4.5.2 Environmentally Sensitive Areas

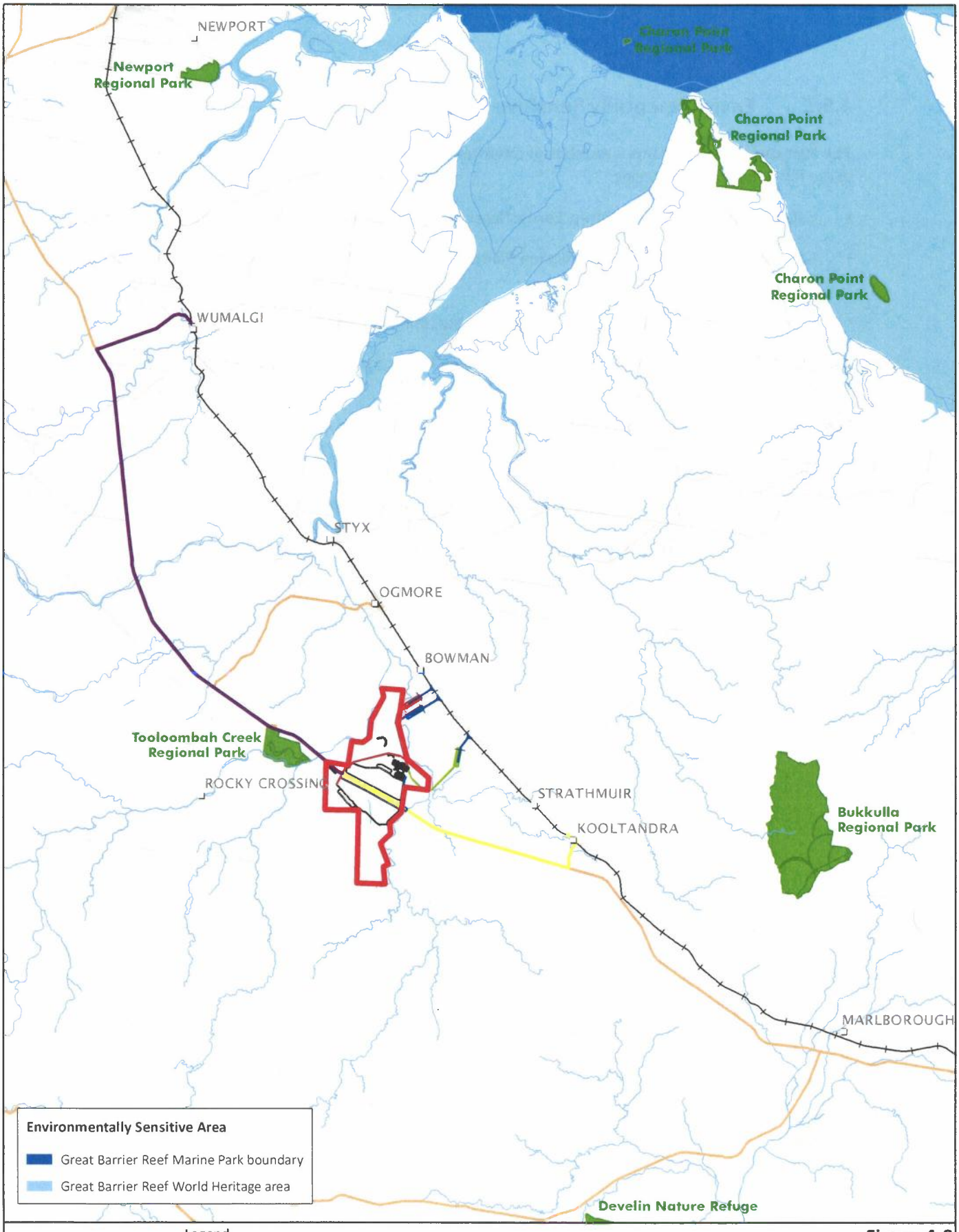
The Styx catchment contains a number of Environmentally Sensitive Areas (ESAs) including areas in the following ESA categories:

- Category A: Conservation Parks, Forest Reserves, Great Barrier Reef Marine Park Region;
- Category B: Fish Habitat Area, Marine Plants, Endangered Regional Ecosystems (Biodiversity Status); and
- Category C: Nature Refuges, State Forests, Coastal Management District.

Category A, B and C ESAs located within the broader Project area are shown at Figure 4-8, Figure 4-9 and Figure 4-10.

ESAs associated with the Project and adjacent areas include:

- Category A: Conservation Parks – Tooloombah Creek Regional Park;
- Category B –Endangered Regional Ecosystems (Biodiversity Status); and
- Category C – Coastal Management District.



