Section 5

NATURE CONSERVATION

5. Nature Conservation

The purpose of this Section is to detail the existing nature conservation values of the Project area. These values are described in terms of the:

- Biological diversity of flora and fauna including habitat of rare and threatened species;
- Integrity of sensitive environmental areas that may be affected by the Project;
- Potential environmental impacts of the Project on terrestrial and aquatic flora and fauna; and
- The measures that will be adopted to avoid and/or minimise any environmental impacts.

5.1 Methodology

The methodology adopted for the Nature Conservation assessment is largely determined by the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the Queensland *Nature Conservation Act 1992, Vegetation Management Act 1999* and IP Act. It is a requirement of the legislation to identify the potential of the Project to harm (directly or indirectly) threatened species, populations or communities afforded protection under these Acts. Equally, any individual or organisation has a "general environmental duty" under s319 of the *Environmental Protection Act 1994* to prevent actions being undertaken which cause, or are likely to cause, environmental harm, unless all reasonable and practical measures are taken to prevent or minimise harm.

The methodology adopted was as follows:

- A search of the Department of Environment, Water, Heritage and the Arts (DEWHA) and Environmental Protection Agency threatened species databases to identify known records of threatened flora and fauna in the study area;
- A review of previous studies conducted in the area for any survey records of threatened flora and fauna surrounding the study area;
- Field surveys that included terrestrial flora and fauna and general observations of aquatic environments;
- Analysis of the desktop study, community consultation inputs and field results to assess the likelihood of threatened or significant species, communities and populations occurring in the study area; and
- Determination of the potential impacts of the Project on the plants and wildlife and measures required in order to protect any significant conservation values that occur.

Detailed survey methodologies are described in Appendix H.1.

5.2 Description of Environmental Values

5.2.1 Flora

General Description

As previously described in Section 1.1 the preferred alignment largely follows existing road reserves and property boundaries. These reserves have typically been cleared and are often dominated by exotic grasses and pasture species, or regrowth of native vegetation. Intact or near-intact stands of native vegetation of varying quality exist in riparian corridors along creek lines and the relatively undisturbed Auburn Range. The range is characterised by mixed eucalypt woodlands on steep sandstone ridges and steeply incised gullies. However, nearly all vegetation along the preferred alignment has experienced some level of disturbance due to previous clearing and cattle grazing.

Endangered Ecological Communities

Endangered ecological communities are a Matter of National Environmental Significance under the assessment and approval provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Three endangered ecological communities occur in the study area, as shown in Map 18 – EPBC listed Communities in the Map Folio. These are listed in Table 5-1.

Table 5-1: Endangered Ecological Communities

Endangered Ecological Community	Area within the Study Area* (ha)
Brigalow *(Acacia harpophylla)* dominant and co-dominant	242
Bluegrass *(Dichanthium* spp.) dominant grasslands of the Brigalow Belt Regions (North and South)	68
Semi-evergreen Vine Thicket (SEVT's) of the Brigalow Belt (North and South) and Nandewar Bioregions	30
Community dependant on the natural discharge of groundwater from the Great Artesian Basin (also known as Boggomoss)	0

* Area calculations based on EPA regional ecosystem mapping using the study area defined as of 05.08.2008 – accurate to the nearest whole hectare (ha).

Brigalow open forest and woodland communities are characterised by a species of silvery wattle (*Acacia harpophylla)* that is either dominant or co-dominant with *Casuarina cristata*, *Eucalyptus cambageana, E. populnea*, *Acacia cambagei*, *Terminalia oblongata* or *Acacia petraea*.

In Queensland, the Brigalow ecological community that has been listed under the EPBC Act is defined by reference to 16 regional ecosystems, all of which are listed as 'endangered' under the Queensland *Vegetation Management Act 1999* (VM Act).

The Brigalow ecological community was listed as a nationally endangered ecological community because it has declined to approximately 10% of its former area. That is, only 661,000 hectare (ha) (approximately) of the original extent of the Brigalow ecological community remains in Queensland (DEWHA, 2008). There is however currently no recovery plan for this community.

Bluegrass *(Dichanthium* spp.) communities of the Brigalow Belt Regions (North and South) are characterised by *Dichanthium sericeum* grassland ± *Astrebla* spp and often forms a mosaic with clumps of *Acacia harpophylla, Lysiphyllum hookeri* and *L. carronii* (EPA, 2007B). The endangered ecological community as listed under the EPBC Act corresponds to the RE's 11.4.4, 11.3.21, 11.9.12 and 11.8.11; three of which are mapped within the study area. An action plan for these communities

is being prepared by the Australian government, however at the time of writing, no information was publically available. The DEWHA acknowledges that the mapped extent significantly overestimates the area of Bluegrass (*Dichanthium* spp.) dominant grasslands of the Brigalow Belt Bioregions (North and South) in a semi-natural condition (DEWHA, 2008b). Field surveys confirmed that the mapped bluegrass communities within the study area were in poor condition, with *Dichanthium queenslandicum* representing, on average, less than 5% of the total population of the community. These communities were also dominated by *Parthenium hysterophorus,* an exotic herb, and therefore would not meet the criterion set for the Threatened Species Scientific Committee under the EPBC Act.

Semi-evergreen Vine Thicket (SEVT) is a dry rainforest community that is typically found on sites with deep, loamy, high nutrient soils derived from basalt or other volcanic rocks. Suitable habitat conditions for SEVT occur on the northern side of the Auburn Range at the base of ridges on black soils where water and nutrients are concentrated.

As a result of clearing, the SEVT ecological community generally occurs as fragmented patch sizes of <10 ha. The small and fragmented occurrence of this ecological community suggests that remnant patches are subject to further degradation and decline from such threatening processes as clearing, inappropriate fire regimes, grazing and weed invasion. This community is listed as Endangered under the EPBC Act and the 11 RE's that define the community are listed as Endangered under the VM Act. As with bluegrass communities, the Australian government is preparing an action plan for the recovery of the SEVT community.

While the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin has been identified in the locality (refer to Appendix H.2), this community was not identified in the study area. Further discussion on this community and its relationship to the Project is given in Section 5.2.2.

Regional Ecosystems

RE's are vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil (Sattler and Williams, 1999). They are used to manage regional biodiversity in Queensland and are recorded in the Regional Ecosystem Digital Database (REDD) (EPA, 2007B).

RE's within the REDD are given status listings under the VM Act that regulate clearing (their Vegetation Management Status) and a second status listing by the EPA to guide decision makers known as their Biodiversity Status. The Vegetation Management Status is based on an assessment of the pre-clearing and remnant extent of a Regional Ecosystem. The Biodiversity Status is based on an assessment of the condition of remnant vegetation in addition to the pre-clearing and remnant extent of a RE.

The majority of the multi-user corridor lies in cleared grazing lands. As shown in Map 19 – Flora in the Map Folio, impacts on RE's are restricted to Not of Concern RE associated with the Auburn Range and occasional isolated remnants of Of Concern and Endangered RE. Areas of Of Concern vegetation exist along many of the creek lines. The Endangered communities comprise Brigalow and SEVT and are generally small in size. In total, approximately 123 ha of remnant RE's will be cleared for the multi-user corridor. This represents about 9% of the total 1,411 ha of construction footprint.

These RE's comprise approximately:

- 8.0. ha of Endangered RE's;
- 14.4 ha of Of Concern RE's; and
- 100.5 ha of Not of Concern RE's.

Additional clearing is required for the Nathan Gorge Road realignment, which affects both Endangered and Not of Concern RE. A further 2.4 ha of Endangered RE and 14.9 ha of Not of Concern RE may be cleared for this road realignment.

A community description, summary of specialised habitat values and the approximate areas of each RE classification type along the preferred alignment are provided in Table 5-2. The impact of the Project on these RE's is addressed in Section 5.3.

