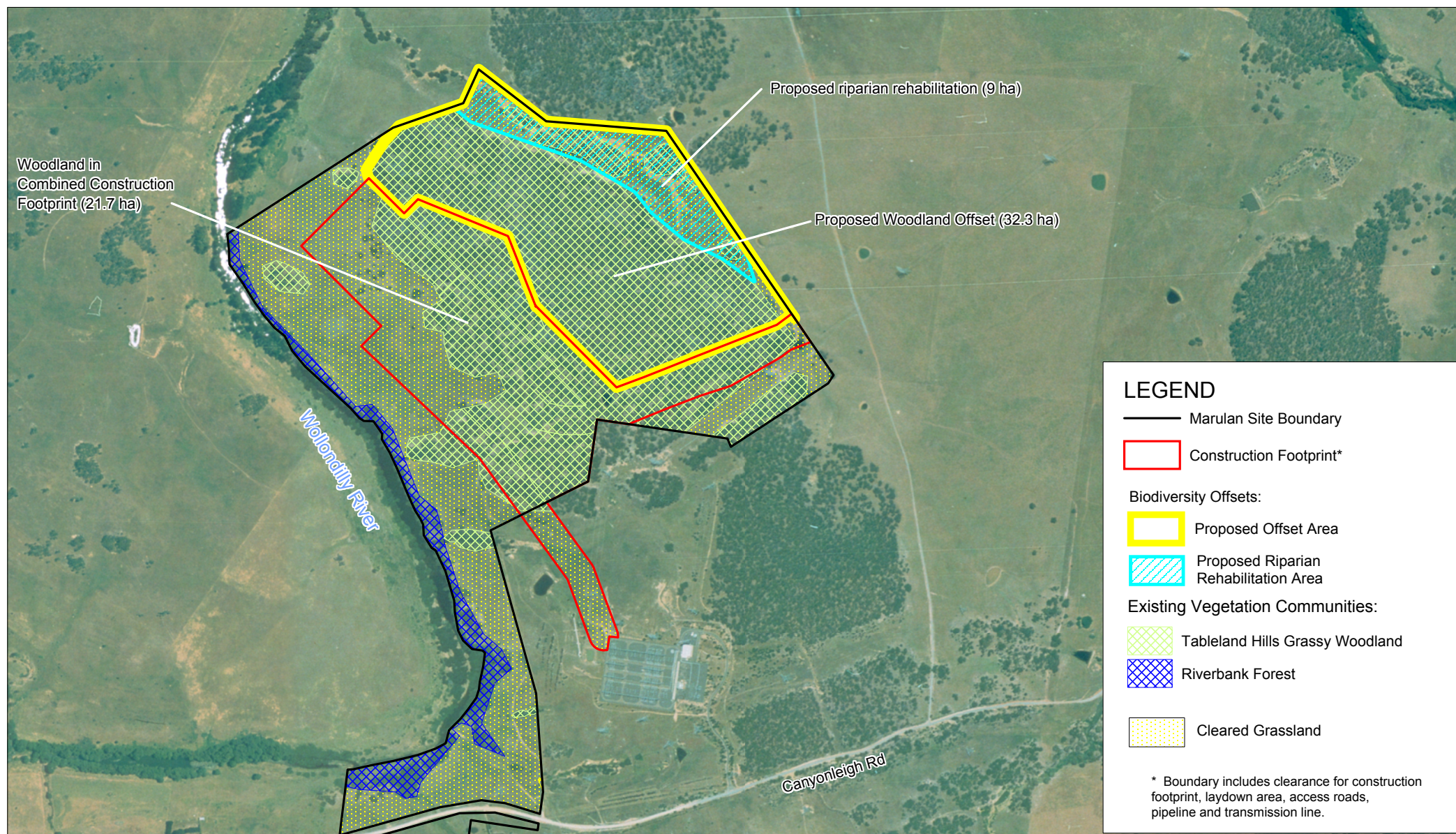
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Riparian Rehabilitation Zone