Legend

- Styx Coal Project Mining Lease Application Area
- Proposed mine infrastructure
- Cadastral boundary
- North Coast Rail Line
- Main road
- Watercourse
- Proposed Rail Siding

TLF Rail Options

- TLF / Haul Road Option 1
- TLF / Haul Road Option 2
- TLF / Haul Road Option 3
- TLF / Haul Road Option 4
- TLF / Haul Road Option 5

N

0 2.5 5 km

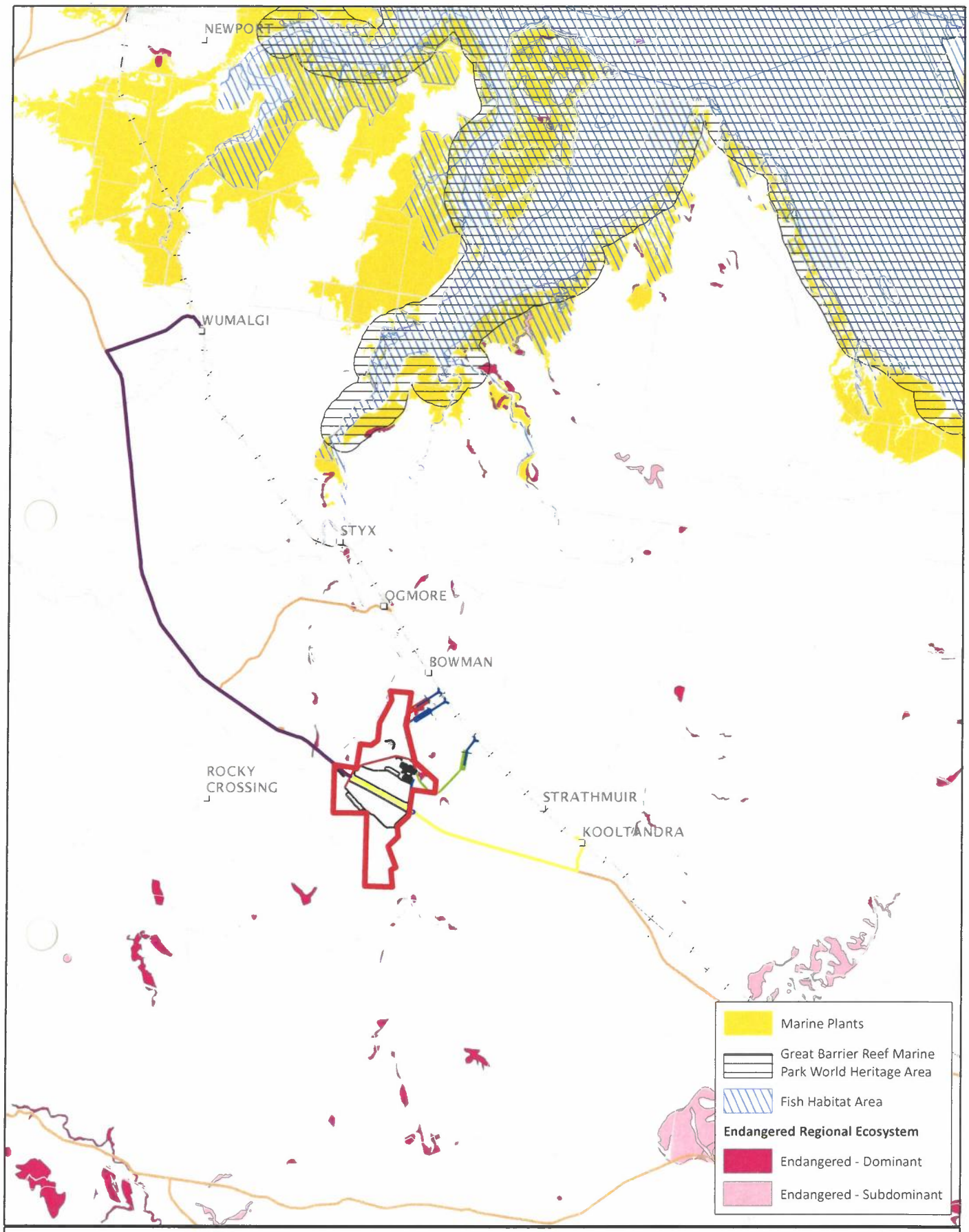
Scale @ A4 1:250,000
Date: 14/12/16
Drawn: Gayle B.