Table 5-2: Regional Ecosystems directly impacted by the Project

RE type	VM Act Status*	Community Description	Specialised Habitat Values	Total area (ha)**	Survey site ref.†
11.10.13a/ 11.10.7/ 11.10.9/ 11.10.13a	N	*Eucalyptus cloeziana* ± *E. melanoleuca* ± *E. bunites* ± *E. sphaerocarpa* woodland to open-forest. *Eucalyptus crebra and/or E. melanophloia* ± *E. populnea shrubby woodland. Callitris glaucophylla* woodland on coarse-grained sedimentary rocks	Habitat for species with restricted and disjunct distributions including *Eucalyptus suffulgens* and *Corymbia bunites*. Habitat for several threatened plant taxa, including *Wahlenbergia islensis* and *Eucalyptus rubiginosa*	**68.8**	**4 & 12**
11.10.7/ 11.10.9	N	*Eucalyptus crebra* and *Callitris glaucophylla* woodland on coarse-grained sedimentary rocks	Fallen logs, hollow bearing trees and nesting sites potentially create habitat for a range of native fauna including birds, reptiles and mammals	**4.6**	**-**
11.10.7/ 11.9.2	N	*Eucalyptus crebra* woodland on coarse-grained sedimentary rocks and *Eucalyptus melanophloia* ± *E. orgadophila* woodland on fine-grained sedimentary rocks	Fallen logs, hollow bearing trees and nesting sites potentially create habitat for a range of native fauna including birds, reptiles and mammals	**0.3**	**-**
11.10.9/ 11.3.2/ 11.10.9	O (SD)	*Callitris glaucophylla* woodland on coarse-grained sedimentary rocks and *Eucalyptus populnea* woodland on alluvial plains	Habitat for threatened flora species including *Homopholis belsonii*.	**0.2**	**Q8**
11.12.1/ 11.10.9	N	*Eucalyptus crebra* woodland on igneous rocks and *Callitris glaucophylla* woodland on coarse-grained sedimentary rocks	Fallen logs, hollow bearing trees and nesting sites potentially create habitat for a range of native fauna including birds, reptiles and mammals	**10.4**	**-**

RE type	VM Act Status*	Community Description	Specialised Habitat Values	Total area (ha)**	Survey site ref.†
11.12.1/ 11.12.1	N	*Eucalyptus crebra* woodland on igneous rocks	Fallen logs, hollow bearing trees and nesting sites potentially create habitat for a range of native fauna including birds, reptiles and mammals	**1.3**	-
11.12.1/ 11.12.2/ 11.12.6b	N	*Eucalyptus crebra* and *Eucalyptus melanophloia* woodland on igneous rocks. *Callitris glaucophylla* ± *Eucalyptus* spp woodland	Fallen logs, hollow bearing trees and nesting sites potentially create habitat for a range of native fauna including birds, reptiles and mammals	**5.3**	-
11.12.1/ 11.12.3	N	*Eucalyptus crebra, E. tereticornis, Angophora leiocarpa* woodland on igneous rocks especially granite	Fallen logs, hollow bearing trees and nesting sites potentially create habitat for a range of native fauna including birds, reptiles and mammals	**2.9**	**Q14 & Q16**
11.12.2/ 11.12.1	N	*Eucalyptus melanophloia* and *Eucalyptus crebra* woodland on igneous rocks	Fallen logs, hollow bearing trees and nesting sites potentially create habitat for a range of native fauna including birds, reptiles and mammals	**5.0**	-
11.3.1/ 11.3.11	E	*Acacia harpophylla* and/or *Casuarina cristata* open forest and SEVT on alluvial plains	Habitat for threatened flora species including painted honeyeater *Grantiella picta* (Oliver *et al,* 2003), *Actephila sessilifolia, Atalaya calcicola* and *Eucalyptus raveretiana* (within Dipperu NP).	**<0.01**	-
11.3.11/ 11.3.1	E	SEVT and *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains	Habitat for threatened flora species including painted honeyeater *Grantiella picta* (Oliver *et al.*, 2003), *Actephila sessilifolia, Atalaya calcicola* and *Eucalyptus raveretiana* (within Dipperu NP).	**0.3**	**Q10 & Q11**
11.3.2	O	*Eucalyptus populnea* woodland on alluvial plains	Habitat for rare and threatened flora species including *Homopholis belsonii*.	**0.1**	-

RE type	VM Act Status*	Community Description	Specialised Habitat Values	Total area (ha)**	Survey site ref.†
11.3.2/ 11.3.25	O (D)	*Eucalyptus populnea* woodland on alluvial plains and *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	Habitat for threatened flora species including *Homopholis belsonii, Eucalyptus raveretiana* and potentially *Livistona nitida*. Associated with high fauna species richness in the Taroom area (Venz *et al,* 2002). Includes the threatened freshwater turtle *Rheodytes leukops* and other riparian freshwater turtle species.	**1.6**	**6**
11.3.2/ 11.3.4	O	*Eucalyptus populnea, Eucalyptus tereticornis* and/or *Eucalyptus* spp. tall woodland on alluvial plains	Habitat for threatened flora species including *Homopholis belsonii* and *Eucalyptus raveretiana*. Potential habitat for *Adclarkia dawsonensis*.	**3.1**	**Q12 & Q13**
11.3.2/ 11.3.4/11. 3.25	O (D)	*Eucalyptus populnea, Eucalyptus tereticornis* and/or *Eucalyptus* spp. tall woodland on alluvial plains. *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	Habitat for threatened flora species including *Homopholis belsonii*, *E. raveretiana* and potentially *Livistona nitida*. Associated with high fauna species richness in the Taroom area (Venz *et al*., 2002). Includes the threatened freshwater turtle *Rheodytes leukops* and other riparian freshwater turtle species. Potential habitat for *Adclarkia dawsonensis*.	**1.9**	**16**
11.3.2/ 11.9.5	E (SD)	*Eucalyptus populnea* woodland on alluvial plains and *Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	Habitat for threatened flora species including *Homopholis belsonii*.	**2.6**	**10**
11.3.25/ 11.3.2	O (SD)	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines and *Eucalyptus populnea* woodland on alluvial plains	Habitat for threatened flora species including *Eucalyptus raveretiana* and *Homopholis belsonii* and potentially *Livistona nitida*. Associated with high fauna species richness in the Taroom area (Venz *et al*., 2002). Includes the threatened freshwater turtle *Rheodytes leukops* and other riparian freshwater turtle species.	**0.2**	**-**

RE type	VM Act Status*	Community Description	Specialised Habitat Values	Total area (ha)**	Survey site ref.†
11.3.25/ 11.9.10/ 11.9.7	O (SD)	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines. *Acacia harpophylla*, *Eucalyptus populnea* open forest and *Eremophila mitchellii* shrubby woodland on fine-grained sedimentary rocks	Habitat for threatened flora species including *Eucalyptus raveretiana* and potentially *Livistona nitida*. Associated with high fauna species richness in the Taroom area (Venz *et al.*, 2002). Includes the threatened freshwater turtle *Rheodytes leukops*. and other riparian freshwater turtle species	**1.8**	**7**
11.3.25d	N	*Melaleuca bracteata* woodland to open-forest. Occurs on fringing alluvial soils or near-channel levees on heavy wet clays	Habitat for threatened flora species including *Eucalyptus raveretiana*. Associated with high fauna species richness in the Taroom area (Venz *et al.*, 2002). Includes the threatened freshwater turtle *Rheodytes leukops* and other riparian freshwater turtle species.	**0.5**	**Q9**
11.3.4/ 11.3.2	O	*Eucalyptus tereticornis, Eucalyptus populnea* and/or *Eucalyptus* spp. tall woodland on alluvial plains	Habitat for threatened flora species including *Eucalyptus raveretiana* and *Homopholis belsonii*.	**0.3**	**16**
11.3.4/ 11.3.25	O (D)	*Eucalyptus tereticornis*, *E. camaldulensis* and/or *Eucalyptus* spp. tall woodland on alluvial plains and fringing drainage lines	Fallen logs, hollow bearing trees and nesting sites potentially create habitat for a range of native fauna including birds, reptiles and mammals	**3.6**	**-**
11.3.6	N	*Eucalyptus melanophloia* woodland on alluvial plains	Fallen logs, hollow bearing trees and nesting sites potentially create habitat for a range of native fauna including birds, reptiles and mammals	**1.1**	**19 & Q9**
11.9.10	O	*Acacia harpophylla*, *Eucalyptus populnea* open forest on fine-grained sedimentary rocks	Shelter and food for scrub species. Fallen logs, hollow bearing trees and nesting sites potentially create habitat for a range of native fauna including birds, reptiles and mammals	**0.6**	**-**