The other key offset is the conservation and rehabilitation of degraded riparian and woodland habitat along the drainage line in the northern portion of the Site (shown as the Riparian Rehabilitation Zone on **Figure 11-3**). The riparian area contains approximately 6.6 ha of cleared grassland and 2.4 ha of highly modified woodland. The drainage line currently features severe gully erosion and adjacent cleared land is also seriously eroded. This is probably causing ongoing sedimentation and degradation of aquatic habitat in the Wollondilly River downstream. It is recommended that a rehabilitation program be undertaken within this area.

The rehabilitation of the zone would have an emphasis on controlling the gully erosion that is currently evident. Measures proposed include erosion control, complementary plantings, weed control, habitat enhancement and stock fencing. Plantings should be extended to bridge cleared areas between the proposed woodland offset area and Disturbed Woodland along the drainage line. This would provide an important linkage between the offset area, woodland to the north of the Site, and the riparian vegetation along the drainage line. Details of the rehabilitation program would be included in the EMP for the proposed works.



LEGEND

— Marulan Site Boundary

Construction Footprint*

Biodiversity Offsets:

Proposed Offset Area

Proposed Riparian Rehabilitation Area

Existing Vegetation Communities:

Tableland Hills Grassy Woodland

Riverbank Forest

Cleared Grassland

* Boundary includes clearance for construction footprint, laydown area, access roads, pipeline and transmission line.



0 250 500
metres

Client
ENERGYAUSTRALIA

URS

Project
MARULAN
GAS TURBINE FACILITY

Drawn: TE Approved: BH Date: 07.02.08

Job No: 43177371 File No: 43177371-180.wor

Title
PROPOSED OFFSET AREAS

Figure: 11-3

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The Maintain or Improve Test

The DEC (2005) guidelines identify matters that are relevant to the assessment of impacts to threatened species, populations or ecological communities, or their habitats, arising from a development proposal assessed under Part 3A. A key principle presented in these guidelines is that proposals should maintain or improve biodiversity values (i.e. there is no net impact on threatened species or native vegetation). Where impacts cannot be avoided or mitigated then it is necessary to identify a suitable biodiversity 'offset' in order to maintain or improve biodiversity values.

This application of the 'maintain or improve' test to the proposal is summarised in **Table 11-1**

Table 11-1 Comparison of Biodiversity Impacts and Offsets

Impacts	Mitigation	Offsets
- Permanent removal of 21.7 ha of Tableland Hills Grassy Woodland during construction - Permanent loss of fauna habitat features (mature hollow-bearing trees, logs, leaf litter, ground debris, rocks and other resources) - Loss of 21.7 ha of threatened fauna species habitat	- Retention of fallen timber (salvage of selected felled trees in development footprint) - Temporary exclusion fencing during construction - Timing of construction to avoid breeding seasons of resident fauna (where practical) - Retention of woodland on other parts of the Site; - presence of similar woodland in the locality - Pre-clearing surveys for (and salvage of) resident native fauna - Installation of nest boxes for displaced arboreal fauna located in the development footprint	- Maintenance of woodland biodiversity values through permanent conservation of 32.3 ha of Tableland Hills Grassy Woodland. Land portion to be re-titled (with VCA or equivalent) for this purpose in perpetuity. - Permanent conservation of fauna habitat features (hollow-bearing trees, logs, leaf litter, ground debris, rocks and other resources) equivalent to those in impact area. - Improvement in biodiversity values through ongoing management of woodland offset area. Stock-proof fencing, retention of fallen timber, weed control, erosion control, feral animal control. - Rehabilitation of 9 ha of riparian vegetation and adjoining cleared land in Riparian Rehabilitation Zone. Creation of vegetated corridor connecting offset area to nearby woodland stands and adjacent riparian zone.