Figure 4-8
Environmental Sensitive Areas - Category A

DATA SOURCE
QLD Department of Environment and Heritage Protection, 2016;
QLD Spatial Catalogue (QSpatial), 2016

CDM Smith

BRUGGEMANNGD B:\BES150160 Styx Coal\GIS\DATA\MXD\FINAL\BES150160.01 R1 environmentally sensitive area-Cat A.mxd 12/14/2016



Legend

- Styx Coal Project Mining Lease Application Area
- Proposed mine infrastructure
- Cadastral boundary
- Main road
- North Coast Rail Line
- Watercourse
- Proposed Rail Siding

TLF Rail Options

- TLF / Haul Road Option 1
- TLF / Haul Road Option 2
- TLF / Haul Road Option 3
- TLF / Haul Road Option 4
- TLF / Haul Road Option 5

N

0 2.5 5 km

Scale @ A4 1:250,000
Date: 14/12/16
Drawn: Gayle B.

Figure 4-9
Environmentally Sensitive Areas - Category B

DATA SOURCE
QLD Department of Environment and Heritage Protection, 2016;
QLD Spatial Catalogue (QSpatial), 2016

CDM Smith

BRUGGEMANNGD B:\BES150160 Styx Coal\GIS\DATA\MXD\FINAL\BES150160 01 R1 environmentally sensitive area-Cat B.mxd 12/14/2016