RE type	VM Act Status*	Community Description	Specialised Habitat Values	Total area (ha)**	Survey site ref.†
11.9.4a	E	SEVT. Common co-dominant species include *Croton insularis, Denhamia oleaster, Eucalyptus orgadophila* and *Casuarina cristata* on drier, poorer sites. Occurs on steep upper and middle slopes where heavy clay soils have formed from sediments. It may grade into *Acacia harpophylla*, softwood spp. (11.9.4) on the lower slopes.	Habitat for rare and threatened flora species including *Cadellia pentastylis*. Low tree layer is floristically diverse	**1.2**	**-**
11.9.4b/ 11.9.4a	E	SEVT. *Acacia harpophylla* predominates and forms a fairly continuous canopy (10-18 m high). Other tree species such as *Eucalyptus populnea, Casuarina cristata, Cadellia pentastylis* and *Brachychiton* spp. may also be present	Habitat for rare and threatened flora species including *Cadellia pentastylis*. Low tree layer is floristically diverse	**0.9**	**-**
11.9.4b/ 11.9.5	E	SEVT. *Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	Habitat for rare and threatened flora species including *Cadellia pentastylis*. Low tree layer is floristically diverse	**2.8**	**Q10 & Q11 (part)**
11.9.7	O	*Eucalyptus populnea, Eremophila mitchellii* shrubby woodland on fine-grained sedimentary rocks	Fallen logs, hollow bearing trees and nesting sites potentially create habitat for a range of native fauna including birds, reptiles and mammals	0.5	-
Non-remnant	-	All vegetation not mapped as remnant. May include regrowth, heavily thinned and significantly disturbed vegetation that fails to meet the structural and/or floristic characteristics of remnant vegetation. Also includes cropping land.		1,285.6	-

* VM Act = *Vegetation Management Act 1999*; E = Endangered; O = Of Concern; N = Not of Concern; D = Dominant; SD = Sub Dominant

** Total area within the construction footprint (refer to Section 5.3 for definition).

† Where relevant, a reference to the tertiary flora field survey site is given (refer to Appendix H.3). Q = quaternary flora field survey site (refer to Appendix H.4).

Field surveys (January 2008) verified that the vegetation communities within the study area, and as described in Table 5-2, are broadly consistent with those mapped by the EPA mapping. This is important because the total areas of each RE type as mapped by the EPA was used to calculate vegetation clearing quantities. The full findings of the 23 flora site surveys, including location, environmental and overall structural information as well as a comprehensive list of woody species, are included in Appendix H.3.

Field survey results do however suggest minor discrepancies in the EPA mapping and community classifications. The following list is a summary of findings, with the full site descriptions also provided in Appendix H.3. The location of field survey sites are shown in Map 19 – flora in the Map Folio:

- Site 8 – was mapped as Of Concern RE 11.10.9/11.3.2, but was found to contain characteristics more representative of Of Concern RE 11.3.4;
- Site 12 – was mapped as Endangered RE 11.12.1/11.10.9, but did not contain brigalow and was more consistent with Not of Concern RE 11.9.4b;
- Site 14 – was mapped as Of Concern RE 11.9.5, but was found to contain characteristics more representative of Endangered RE 11.3.1;
- Site 17 – was mapped as Endangered RE 11.12.17/11.12.1, but was found to contain characteristics more representative of Of Concern RE 11.3.4; and
- Site 19 – was mapped as Not of Concern RE 11.3.25d, but was found to contain characteristics more representative of Of Concern RE 11.3.2b.

With the exception of Site 19, the preferred alignment avoids these communities and as such, they will not be directly impacted by the Project. Site 19 (The Brae, approximately 4 km north west of Cracow) is likely to be impacted by the Project and consideration should be given to the vegetation management status with regard to clearing applications.

Threatened Flora

Commonwealth-listed threatened species are those nominated under the EPBC Act as critically endangered, endangered or vulnerable. Under the EPBC Act, a person must not take an action that has, will have, or is likely to have, a significant impact on a listed threatened species, without approval from the Minister for the DEWHA.

State-listed threatened species are those nominated under the *Nature Conservation Act 1992* (NC Act) and regulations as endangered, vulnerable or rare. Under the NC Act, each category of threatened species has proposed management intent (s.14, 19 and 24 of the *Nature Conservation (Wildlife) Regulation 2006*). This includes:

- Taking action to ensure viable populations are preserved or re-established;
- Cooperating with the Commonwealth and other State agencies for the ongoing protection and management of the wildlife and its habitat;
- Protecting the critical habitat or the areas of major interest for the wildlife; and
- Monitoring and review of environmental impact procedures to ensure they accurately assess the extent of impact, provide for effective measures to mitigate any adverse impacts and provide for the enhancement of other areas where the wildlife normally lives if the adverse impact cannot be avoided or mitigated.

Appendix H.2 lists threatened flora species and communities that may occur within the general locality of the study area. This listing was extracted from searches of the DEWHA's Protected Matter Search Tool and EPA's Wildlife Online. Species were then ranked as having a high, moderate or low likelihood of occurrence based on previous observations, detection of species during survey and availability of suitable habitat.

Of the threatened flora identified, five species (Table 5-3) were observed or are highly likely to occur within the study area.

Table 5-3: Threatened Flora Species Highly Likely to Occur in the Study Area

Species	Common Name	Conservation Status*		Comment
		Cwth	QLD	
Acacia calantha	-	-	R	Observed during field investigations near Delusion, Oxtail and Gryandra Creeks. Also in understory of Nathan Gorge Range Eucalypt woodland
Cadellia pentastylis	ooline	V	V	Species is associated with RE's that occur in the study area, though no field observations made of specimens in its natural habitat. One cultivated specimen observed.
Dichanthium queenslandicum	King blue-grass	V	V	Observed during field investigations in two patches mapped as bluegrass communities. Sparse distribution at these locations.
Homopholis belsonii	-	V	E	Species is associated with RE's that occur in the study area.
Livistona nitida	Carnarvon fan palm	-	R	Observed during field investigations. Locally abundant along Oxtail and Delusion Creeks near Cracow

* QLD: Indicates the Queensland conservation status of each taxon under the NC Act. The codes are Presumed Extinct (PE), Endangered (E), Vulnerable (V), Rare (R), Common (C) or Not Protected (-).
Cwth: Indicates the Australian conservation status of each taxon under the EPBC Act. The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW), Vulnerable (V)

Exotic and Weed Species

Several weeds detected during site investigations are declared under the *Land Protection (Pest and Stock Route Management) Act 2002* (Table 5-4). *Opuntia stricta* (prickly pear) was the most common, observed throughout the study area, whilst all others appeared as scattered individuals.

Table 5-4: Pest Species Listed under the Land Protection (Pest and Stock Route Management) Act 2002 observed in the Study Area

Class 1	Class 2	Class 3
Acacia farnesiana (mimosa bush).	*Bryophyllum delagoense (mother of millions)* *Baccharis halimifolia (groundsel bush)* *Opuntia stricta (prickly pear)* *Opuntia tomentosa (velvety tree pear)* *Parthenium hystophorus (parthenium)*	*Lantana camara (lantana)* *Asaparagus africanus (climbing asparagus fern)* *Macfadyena unguis-cati (cats claw creeper)* *Cardiospermum grandiflorum (balloon vine)*

Forest Products

There are no state forests or timber reserves within the study area. All potential sources of timber resources will be from the remaining vegetation classified as RE. The preferred alignment requires the clearance of approximately 123 ha of classified RE, of which all have potential timber significance. These areas potentially contain flora species that are valued for their timber resources. A full list of timber species potentially occurring in the preferred alignment, to the satisfaction of DNRW, has been provided in Appendix H.4. The majority of these areas occur as fragmented and isolated patches along the preferred alignment thus providing limited value for extracting these resources. The largest continuous tract of vegetation that will be cleared and may be considered commercially significant for timber purposes is approximately 42 ha associated with the Auburn Range crossing. At this stage of the Project, no attempt has been made to calculate the volumes available or the commercial viability of harvesting this material.

5.2.2 Fauna

Description of Fauna Habitats

The study area provides a variety of habitats for native fauna. The design of the Project has given due consideration to the conservation values of large, connected, remnant vegetation and has, wherever possible, avoided any direct or indirect impact on these communities and wildlife habitats. This is through the use of road reserves, cleared properties and the foothills of the Auburn Range. However, there are some remnant patches of vegetation that can not be avoided and these include the following fauna habitats:

- Isolated remnants of mixed eucalypt woodland and Brigalow scrub;
- Riparian vegetation of varying quality and condition associated with both ephemeral and perennial creeks;
- Rock outcrops and exposed surface boulders providing potential habitat for a range of reptile and small mammal species; and
- Hollow-bearing trees that are a limited resource in the wider study area and provide suitable nesting habitat for a range of fauna including birds, arboreal mammals and insectivorous bat species.