The biodiversity offset package is proposed as a means to ensuring that construction and operation of the proposed Facilities maintains or improves biodiversity values at the Site. The offset will protect and conserve, in perpetuity, threatened species habitats, vegetation types, habitat types and landscape features similar or equivalent to those found within the development footprint. Moreover, the proposed offset package will improve biodiversity values at the Site due to the following:

- the woodland offset area is larger than the area of woodland impacted by the Project;
- ongoing management of the offset area will improve its condition and biodiversity values;
- rehabilitation of the degraded drainage line in the northern portion of the Site will provide substantial improvements in the biodiversity values of riparian and aquatic habitats; and
- rehabilitation of the riparian corridor will also enhance corridor links between the woodland offset and similar woodland stands adjoining the Site to the north.

On the basis of the assessment, the proposed offset is consistent with the DECC guidelines for offsets and meets the key criterion for like-for-like trade-offs of biodiversity values. Adoption of the offset would adequately compensate for the loss of threatened species habitat associated with the Project and maintain biodiversity values.

Ongoing management of the offset area would be required to comply with the DECC (2006a) guidelines and to maintain or improve biodiversity values. Management actions would include, as a minimum:

- exclusion of grazing through fencing;
- weed removal and control;
- erosion control;
- retention of fallen timber, hollow logs, leaf litter, rocks and other habitat resources;
- maintenance and monitoring of natural surface water quality and flows;
- control of feral animals, where appropriate and practical; and
- annual monitoring and reporting on biodiversity, results of management actions undertaken and general condition of the Site.

Full details of the proposed management regime would be included in a Vegetation Management Plan that would be included in the Environmental Management Plan for the Site.

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Table 11-2 Summary of Mitigation Measures

Mitigation Measures	Implementation of mitigation measure	
	EnergyAustralia Facility	Cumulative Impact
As part of the Environmental Management Plan, prepare and implement a Vegetation Management Plan which complies with the DECC (2006a) guidelines.	✓ (Cons. & Ops)	✓ (Cons. & Ops)
Management actions would include the implementation of an offset strategy jointly by Delta Electricity and EnergyAustralia and include measures (as appropriate) such as: • exclusion of grazing through fencing; • weed removal and control; • erosion control; • retention of fallen timber, hollow logs, leaf litter, rocks and other habitat resources; • installation of nest boxes for displaced arboreal fauna (if required); • maintenance and monitoring of natural surface water quality and flows; • control of feral animals, where appropriate and practical; • timing construction to recognise breeding seasons of resident fauna (where practical); • setting low maximum speed limits to reduce fauna road fatalities; • limiting vehicular and personnel entry to adjacent vegetation through appropriate fencing; and • using down-lights and motion sensor lighting in order to reduce impacts on fauna species using woodland.	✓ (Planning, Cons. & Ops)	✓ (Planning, Cons. & Ops)
Delta Electricity and EnergyAustralia would jointly implement an offset strategy with key measures such as: • maintenance of woodland biodiversity values through permanent conservation of approximately 32.3 ha of Tableland Hills Grassy Woodland. Land portion to be re-titled (with VCA or equivalent) for this purpose in perpetuity; • rehabilitation of 9 ha of riparian vegetation and adjoining cleared land in Riparian Rehabilitation Zone. Creation of vegetated corridor connecting offset area to nearby woodland stands and adjacent riparian zone; and • temporary exclusion fencing of offset area during construction.	✓ (Cons. & Ops)	✓ (Cons. & Ops)
A Weed and Pest Management plan would be undertaken as part of the EMP for the Site, which would aim to actively control feral animals and noxious weeds.	✓ (Cons. & Ops)	✓ (Cons. & Ops)
The CEMP would formulate safeguard measures to reduce soil erosion and pollutant runoff for the Site particularly for waterbodies.	✓ (Cons. & Ops)	✓ (Cons. & Ops)
Disturbed sites would be quickly revegetated or covered with a non-erodible surface following construction.	✓ (Cons.)	✓ (Cons.)