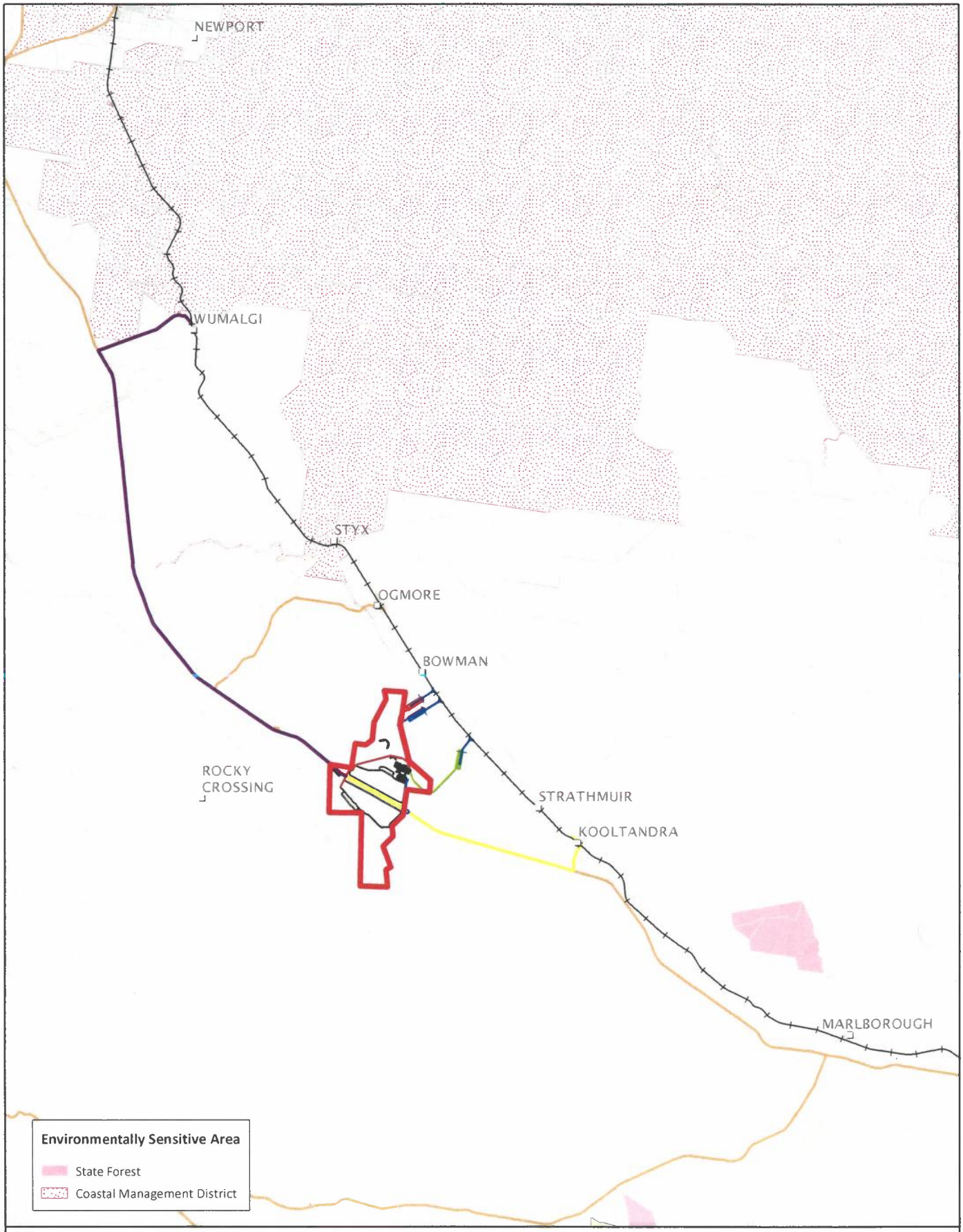


Figure 4-10
Environmentally Sensitive Areas - Category C

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4.5.3 Regional Ecosystems

Assessment of current DNRM RE mapping identified 12 REs occurring on six land zones within the Project area: alluvial river and creek flats (land zone 3); Cainozoic clay plains (land zone 4); Cainozoic sand plains (land zone 5); Cainozoic lateritic duricrust (land zone 7); coarse-grained sedimentary rocks (land zone 10) and (land zone 11) (Neldner et al. 2014). Of the mapped REs, one has been classed as Endangered, four have been classed as Of Concern and the remainder are classed as Least Concern under the provisions of the VM Act.

The Project area incorporates land holdings currently used for cattle grazing. Due to historical and current farming practice, native vegetation has been substantially cleared with approximately 1,812 ha of the 2,276 ha MLA area mapped as non-remnant. This equates to approximately 70% of the MLA area being mapped as non-remnant. All REs mapped as occurring within and adjacent to the MLA area and TLF options are listed at Table 4-4 and presented in Figure 4-11.

Table 4-4 Regional Ecosystem descriptions

RE	VM Act status	EP Act status	Description*
Within MLA area disturbance footprint			
11.3.25	Least Concern	Of Concern	*E. camaldulensis* or *E. tereticornis* open forest to woodland. Occurs on fringing levees and banks of major rivers and drainage lines of alluvial plains throughout the region. Soils are very deep, alluvial, grey and brown cracking clays.
11.4.2	Of Concern	Of Concern	*Eucalyptus* spp. and/or *Corymbia* spp. grassy or shrubby woodland on Cainozoic clay plains
11.4.9	Endangered	Endangered	*Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains
Within MLA area but outside of the disturbance footprint			
11.4.2	Of Concern	Of Concern	*Eucalyptus* spp. and/or *Corymbia* spp. grassy or shrubby woodland on Cainozoic clay plains
11.5.8a	Least Concern	No Concern	*Melaleuca* spp., *Eucalyptus crebra*, *Corymbia intermedia* woodland on Cainozoic sand plains/remnant surfaces
11.7.2	Least Concern	No Concern	*Acacia* species woodland on Cainozoic lateritic duricrust.
11.10.1	Least concern	No Concern	Corymbia citriodora woodland on coarse-grained sedimentary rocks
11.10.7	Least concern	No Concern	Eucalyptus crebra woodland on coarse-grained sedimentary rocks
11.11.15a	Least Concern	No Concern	*Eucalyptus crebra* woodland on deformed and metamorphosed sediments and interbedded volcanics
TLF Option 1			
11.3.4	Of Concern	Of Concern	*Eucalyptus tereticornis* and/or *Eucalyptus* spp. woodland on alluvial plains
11.4.9	Endangered	Endangered	*Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains
TLF Option 2			
11.3.4	Of Concern	Of Concern	*Eucalyptus tereticornis* and/or *Eucalyptus* spp. woodland on alluvial plains
11.4.9	Endangered	Endangered	*Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains
TLF Option 3			
11.3.25	Least Concern	Of Concern	*E. camaldulensis* or *E. tereticornis* open forest to woodland. Occurs on fringing levees and banks of major rivers and drainage lines of alluvial plains throughout the region. Soils are very deep, alluvial, grey and brown cracking clays.
TLF Option 4			
11.3.4	Of Concern	Of Concern	*Eucalyptus tereticornis* and/or *Eucalyptus* spp. woodland on alluvial plains
11.11.10a	Of Concern	Of Concern	*Eucalyptus moluccana* woodland. *Eucalyptus moluccana, E. tereticornis* may be prominent components of the tree layer, particularly on lower slopes.