Each of these areas provide potential habitat for a range of fauna species as described below.

Fauna Species

Historical records exist for 252 fauna species within the local area (EPA, 2007). Field surveys carried out for the Project identified a total 171 species within the study area (refer to Appendix H.1 for survey methodology and Map 20 – Fauna in the Map Folio). These include 21 amphibians, 37 reptiles, 23 mammals and 90 birds. A list of these species is included in Appendix H.5.

The majority of the species recorded during survey are considered to be common species and are listed under the *Nature Conservation (Wildlife) Regulation 2006* as Least Concern. The species encountered are generally representative of the fauna assemblage for the local area, though notably a number of guilds were missing – rodents and insectivorous marsupials, large elapids (venomous snakes), agamid lizards, fossorial skinks, ctenotus and legless lizards. Arboreal species were depauperate and few possums were found. The Castle Creek/Defence Road area demonstrated the highest degree of complexity supporting a number of habitats, including palustrine wetland, ephemeral riverine ecosystem, riparian zone, rocky outcrops and open woodland/forest.

Threatened Fauna

A list of the Commonwealth and/or State listed threatened fauna species, together with their preferred habitat and an indication as to whether they are likely to occur within the study area is given in Appendix H.2. Likely occurrence was based on historical records, detection of species during survey and availability of suitable habitat within the study area.

This assessment identified the 13 species listed in Table 5-5 that were observed or considered highly likely to occur within the study area.

Table 5-5: Threatened Fauna Species observed or highly likely to Occur within the Preferred Alignment

Species	Common Name	Conservation Status*		Comment
		Cwth	QLD	
Geophaps scripta scripta	Squatter pigeon	V	V	Observed during field investigation on Nathan Gorge Track
Chalinolobus picatus	Little pied bat	-	R	Suitable habitat within the study area
Dasyurus hallucatus	Northern quoll	E	-	QLD museum records and preferred habitat within study area
Acanthophis antarcticus	Common death adder	-	R	Suitable habitat within the study area, particularly through the Nathan Gorge Range
Anomalopus brevicollis	Short-necked worm skink	-	R	Observed during field investigations.
Denisonia maculata	Ornamental snake	V	V	QLD museum records and preferred habitat within the study area
Egernia rugosa	Yakka skink	V	V	QLD museum records and several areas of preferred habitat within the study area, particularly in the Nathan Gorge Range area
Furina dunmalli	Dunmall's snake	V	V	Preferred habitat within the study area, particularly areas containing Brigalow

Species	Common Name	Conservation Status*		Comment
		Cwth	QLD	
Paradelma orientalis	Brigalow scaly-foot	V	V	Preferred habitat within the study area
Rheodytes leukops	Fitzroy turtle	V	V	Inhabits the Fitzroy River and its tributaries, including the Dawson River. Preferred habitat in the study area (RE 11.3.25)
Strophurus taenicausa	Golden-tailed gecko	-	R	QLD museum records and preferred habitat in the study area, particularly common in cypress and brigalow
Cyclorana verrucosa	Rough collared frog	-	R	Observed at Cracow Creek. Preferred habitat within the study area, also around the wetland at Castle Creek
Jalmenus evagoras eubulus	Imperial hairstreak (northern subspecies)	V	V	Brigalow is its principal associated plant community and preferred food plant for its larvae.

* QLD: Indicates the Queensland conservation status of each taxon under the NC Act. The codes are Presumed Extinct (PE), Endangered (E), Vulnerable (V), Rare (R), Common (C) or Not Protected ().
Cwth: Indicates the Australian conservation status of each taxon under the EPBC Act. The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW), Vulnerable (V)

The potential impacts of the Project on the critically endangered (Cth) Boggomoss Snail (*Adclarkia dawsonensis*) were considered following the recent EPA publication on the subject (EPA, 2008). The current distribution of this species appears to be restricted to alluvial flats and riparian environments between Taroom and Theodore. Much of the soil in this area is well drained brown/grey clay derived from basalt forming a series of small peat bogs fed by aquifers of the Great Artesian Basin, known as Boggomosses. In spite of intensive field survey conducted by the Queensland Museum between 1993-1998, the snail was not found in either the surrounding Brigalow community or scattered vine thickets (EPA, 2008). Living populations are only known to occur in two localities (Boggomoss and Mount Rose Nature Refuges); both of which were identified in the early stages of the Project and specifically avoided as part of the route selection process. Consultation with the Department of Infrastructure and Planning (October 2008) has confirmed that recent intensive surveys for the Boggomoss Snail conducted for other regional projects with a mutual interest in the Surat Basin have found no evidence to suggest that they occur, or are likely to occur, outside of the two known localities. Table 5-1 confirms that these sites, listed under the EPBC Act as "communities dependant on the natural discharge of groundwater from the Great Artesian Basin" will be avoided by the Project.

In addition to direct impact on known locations supporting populations of the Boggomoss snail, the Project has the potential to impact on vegetation that provides potential habitat to this species. Land clearing of the snail's preferred habitat is listed by the EPA as one of the major threats to the survival of the species. The Recovery Plan for the Boggomoss Snail (*Adclarkia dawsonensis*) (EPA, 2008) described the types of habitat thought critical to the survival of the species as alluvial flats along the drainage lines of the Dawson River with grassy eucalypt frontage. This landscape is broadly described as RE 11.3.3 and RE 11.3.4. Elements of the community RE 11.3.25 are also consistent

with this preferred habitat (EPA, 2008). Whilst Table 5-2 indicates there are several RE community types within the alignment that contain elements consistent with RE 11.3.4 and RE 11.3.25, analysis of the field data shows that there is only one location along the construction footprint that possibly conforms to the description of potential habitat to this species. This is at the point where the alignment crosses Lonesome Creek (as described in Appendix H3 as Survey Site 16). Impact mitigation strategies for this site are discussed in Section 5.3.

Migratory Fauna

A number of migratory protected species and/or marine protected species listed under the EPBC Act have the potential to occur within the study area (listed in Appendix H.2). Whilst there will be no direct impacts on marine habitats, those migratory marine species may cross the Project or use suitable habitat that is available within the study area. The species considered most likely to occur within the study area, and therefore have the potential to be impacted by the Project, are listed in Table 5-6.

Table 5-6: EPBC Listed Migratory and/or Marine Species likely to Occur in the Study Area

Species	Common Name	Conservation Status*		Comment
		Cwth	QLD	
Anas rhynchotis	Australasian shoveler	M	-	QLD museum records and preferred habitat within study area
Apus pacificus	Fork-tailed swift	M/Ma	-	Suitable habitat within study area
Ardea alba	Great egret	M/Ma	-	Suitable habitat within study area
Ardea ibis	Cattle egret	M/Ma	-	Observed during field investigations
Cincloramphus mathewsi	Rufous songlark	M	-	QLD museum records and preferred habitat within study area
Cisticola exilis	Golden-headed cisticola	M	-	QLD museum records and preferred habitat within study area
Elseyornis melanops	Black-fronted dotterel	M	-	QLD museum records and preferred habitat within study area
Falco hypoleucos	Grey falcon	M/Ma	-	Observed during field investigations
Falco longipennis	Australian hobby	M	-	Suitable habitat within study area
Merops ornatus	Rainbow bee-eater	M/Ma	-	Observed during field investigations

* Cwth: Indicates the Australian conservation status of each taxon under the EPBC Act. The values of EPBC shown are Migratory (M) and/or Marine (Ma).

Feral and Exotic Species

A number of feral or introduced animals were observed during the field investigations. These are listed in Table 5-7. Domestic livestock were not considered to be exotic species, although they have had significant detrimental impacts on habitat values for native fauna throughout the study area. No major pest infestations (Red Imported Fire Ant (*Solenopsis invicta)* or Yellow Crazy Ants (*Anoplolepis gracilipes*) are recorded for the study area (DPIF, 2008).

Table 5-7: Feral and Introduced Species Recorded during Field Survey

Scientific Name	Common Name	Location Detected
Vulpes vulpes	Fox	Incidental observation between survey sites
Mus musculus	House mouse	Individual captured at Castle Creek wetland
Lepus capensis	Brown hare	Observed, track and trace evidence throughout the study area
Oryctolagus cuniculus	European rabbit	Observed, track and trace evidence throughout the study area
Canis lupus	Wild dog	Incidental observation between survey sites
Felis catus	Feral cat	Observed at Site 2 – west of Wandoan
Rhinella marina	Cane toad	Observed throughout the study area
Sus scrofa	Feral pig	Observed in reserve between Deearne Rd and Nathan Rd intersection

Note: Record of distribution and abundance is given in the fauna species list provided in Appendix H.5.