RE	VM Act status	EP Act status	Description*
11.11.15a	Least Concern	No Concern	*Eucalyptus crebra* woodland on deformed and metamorphosed sediments and interbedded volcanics
11.3.36	Of Concern	Of Concern	*Eucalyptus crebra and/or E. populnea and/or E. melanophloia* on alluvial plains. Higher terraces
TLF Option 5			
11.3.25	Least Concern	Of Concern	*E. camaldulensis* or *E. tereticornis* open forest to woodland. Occurs on fringing levees and banks of major rivers and drainage lines of alluvial plains throughout the region. Soils are very deep, alluvial, grey and brown cracking clays.
Adjacent to MLA area boundary or TLF Options			
11.3.4	Of Concern	Of Concern	*Eucalyptus tereticornis* and/or *Eucalyptus* spp. woodland on alluvial plains
11.3.25	Least Concern	Of Concern	*E. camaldulensis* or *E. tereticornis* open forest to woodland. Occurs on fringing levees and banks of major rivers and drainage lines of alluvial plains throughout the region. Soils are very deep, alluvial, grey and brown cracking clays.
11.4.2	Of Concern	Of Concern	*Eucalyptus* spp. and/or *Corymbia* spp. grassy or shrubby woodland on Cainozoic clay plains
11.4.9	Endangered	Endangered	*Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains
11.10.1	Least concern	No Concern	Corymbia citriodora woodland on coarse-grained sedimentary rocks
11.10.7	Least concern	No Concern	Eucalyptus crebra woodland on coarse-grained sedimentary rocks
11.11.1	Least concern	No concern at present	Sporobolus virginicus grassland on marine clay plains
11.11.15a	Least Concern	No Concern	*Eucalyptus crebra* woodland on deformed and metamorphosed sediments and interbedded volcanics

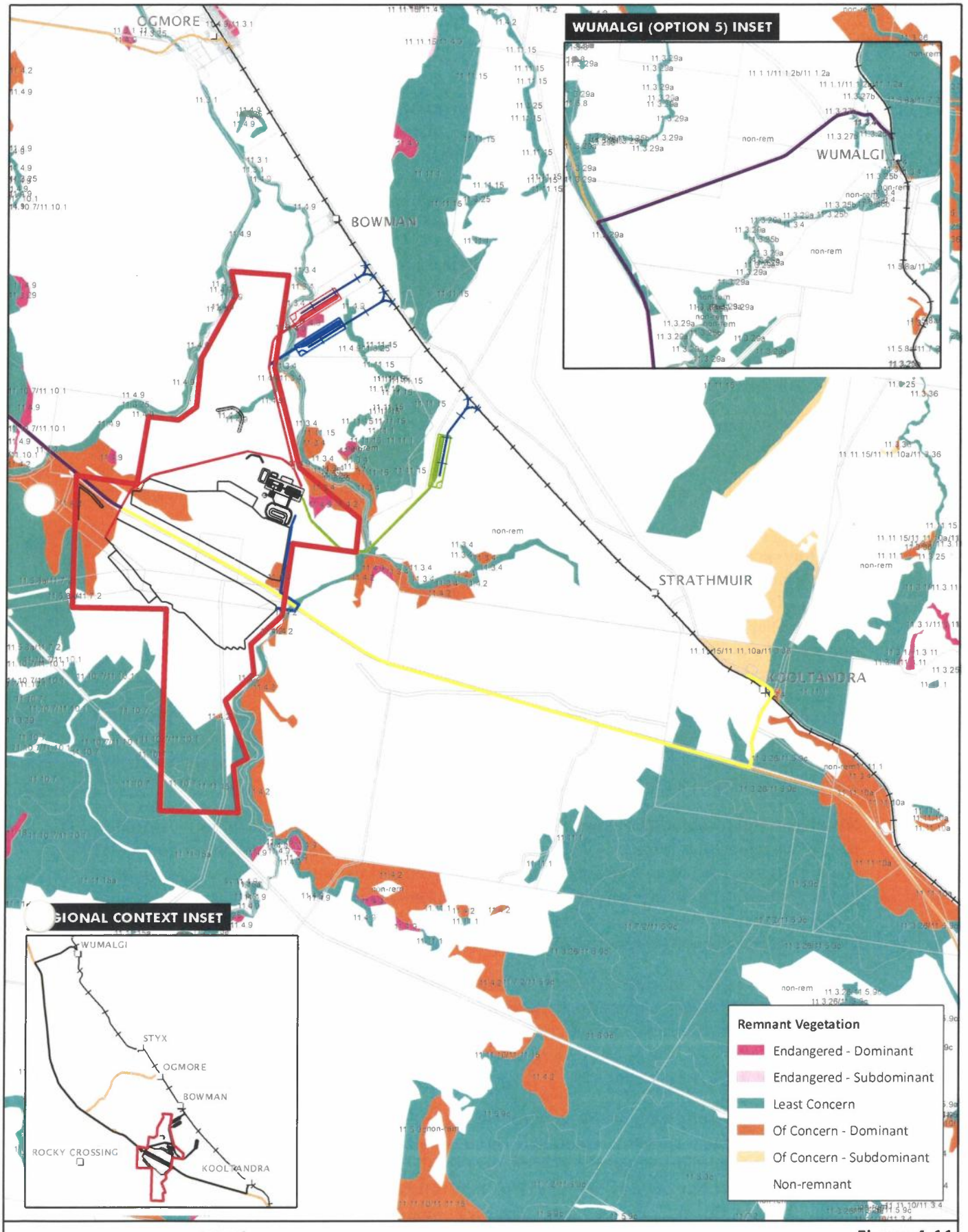
*(Source – Queensland Herbarium 2015)