5.2.3 Aquatic Environment

The following descriptions relate to the available information for the riparian and riverine environments within the study area. Due to prolonged dry periods and lack of suitable sampling sites within the study area, the sampling of aquatic habitats was limited (refer to the detailed methodology in Appendix H.1). A review of available information was undertaken to determine that no significant species are likely to be impacted by the Project and a summary of the findings are presented here.

As described in Section 6, the preferred alignment intersects a number of small creeks and drainage lines which are tributaries of the Dawson River. A total of 94 streams are intersected, of which 65% are 1st order streams (65), 15% of 2nd order (15), 10% of 3rd order (7) and 10% of 4th order (7).

All tributaries of the Dawson River are ephemeral and experience flow only following major rainfall events. The sub-catchment is thus best described as lentic, where water is mostly found in pools.

Smaller streams (1st and 2nd order) remain dry under most conditions; however larger creeks (i.e. 4th order streams) are more likely to contain pools and experience water flow following rainfall events. Based on the site inspections (see Section 6), the creeks most likely to experience water flow following a rainfall event and retain water in pools include Juandah, Roche, Castle and Lonesome Creeks. Other larger creeks where pools are mostly found include Weringa, Downfall, Cockatoo and Banana Creeks.

The site inspections revealed that the substrate of the creeks mainly consists of sediments (clay), silty clay, silty sand and gravely sand.

Water quality of the creeks within the study area is relatively low, as discussed in Section 6. Low flow in combination with a high organic detritus has resulted in the deoxygenating of the water present in the remnant pools. Turbidity levels are usually high, as are the levels of nitrogen and phosphorus, reflecting agricultural land uses in the catchment and anthropogenic influences.

Riparian vegetation found within the study area all exhibits some level of disturbance. In many areas, riparian vegetation comprises a canopy layer with no mid-layer and limited ground cover as a result of disturbance from livestock. Assessment of riparian vegetation was undertaken at four sites (refer to Appendix H.3). The riparian communities are described in Table 5-8.

Table 5-8: Riparian Communities

Location	Description
Creek crossing Nathan Rd (adj. to Number Two Rd)	Riparian community dominated by *Eucalyptus tereticornis* with occasional *E. populnea*. The sub-tree layer was dominated by *Lysiphyllum* spp. and *E. melanophloia*. The shrub layer was dominated by *Ventilago viminalis* and *Acacia farnesiana*. The ground layer was dominated by *Panicum maximum* with occasional occurrences of *Paspalum dilitatum*, *Themeda trianda* and *Sorghum halepense*.
Drainage line east of 12 Mile Rd	Riparian community dominated by *Eucalyptus camaldulensis*, *E. populnea*, and *E. melanophloia*. The shrub layer was sparse and dominated by *Acacia decora* and *Ventilago viminalis*. The ground layer was dominated by *Megathyrsus maximus,* with occasional *Lomandra longifolia, Verbena tenuisecta, Themeda triandra* and *Heteropogon contortus*.
Lonesome Creek	Riparian community was dominated by *Eucalyptus camaldulensis*, *Casuarina cunninghamiana* and *Acacia salicina*. The sub-tree layer is dominated by *Lysiphyllum* spp, and *Ficus opposita*. There was no shrub layer and the ground layer was dominated by *Megathyrsus maximus*.
Castle Creek	Riparian community was dominated by *Corymbia tessellaris* and *Eucalyptus camaldulensis*. *Acacia salicina* and *Casurina cunninghamiana*. The sub-tree layer was dominated by *Brachychiton populnea*. The shrub layer was dominated by *Ficus opposita, Duboisia leichhardtii,* and *Callistemon viminalis*. The ground layer was dense and consisted of *Megathyrsus maximus* and *Cynodon dactylon*.

Aquatic Flora

Creeks contained few aquatic flora species due to the disturbance associated with grazing throughout the study area and the ephemeral nature of these streams. Small areas of naturally and artificially ponded water were found across the study area. The main flora species present in these areas included large single-species stands of *Typha orientalis* (cumbungi), *Phragmites australis* (common reed) and sedges.

Aquatic Fauna

Table 5-9 lists fauna species and communities that may occur within the general locality of the study area. This listing was extracted from searches of the DEWHA Protected Matters Search Tool and EPA's Wildlife Online (DEWHA, 2007; EPA, 2007).

Table 5-9: Aquatic Fauna from the Local Area

Family	Species	Common Name*	EPBC Act	NC Act
Ambassidae	*Ambassis agassizii*	Agassiz's glassfish	-	-
Anguillidae	*Anguilla reinhardtii*	longfin eel	-	-
Ariidae	*Arius graeffei*	blue catfish	-	-
Atherinidae	*Craterocephalus stercusmuscarum*	flyspecked hardyhead	-	-
Cheluidae	*rheodytes leukops*	Fitzroy river turtle	V	V
Clupeidae	*Nematalosa erebi*	bony bream	-	-
Cyprinidae	*Carassius auratus*	goldfish*	-	-
Eleotridae	*Hypseleotris galii*	firetail gudgeon	-	-

Family	Species	Common Name*	EPBC Act	NC Act
Eleotridae	*Mogurnda adspersa*	southern purple-spotted gudgeon	-	-
Eleotridae	*Philypnodon grandiceps*	flathead gudgeon	-	-
Eleotridae	*Hypseleotris klunzingeri*	western carp gudgeon	-	-
Eleotridae	*Hypseleotris species 1*	Midgley's carp gudgeon	-	-
Eleotridae	*Hypseleotris compressa*	empire gudgeon	-	-
Eleotridae	*Oxyeleotris lineolata*	sleepy cod	-	-
Melanotaeniidae	*Melanotaenia splendida splendida*	eastern rainbowfish	-	-
Osteoglossidae	*Scleropages leichardti*	southern saratoga	-	-
Percichthyidae	*Maccullochella peelii peelii*	Murray Cod	V	-
Percichthyidae	*Macquaria ambigua*	golden perch	-	-
Plotosidae	*Tandanus tandanus*	freshwater catfish	-	-
Plotosidae	*Neosilurus hyrtlii*	Hyrtl's catfish	-	-
Poeciliidae	*Gambusia holbrooki*	mosquito fish*	-	-
Pseudomugilidae	*Pseudomugil signifer*	Pacific Blue Eye	-	-
Terapontidae	*Bidyanus bidyanus*	silver perch	-	-
Terapontidae	*Hephaestus fuliginosus*	sooty grunter	-	-
Terapontidae	*Leiopotherapon unicolour*	spangled perch	-	-
Terapontidae	*Amniataba percoides*	barred grunter	-	-
Terapontidae	*Scortum hillii*	leathery grunter	-	-

* Denotes the species is introduced.

During the field study, *Gambusia affinis* (mosquito fish) were observed to be the dominant species. These are declared noxious in Queensland. A small number of native fish including *Hypseleotris compressa* (carp gudgeon), *Hypseleotris galii* (firetail gudgeon) and *Ambassis agassizi* (Chandra perch) also seemed to be abundant. These species are considered common for this region.

The presence of *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines (RE 11.3.25) within the study area suggests that the vulnerable Fitzroy river turtle may occur locally. This riparian vegetation community is known to be important habitat for riparian freshwater turtle species, including the Fitzroy river turtle. The common species, *Elseya latisternum* (saw-shelled turtle) was the only turtle species to be recorded during field investigations (Maunsell, 2005).

5.2.4 Sensitive Environmental Areas

World Heritage Areas

Sensitive environmental areas include areas classified as having National, State, regional or local biodiversity significance.

No World Heritage Areas are located within the study area, however the Dawson River, which the catchment area of the Project drains into, is located approximately 400 km upstream of waters of International, National and State significance (see Map 21 – Dawson River Catchments in the Map Folio). These are:

- Great Barrier Reef World Heritage Area which encompasses approximately 348,000 km^2, extending from the low water mark of the mainland and including all islands, internal Queensland waters and *Sea and Submerged Lands Act 1973* exclusions; and
- Great Barrier Reef Marine Park (Marine Park), which extends from the mean low water mark out toward the 200 nautical mile Economic Exclusion Zone, but excludes Queensland owned islands, internal waters of Queensland and exclusions under the *Seas and Submerged Lands Act 1973*. The Marine Park is legislated by the Queensland government under the *Marine Parks Act 2004*, *Marine Parks Regulation 2006* and Marine Parks (Great Barrier Reef Coast) Zoning Plan 2004.