Mining activities are exempt from requiring a permit to clear remnant vegetation under the VM Act. However, all REs occurring in the proposed mine disturbance area have a Biodiversity Status as Of Concern and may trigger requirements for vegetation offsets under the Queensland Environmental Offset Policy (Version 1.2) July 2016 and the EO Act.

An initial vegetation survey was carried out across a wide area surrounding the current Project site in March 2011 (YCE, 2011). Although the majority of survey sites were located outside of Project area, a number of sites lie within the current Project area.

Vegetation communities surveyed within the Project area included eucalypt woodlands, brigalow woodland, patches of regrowth and cleared sites associated with pastoral land use. Detailed description of the vegetation communities present within the MLA and adjacent areas are provided below. The vegetation communities delineated on site are broadly consistent with the mapped REs; however, these will be further verified through additional field assessment.

***Melaleuca leucadendra* and/or *Eucalyptus tereticornis* fringing open forest.** This vegetation community occurs along active riparian areas throughout the Project area. The canopy tended to be between 15 and 20 m and characterised by Melaleuca leucadendra and/or Forest Red Gum. Other taxa that may occur in the canopy include Carbeen (*Corymbia tessellaris*) and Northern Swamp Mahogany (*Lophostemon grandifloras*). An understorey is often present and may be characterised by Weeping Bottlebrush (*Melaleuca viminalis*), River Sheoak (*Casuarina cunninghamiana*), Red Ash (*Alphitonia excelsa*), Cocky Apple (*Planchonia careya*), White Cedar (*Melia azedarach*) or Sally Wattle (*Acacia salicina*). A variable shrub layer may be present at some sites and consist of Currant Bush (*Carissa ovata*), Coffee Bush (*Breynia oblongifolia*), Quinine Berry (*Petalostigma pubescens*) or *Indigofera* spp. The exotic species Lantana (*Lantana camara*) and Stylo (*Stylosanthes scabra*) may invade this community at some sites.



N

0 1 2 km

Scale @ A4 1:90,000
Date: 14/12/16
Drawn: Gayle B.

Legend

- Styx Coal Project Mining Lease Application Area
- Proposed mine infrastructure
- Proposed Rail Siding
- Cadastral boundary
- North Coast Rail Line
- Main road

TLF Rail Options

- TLF / Haul Road Option 1
- TLF / Haul Road Option 2
- TLF / Haul Road Option 3
- TLF / Haul Road Option 4
- TLF / Haul Road Option 5

Figure 4-11
Remnant vegetation

DATA SOURCE
QLD Department of Environment and Heritage Protection, 2016;
QLD Spatial Catalogue (QSpatial), 2016

CDM Smith

BRUGGEMANNGO B:\BES150160 Styx Coal\GIS\DATA\MXD\FINAL\BES150160 01 R1 remnant vegetation.mxd 12/14/2016

The ground layer tends to be open to sparse and consists of Spiny-head Matrush (*Lomandra longifolia*), Kangaroo Grass (*Themeda triandra*), Golden-Beard Grass (*Chrysopogon fallax*), Spreading Nutheads (*Epaltes australis*) or Queensland Bluegrass (*Dichanthium sericeum*). The ground layer is prone to invasion by exotic species such as Guinea Grass (*Megathyrsus maximus*), Snake Weed (*Stachytarpheta jamaicensis*), or Paspalum (*Paspalum dilatatum*). The species composition, land form and soil type correspond with the description of RE 11.3.25 (Least Concern).

Crebra woodland on alluvial plains. This vegetation community is associated with alluvial plains and is characterised by Forest Red Gum with Carbeen to 22 m. Narrow-leaved Ironbark can sometimes be present. An understorey is often present and comprised of Swamp Mahogany (*Lophostemon suaveolens*), Pegunny (*Lysiphyllum hookeri*) and Red Ash. Black Tea Tree (*Melaleuca bracteata*), Weeping Bottlebrush and/or *Melaleuca trichostachya* may be present in associated drainage lines or ponded areas.