Wetlands of International Significance

The nearest wetlands of international significance (Ramsar listed) are the Narran Lake Nature Reserve situated approximately 460 km southwest in the north west of New South Wales and the Shoalwater and Corio Bays Area, located in Livingstone Shire in Queensland approximately 220 km to the north. Catchments within the study area do not flow to these wetlands.

Protected Areas

Precipice National Park and Isla Gorge National Park form part of the Gilbert Range. These National Parks are surrounded by areas of State Forest and the Shankeen Nature Refuge. Previous alignment options contained critical sections that passed through these protected areas posing significant environmental constraints to the Project. In response, the preferred coal/freight alignment has specifically been refined to avoid these significant protected areas. A critical decision in favour of the preferred alignment is the fact that the route successfully avoids all National Parks and State Forests.

The importance of the Boggomosses Area Nos. 1 and 2, listed as 'Other Matters Protected' under the EPBC Act (DEWHA, 2007) has been discussed in Section 5.2.2 with reference to the Boggomoss snail. Consideration has also been given to the potential impact of sourcing groundwater for construction purposes on this protected community. As discussed with NRW and in Section 6.2.5, detailed groundwater impact assessments will be undertaken as part of the application process for water licenses and permits to utilise existing allocated or unallocated water resources in the study area. This assessment will consider the impact on nearby water users in the related aquifers, nearby springs (boggomoss communities) and baseflow streams.

Local to the study area is the Brigalow Invertebrate Site which is listed on the Register of the National Estate. The site is located in the road reserve along the Leichhardt Highway from approximately 6 to 13 km north of Taroom. This protected area will not be impacted by the Project.

Parts of Oxtrack Nature Refuge fall within the study area. The preferred alignment specifically avoids this protected area and passes approximately 1.5 km to the west of the Nature Refuge and will have no direct impact.

Sensitive Habitats

Essential Habitat is a Queensland classification of an area or location with essential resources for the maintenance of priority taxa populations. Priority taxa include flora and fauna taxa that are:

- Currently listed as endangered/vulnerable/rare/culturally significant under State or Commonwealth legislation;
- Identified in various Action Plans as being of concern (Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, Near Threatened and Conservation Dependent);

- Most transcontinental migrants listed under international agreements (e.g. CAMBA and JAMBA);
- At risk or of management concern within specific bioregions based on the written opinion of experts; or
- Of scientific interest as relictual, endemic or locally significant populations (e.g. flying fox camp) based on the written opinion of experts.

No areas of essential habitat will be directly or indirectly affected by the Project.

Queensland's declared Fish Habitat Area (FHA) network provides long-term protection for fish habitats by protecting selected inshore and estuarine fish habitats to sustain local and regional fisheries. Parts of the Fitzroy River estuary are declared FHA's. These lie at the mouth of the river which flows into Keppel Bay approximately 400 km downstream of the Project.

Wildlife Corridors and Refuges

As previously described, the wider environment of the study area is significantly fragmented through clearing, mainly from agriculture. While some patches of vegetation remain, these are seldom connected by corridors of sufficient width (>100 m). Consequently, any areas of retained riparian vegetation provide either regionally or locally significant fauna corridors. Watercourses also provide a source of water and are often the only source in dry season. This in turn provides a refuge for many fauna species.

Wetlands are also an important dry season refuge for many fauna, as well as feeding and breeding habitat for a range of frogs and waterbirds. The only sizeable wetland observed within the study area was just south of Castle Creek. This wetland provides the only significant area of preferred habitat within the study area for many of the listed waterbirds and waders in Table 5-6. A total of eleven native frog species were recorded at this wetland.

Areas of Biodiversity Significance

Biodiversity Planning Assessment (BPA) is a mapping and database information product maintained by the EPA. A BPA has been compiled for those bioregions in Queensland that are under the most pressure from development using the Biodiversity Assessment and Mapping Methodology (BAMM). BAMM provides a consistent approach for assessing biodiversity values at the landscape scale and to advise a range of planning or decision-making processes in Queensland.

BAMM assigns three levels of Biodiversity Significance to patches of remnant vegetation:

- *State Significance* – Areas assessed as being significant for biodiversity at the bioregional or state scales. They also include areas assessed by other studies/processes as being significant at national or international scales;
- *Regional Significance* – Areas assessed as being significant for biodiversity at the sub-bioregional scale. These areas have lower significance for biodiversity than areas assessed as being of State significance; and
- *Local Significance and or Other Values* – Areas assessed as not being significant for biodiversity at State or Regional scales. Local values are of significance at the local government scale.

The level of Biodiversity Significance is based on eleven diagnostic criteria including habitat for endangered/vulnerable/rare taxa, tract size, condition, ecosystem diversity and the presence/absence of threatening processes (EPA, 2002). As with RE's, patches assessed under the BPA are sourced from Queensland Herbarium vegetation mapping.

Map 22 – Biodiversity Planning Assessment in the Map Folio shows BPA data for the study area are generally consistent with the RE mapping which emphasises the conservation value of these area. The areas identified with the highest level of biodiversity significance within the study area (regional-level) are associated with the Auburn Range and along riparian corridors.

5.3 Potential Impacts

5.3.1 Methodology for Vegetation Clearance Calculations

The amount of vegetation to be cleared by the Project was calculated using aerial photography and spatial analysis functions in ArcGIS (ESRI, version 9.1). The assessment was based on the preferred coal/freight alignment (provided by the design team 22.06.2008) using the construction footprint of the rail formation plus a 15 m buffer. This buffer is to account for additional land disturbance associated with the access track in fill, drains required outside the earthworks area, turnarounds and detention basins, etc. A generic 30 m buffer was applied at all bridge crossings. The assessment also accounts for Nathan Gorge Road realignment where a 60 m construction corridor was applied. Digital layers of certified RE maps from the EPA was used to calculate the total area of vegetation that falls within this total construction footprint.

The exact footprint of the earthworks will not be accurately determined until detailed design, therefore the assumptions made in this EIS are conservative and equate to vegetation disturbance from direct or indirect construction activities within a corridor of approximately 60 m for the whole alignment. Ultimately, the area calculated for remnant vegetation disturbance is likely to be less that reported here as the approvals granted under the *Vegetation Management Act 1999* will control the clearing of RE vegetation to the minimum extent necessary for the project, and measures set out in the environmental management plan will ensure that alternatives to clearing for ancillary works and strict clearing boundaries are enforced, particularly within Endangered and Of Concern REs.

5.3.2 Vegetation Clearance

Table 5-10 summarises the amount of vegetation clearing required for the construction works of the Project.

Table 5-10: Vegetation Clearance Required for the Project

Conservation Status	Area to be cleared (Ha)
Endangered	10.4
Of Concern	14.4
Not of Concern	115.5
Regional Ecosystems (total)	140.3

As described in Section 5.2.1, endangered ecological communities are made up of regional ecosystem communities. Therefore, the clearing of RE's listed in Table 5-11 will equate to the loss of the following EPBC listed communities:

Table 5-11: Total Clearance of Endangered Ecological Communities

Endangered Ecological Community	Estimated area of impact EPBC Referral (January 2008) (ha) (Preliminary alignment)	Estimated area to be cleared EIS (November 2008) (ha) (Preferred alignment)
Brigalow (*Acacia harpophylla* dominant and co-dominant)	1.25	1.39
Bluegrass (*Dichanthium* spp.) dominant grasslands of the Brigalow Belt Regions (North and South)	2.65	0
SEVTs of the Brigalow Belt (North and South) and Nandewar Bioregions	7.84	4.76 (multi-user corridor) 2.41 (Nathan Gorge Road realignment)

The difference between estimates of vegetation clearance is as a result of the design development process and assessment of alternatives, as described in Section 1.6.2. During community engagement activities in January 2008, several constraints were identified surrounding the potential impact of the preliminary alignment on local properties. As a result of this feedback, the project team undertook a Multi-Criteria Analysis (MCA) of the area, taking into account a range of engineering, environmental and community factors in refining the preliminary alignment. Where possible, comments and concerns were incorporated in the design to achieve a more positive outcome both for the project and the landowner. The outcome is a preferred coal/freight alignment that has balanced some positive and negative environmental outcomes. It should be acknowledged that the preferred alignment has reduced the potential impact on SEVT by more than half a hectare and eliminates any impact on bluegrass dominant grasslands. Ongoing consultation with the Department of Environment, Heritage, Water and the Arts and Queensland EPA in relation to the increased impact on Brigalow will ensure transparency through the impact assessment process. Similarly, the mitigation measures taken by the Project to compensate for the necessary clearing of vegetation will be developed in partnership with the EPA and DNRW through an offset policy.