A sparse shrub layer may be present with taxa such as Coffee Bush, Currant B or Booneree (*Alectryon diversifolius*). The ground layer tends to be dense and dominated by grasses such as *Bothriochloa* spp., Kangaroo Grass (*Themeda triandra*) and Black Spear Grass (*Heteropogon contortus*). The species composition, land form and soil type correspond with the description of RE 11.3.4 (Of Concern).

Brigalow shrubby woodland. This vegetation community is commonly associated with clay plains and areas of alluvium throughout the Project area. The ecologically dominant layer tends to be dominated by Brigalow with Belah at some sites. Emergent Gum-topped Box (*Eucalyptus moluccana*) or Forest Red Gum may occasionally be present. A low tree or tall shrub layer may be present and characterised by Red Ash, Yellow-wood (*Terminalia oblongata*), Yellow-berry Bush (*Maytenus cunninghamii*), Currant Bush, Boonaree and Wilga (*Geijera parviflora*).

The ground layer tends to be dominated by grasses with exotic grasses becoming more prevalent with increased grazing. Where this community occurs on alluvial soils, it corresponds with the description of RE 11.3.1 (Endangered). Where it occurs on clay plains it corresponds with the description of RE 11.4.9 (Endangered).

Mixed eucalypt woodland on clay plains. This dry sclerophyll vegetation community is associated with clay plains in the Project area. The canopy is characterised by co-dominance of a range of eucalypt species, including Narrow-leaved Ironbark, Poplar Box, Gum-topped Box, Queensland peppermint, Poplar Gum (*E. platyphylla*), Dawson Gum, Pink Bloodwood (*Corymbia intermedia*) and Carbeen. The understorey varies from open to sparse and is characterised by Belah, Red Ash, Quinine Bush, Beefwood (*Grevillea striata*), Sally wattle, and/or Corkwood Wattle (*A. bidwillii*).

Shrub layer is variable and may include False Sandalwood (*Eremophila mitchellii*), Broadleaved Tea-tree (*Melaleuca viridiflora*), Whitewood (*Atalaya hemiglauca*), and/or Wilga. Ground layer tends to be dense and characterised by grasses such as Kangaroo Grass, Black spear grass, *Eragrostis* spp., and *Bothriochloa* spp. The species composition, land form and soil type correspond with the description of RE 11.4.2 (Of Concern).

***Corymbia intermedia* and/or *Eucalyptus crebra*, +/- *E. platyphylla*, +/- *E. exserta*, +/- *Melaleuca viridiflora* shrubby woodland.** This vegetation community is associated with areas mapped as colluvial and residual deposits. The ecologically dominant layer is characterised by Pink Bloodwood and/or Narrow-leaved Ironbark to 18 m tall. Other taxa which may be present in the canopy include Carbeen, Poplar Gum, Dallachy's Gum (*Corymbia dallachyana*), Queensland Peppermint or Dawson Gum. Broad-leaved Tea Tree may form distinct patches in the understorey in some situations.

Other species which may occur in the understorey include Rosewood (*Acacia rhodoxylon*), Red Ash, Quinine Bush and *Acacia* spp. A low shrub layer is often present and includes species such as Small-fruited Mock Olive (*Notelaea macrocarpa*), Queensland Hemp (*Sida hackettiana*) or *S. cordifolia.*

A grassy ground layer is present and is variable in cover depending on the shrub density. Species common in the ground layer include Black Speargrass, *Aristida* spp., *Bothriochloa* spp. and Kangaroo Grass. The species composition, land form and soil type correspond with the description of RE 11.5.8 (Least Concern).

Eucalyptus crebra* and/or *Eucalyptus melanophloia* woodland with *Acacia rhodoxylon. This vegetation community is associated with areas of old sedimentary rock within the Project area. The ecologically dominant layer is characterised by Narrow-leaved Ironbark and/or Silver-leaved Ironbark (*E. melanophloia*) over a well-developed understorey of Rosewood. A shrub layer is often present and may include *Hibiscus divaricatus*, *Erythroxylon* sp., Yellow-berry Bush and Currant Bush. The ground layer is typically dense and characterised by various grass species. The species composition, land form and soil type correspond with the description of RE 11.11.1 (Least Concern).

***Eucalyptus crebra*, +/- *E. platyphylla*, +/- *E. populnea* grassy woodland.** The canopy of this vegetation community is characterised by Narrow-leaved Ironbark. Other species which also occur in the canopy include Poplar Box, Poplar Gum and Dallachy's gum. An open to spare understorey may be present and may include Red Ash and Beefwood among other species.