5.3.3 Vegetation Offsets

The objective of the *Vegetation Management Act 1999* (VM Act) is to regulate clearing of native vegetation in order to conserve remnant Endangered, Of Concern and Not of Concern Regional Ecosystems, in areas of high nature conservation value and areas vulnerable to degradation. The VM Act also strives to preserve the loss of biodiversity and maintain ecological processes through the management of environmental effects and reduction of greenhouse gas emissions.

The VM Act sets down the rules and regulations that guide what clearing can be undertaken, and how it must be done to meet the requirements of the law. It regulates clearing of remnant vegetation on freehold land, and of remnant and some non-remnant vegetation on state tenures.

The Department of Natural Resources and Water (DNRW) uses regional vegetation management codes to assess applications for clearing of native vegetation. The Chief Executive of DNRW may refuse any vegetation clearing application on State land where there is commercial timber within the application area.

The Project will require the clearing of native vegetation. RE along the preferred alignment include Endangered, of Concern and Not of Concern communities. Clearing of Endangered and Of Concern RE requires an 'approval for clearing for ongoing purposes' from the DNRW. This application must be prepared in accordance with the Regional Vegetation Management Code for Brigalow Belt and New England Tablelands Bioregions (DNRW, 2006) and includes a legally binding offset strategy. The Code sets out one mandatory requirement plus requirements for management activities under different parts of the Code. The part of the Code relevant to the Project is Part S: Requirements for clearing for significant projects and will be used by DNRW to assess the Project application for approval of vegetation clearing.

The Project meets the mandatory Performance Requirement (PR S1: Limits to Clearing) of the Code in so far as clearing is limited to the extent that is necessary for the project, any associated ancillary works, and the operation of works that comprise a project declared to be a significant project under the State Development and Public Works Organisation Act 1971, Section 26. Additionally, however, there are nine (9) Performance Requirements (PR S2 – PR S10) which the Project would be required to meet. In order to meet these criteria, vegetation offsets are likely to be required in order to "maintain the current extent" of certain vegetation or habitat. This would apply to PR S.3 Watercourses and PR S.7 Conserving remnant Endangered regional ecosystems and Of concern regional ecosystems. "Maintain the current extent" is defined in the Regional Vegetation Management Code: Brigalow Belt and New England Tableland Bioregions as:

- Not clearing;
- Ensuring the Regional Ecosystem structure and function are maintained; or
- Providing an offset in accordance with the current policy for vegetation management offsets administered by the DNRW.

A vegetation management offset (offset) is a legal arrangement or agreement that, over time, guarantees to maintain the extent, structure and function of:

- Regional Ecosystems;
- Essential habitat; and
- Vegetation associated with:
  - Watercourses;
  - Natural wetlands; and
  - Natural significant wetlands.

The policy for Vegetation Management Offsets (DNRW, 2007) sets criteria and provides guidance for what would constitute an acceptable offset under the VM Act applicable code. Financial contribution to fund one or more offsets is not stated as an option under the Vegetation Management Offset Policy, although the Queensland Governments Environmental Offset Policy (EPA, 2008) states that for any case-by-case use of offsets, the regulator retains discretion as to whether or not a contribution into an offsets fund is acceptable.

5.3.4 *Noise and Vibration Impacts*

Many animals detect and depend on sound to communicate, navigate, evade danger and find food, but human-made noise can alter the behaviour of animals or interfere with their normal functioning (Bowles 1997). In some cases it can harm their health, reproduction, survivorship, habitat use, distribution, abundance, or genetic composition (Forman *et al*. 2003).

However, variation in ambient noise, such as from wind or other animals, is part of the natural environment (Eve 1991) and many animals display behavioural adaptations to this variation. For example, certain species of frogs avoid vocalising during loud calling by cicadas (Páez, Bock & Rand 1993) or other frogs (Matsui, Wu & Yong 1993), and some species will time their calls during brief periods of silence (Schwartz & Henderson 1991).

Studies on the impacts of noise on animals relate primarily to domestic animals and have generally been completed outside of Australia. Studies relating to stress in livestock from noise pollution have indicated that increased noise levels can trigger behavioural changes and physiological responses such as:

- increased heart rate and altering of metabolism (eds. Busnel & Fletcher 1978);
- altering of hormone balance (eds. Busnel & Fletcher 1978);
- Head raising, body shifting, trotting short distances, panic and escape behaviour (eds. Busnel & Fletcher 1978);
- A decrease in food intake, habitat avoidance and abandonment, and reproductive losses (Larkin 1996);
- Retreating from favourable habitat near noise sources (Larkin 1996);
- A reduction in foraging efficiency (Berger, Bateman & Stockwell 1991);
- Inhibition of milk production by mother cows during calving season (Harrington & Veitch 1991);
- Cow and calf separation (Harrington & Veitch 1991); and
- Injuries to newborn calves (if the mother bolts) and stillbirths (Harrington & Veitch 1991).

Van der Toorn, Hendriks & van den Dool (1996) studied the effects of human-made noise levels on wildlife and domestic livestock in America and were able to establish minimum sound exposure levels that induced specific behavioural and physiological effects in different species. The study concluded that the minimum threshold of response for disturbance from noise levels was approximately 77 dB and this initiated behavioural or physiological responses from animals ranging from the 'startle effect', changes in hormones (93-120 dB in pigs), accelerated hatchling rates (80 dB) and even hearing loss in some birds (95-100 dB) (refer Table 5-12). Many studies report levels in the vicinity of 100 dB as associated with an observable effect.

Table 5-12: Summary of Noise Levels Associated with Effects on Animals (Adapted from Van der Toom, Hendriks & van den Dool (1996)

Animal Category	Species	Noise Level and Type (if known) Associated with Effect	Effect
Domestic mammals	Dairy cow	105 dB	Reduction in milk production
		97 dB	Changes in blood composition
		110 dB, 1 kHz	Changes in blood composition
	Sheep	108-120 dB	Increased heart rate, respiration
		90 bD "white noise"	Decreased thyroid activity
		100 dB	Increase in number of lambs per ewe
Wild birds	Quail	80 dB	Accelerated hatching rate
	Canary	95-100 dB	Hearing loss
	Tern	Sonic boom, frequent	Reduced reproduction
	Raptors	Sonic booms	Alarm

In the absence of specific trials from Australia with beef cattle and native fauna, these results can be used as a guide. The noise assessment and modelling results in Section 8 show that construction noise levels are likely to exceed 75 dB up to 70 m from the corridor (or 100 m from the centreline), but will decrease as the distance from the source increases. Whilst the construction phase may cause temporary disturbance to animals, the impacts from noise emissions are likely to be localised close to the rail line (up to 60 m) and are not likely to have a significant, long-term impact on either wildlife populations or domesticated animals.

During operation, the noise modelling contours in Figure 8-1 and Figure 8-2 show fauna (and other sensitive receivers) outside the corridor will be subject to noise levels no greater that 70 dB (L_{eq}). According to the American studies this is below the noise threshold level of 77 dB that is likely to causes a physiological or behavioural response. Furthermore, it is likely most animal species will habituate to the periodic noise disturbance (Larkin 1996; Forman *et al*. 2003).

Mitigation measures to control construction and operational noise for local residences as set out in Section 8 will also apply to the local wildlife and stock.

5.4 Mitigation Measures

The mitigation measures already taken and recommendations as to further management actions are summarised in Table 5-13 and Table 5-14.

5.4.1 Construction

Table 5-13: Construction Potential Impact and Mitigation Measures for Nature Conservation

Potential Impact	Mitigation Measure
Direct and permanent loss of 1.39 ha of Brigalow endangered ecological community	• A detailed options assessment phase (refer to Section 1.6) has balanced the environmental, social and economic needs in determining the preferred alignment. During this process, the preferred alignment has avoided this community, where possible, within the overall engineering constraints of the study area. Specifically, an interim alignment (June 2008) was refined in order to protect an additional 5 ha of Brigalow from clearing. Subsequent design phases will look to opportunities to avoid this vegetation unless there is no suitable alternative. Equally, the subsequent design phases will look to reduce the total clearing width of the preferred alignment where it intercepts with this community. Typically, a multi-user corridor will be cleared 30 m either side of the centre line (total clearing width of 60 m) on flat terrain. Opportunities will be investigated for reducing clearing to no more than 20 m either side of the centre line. Consideration will also be given to the co-location of services, drainage systems and service roads to reduce the area required to be cleared. • Construction sites, such as offices, soil stockpiles, machinery/equipment storage are to be located within existing cleared or disturbed areas. • Ultimately, it is unlikely that all Brigalow can be avoided by the Project. In this instance, the Project will be required to obtain approval under the VM Act (refer to Section 18) where by mandatory requirements and management activities is likely to include a legally binding offset strategy. Consultation with the relevant agencies and stakeholders will ensure the best possible outcome and that the loss of vegetation is compensated for appropriately.

Potential Impact	Mitigation Measure
Direct and permanent loss of 7.17 ha of SEVT endangered ecological community	• As with the measures above, the preferred alignment has avoided this community, where possible, within the overall engineering constraints of the study area. • Previous alignments investigated during Stage 2, on which the EPBC referral was based, indicated that up to 7.84 ha of SEVT was likely to be cleared for construction of the Project. • Subsequent refinement of the design has reduced the impact on this community (including the necessary clearing for Nathan Road realignment) to a maximum clearing of 7.17 ha. It is likely that clearing requirements are over-estimated for the Nathan Road realignment due to the existing condition of the road corridor. • As with the Brigalow, subsequent design phases will investigate the opportunities to reduce this clearing requirement even further by minimising the width of the multi-user corridor within safe operating standards. • The clearance of any SEVT will also require approval under the VM Act and legally binding offset strategy.
Direct and permanent loss of 14.4 ha of Of Concern RE's: 11.10.9/ 11.3.2/ 11.10.9; 11.3.2; 11.3.2/ 11.3.25; 11.3.2/ 11.3.4; 11.3.2/ 11.3.4/11.3.25; 11.3.25/ 11.3.2; 11.3.25/ 11.9.10/ 11.9.7; 11.3.4/ 11.3.2; 11.3.4/ 11.3.25; 11.9.10 and 11.9.7 for the purpose of the preferred alignment	• As with endangered RE's, the location of all Of Concern RE's was considered in the selection of a preferred alignment. Further consideration will be given during subsequent design phases to avoid where possible these communities. •
Loss of rare and threatened plants; *Acacia calantha, Cadellia pentastylis, Dichanthium queenslandicum, Homopholis belsonii* and *Livistona nitida*.	• A detailed threatened flora survey of the directly affected vegetation within the construction footprint will be conducted during detailed design to confirm the presence or absence of any threatened flora within the vegetation at risk from clearing. The findings of this survey will be used to develop appropriate management strategies for the protection of threatened plants and committed through the EMP. Management strategies for Homopholis belsonii will be consistent with the Approved Conservation advice (s266B of the EPBC Act) for this species.

Potential Impact	Mitigation Measure
Degradation of RE's through the introduction and spread of weeds as a result of earthworks and uncontrolled movement of soil and plant material onto and within the construction site	• The smaller fragments (< 5 ha) of habitat are at greatest risk of degradation and reduction to a size that they no longer remain viable habitat. Many of these patches already display evidence of edge effects (the exposure of vegetation perimeter to external influences/aggressors) and are at risk from construction activities. • Strict construction controls regarding the movement of plant material and landscape rehabilitation and maintenance works will ensure the introduction and spread of weeds are avoided. This will be managed through a Weed Management Plan as part of the EMP(C).
Loss of habitat, food resources, nesting and breeding habitat (particularly for rare and threatened species as listed in Table 5-5) through the removal of mature vegetation, loss of hollow-bearing trees, damage to riparian vegetation, ground disturbance and damage to rocky outcrops.	• The preferred alignment has avoided the ecologically diverse and complex habitats of Castle Creek/Defence Road wetlands (as described in Section 5.2.2). Appropriate construction controls close to this sensitive area will ensure that the water quality and habitat values are protected. These controls will be managed and monitored through the requirements set out in the EMP. • A detailed survey is to be conducted by a Fauna Manager during detailed design to identify opportunities to protect, relocate or replace critical habitat features for the threatened species including the Boggomoss Snail and those listed in Table 5-5. The findings of this survey will be used to inform species-specific fauna management plans to ensure the protection of threatened fauna committed through the EMP. Approved Conservation advice (as per s266B of the EPBC Act) for Paradelma orientalis, Rheodytes leukops and • Geophaps scripta scripta will be incorporated into the Fauna Management Plans. • Clearing of riparian vegetation will be kept to the minimum required to safely construct the Project. Consideration will be given in detailed design to the type of crossing structures, span widths, construction techniques and landscape rehabilitation. Specific opportunities to reduce the potential impact on Boggomoss snail habitat, and other threatened fauna species that may occur in riparian areas will be included within

Potential Impact	Mitigation Measure
	the Fauna Management Plan.
Inhibition of movement, disruption to wildlife corridors from the removal of vegetation and loss of its associated habitat value (shelter, forage resource, refuge)	• Inclusion of appropriate structures in elevated areas of the preferred alignment on the basis of fauna-sensitive design will limit the impact on the functionality of corridors. As described above, clearing of riparian vegetation, in particular, will be minimised as these provide the greatest connectivity function in the predominantly cleared landscape.
Injury and/or mortality of livestock and native fauna	• All potential habitat trees at the site boundary i.e. trees containing hollows shall be clearly marked and all staff made aware that these trees must not be cleared until hollows have been removed. Vegetation within the construction footprint including fallen timber, loose bark, leaf litter and other shelters for small reptile fauna will be inspected by a Fauna Manager prior to clearing. The movement of native fauna will be conducted in accordance with the NC Act (as described in Section 17). • Livestock will be excluded and securely fenced prior to any construction works commencing. Inspections and maintenance schedules will be established through the EMP's.
Creation of new mosquito and biting midge breeding sites during construction	• The detention of water will be avoided where possible, such as in borrow pits, plant equipment and materials, within and surrounding the construction sites. Detailed management measures are to be included in the EMP (C) to specifically address the potential risks associated with breeding sites of mosquitoes and midges. • If control of natural or unnatural breeding populations of mosquitoes is required, preferred management measure is the treatment of larval mosquito habitat with insecticide (Bacilus thuringiensis var. israelensis de Barjac and Bacillus sphaericus Neide.
Barriers to fish movement and impacts to the riparian environment due to the construction of creek crossings	• It is preferable to design in-stream structures that inherently provides for fish passage by constructing bridges, using 'nature like' or low profile structures for small weirs or by moving small storages such as farm dams off-stream.

Potential Impact	Mitigation Measure
Harm caused to the Boggomoss mound springs as a result of taking groundwater for construction activities	• Ongoing consultation with DNRW will ensure that any groundwater drawn to meet construction water demands for the Project (refer to Section 6.2) is consistent with the criteria for the protection of the flow of water to springs and baseflow to water courses that are provided in the GAB Draft Resource Operation Plan. Mitigation measures will be identified during the impact assessment studies to be undertaken as part of the application process for allocated and unallocated water resources in the study area.
Removal of non-remnant vegetation for the purpose of construction camps and site offices	• The siting of construction camps is limited to areas of non-remnant vegetation. Clearing will be limited to the minimum amount required for the immediate site and necessary access.
Localised and temporary light pollution as a result of new and introduced illumination associated with construction camps	• Consideration will be given during construction for the reduction in light pollution and opportunities in construction camp design for fauna-sensitive lighting.

5.4.2 Operation

Table 5-14: Operational Potential Impact and Mitigation Measures for Nature Conservation

Potential Impact	Mitigation Measure
Localised and temporary light pollution, including direct glare, chronic or periodic increased illumination and temporary unexpected fluctuations in lighting associated with passing trains	• The level of design undertaken to date does not allow for consideration of light intrusion impacts on fauna. Further investigation is required during detailed design and appropriate measures shall be incorporated into the EMP.
Degradation of vegetation communities and fauna habitats through the introduction of weeds from train operations, maintenance vehicles and personnel	• Weeds will be managed during operation of the Project through the maintenance contract. Regular weed management and monitoring will be incorporated into the EMP (Operations).
Injury to livestock and native fauna through rail strike	• Mitigation measures will vary depending on the fauna species. Opportunities to include structures to facilitate the safe passage of terrestrial fauna shall be investigated during detailed design phase. This investigation will include woodland, riparian, wetland and cleared areas. • Livestock fencing will be erected the length of the corridor.