A shrub layer is often present and includes Yellow-berry Bush, Quinine Bush, Coffee Bush, Boonaree and *Hibiscus divaricatus*. Ground layer tends to be dense and characterised by various grass species including Black Speargrass, *Bothriochloa* spp., Kangaroo Grass and *Panicum* spp. The species composition, land form and soil type correspond with the description of RE 11.11.15 (Least Concern).

Wetland. A small wetland area occurs north of Mount Bison Road at the western extremity of the Project area. This wetland is a large closed depression approximately 200 m across. Margins of the wetland are broad and open with extensive area of shallow water (<30 cm deep) with deeper water (>30 cm deep) towards centre of the depression. Broadleaved Tea-tree, up to 8 m in height, occur in standing water with a variety of sedges at centre of the wetland. Sparse cover of hydrophytes (including *Ottelia ovalifolia*) present near centre of wetland as well. Dry margins of wetland with sparse to dense cover of low sedges and forbs (generally <20 cm in height). Surrounded by mixed eucalypt woodland with Poplar Gum, Carbeen and Variable-barked Bloodwood (*Corymbia erythrophloia*) co-dominant and a dense to mid-dense ground layer of grasses and forbs (mostly <50 cm).

Cleared areas. A large proportion (approximately 80%) of the MLA area has been heavily altered by grazing activities. Alteration has occurred through historical vegetation clearing associated with the pastoral industry. These areas typically support a mix of exotic and native perennial grass species and may have patches of regrowth.

4.5.4 Threatened Ecological Communities

The Protected Matters Search Tool identified five listed Threatened Ecological Communities (TECs) listed as Endangered (under the Commonwealth's EPBC act) as having potential to occur in the Project area:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) – Endangered;
- Broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland;
- Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions;
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin; and
- Semi-evergreen vine thickets (SEVT) of the Brigalow Belt (north and south) and Nandewar Bioregions – Endangered.

Current DNRM vegetation mapping indicates there is one RE present within the Project area (RE 11.4.9) that may be considered as a Brigalow TEC. This RE is mapped as occurring in two discrete patches in the northern portion of the MLA area. No other TECs are represented by REs indicated in DNRM mapping. The presence of TEC associated REs will be further verified through additional field assessment.

4.5.5 Essential Habitat

EHP has mapped areas designated as essential habitat for species listed as Endangered, Vulnerable, or Near Threatened (EVNT) under the NC Act. There is no essential habitat identified as occurring on the proposed mine disturbance area.

4.5.6 Threatened Flora

Database searches identified a total of 24 conservation significant flora species listed as Endangered, Vulnerable or Near Threatened (EVNT) under the NC Act as potentially occurring in the Project area. Three of these species are also listed as Vulnerable under the EPBC Act and one species is also listed as Endangered under the EPBC Act. The WildNet database search identified 21 EVNT flora species recorded previously within a 50 km radius of the centre of the Project area. The Protected Matters Online Search Tool predicted the occurrence in the wider area of a further three conservation significant flora species listed under the EPBC Act. These species and their potential to occur within the Project area are discussed in detail in Table 4-5.

Initial field surveys have been conducted across the broader Project area with one conservation significant species, *Eleocharis blakeana* confirmed. This species is listed as Near Threatened under the NC Act. No EPBC Act listed threatened species were recorded from any of the sites assessed during the initial field surveys. The black orchid (*Cymbidium canaliculatum*) was identified as an epiphyte on older trees within the study area. This species is offered protection under the NC Act due to its commercial value. Further field assessments focussing on the disturbance areas will be undertaken as part of the EIS.

Table 4-5 Conservation status listed species that are known or are highly likely to occur

Species	Status		Habitat characteristics	Likelihood of occurrence^
	CTH	QLD		
Bursaria reevesii		V	Grows along drainage lines and creek beds in silty loams derived from ultramafic (serpentine) rocks (Cayzer et al., 1999).	**Unlikely**. Serpentine derived soils not represented in Project area.
Capparis thozetiana	V	V	Confined to serpentinite hills and adjacent undulating colluvial aprons. The species grows on mostly shallow skeletal serpentinitic soils in woodland communities dominated by *Eucalyptus fibrosa* and *Corymbia xanthope*.	**Unlikely**. Serpentine derived soils not represented in Project area.
Corymbia xanthope Glen Geddes bloodwood	V	V	Occurs in woodlands with *Eucalyptus fibrosa* on ridges or hill slopes on serpentinite geology with sandy soils in the Rockhampton area. The total extent of the population occurring from an area of about 20 km^2 between Rockhampton and Yeppoon).	**Unlikely**. This community is recognised as a distinct regional ecosystem (RE 11.11.7 *E. fibrosa* subsp. (Glen Geddes), *C. xanthope* woodland on serpentinite) which has not been recorded within the Project area
Cycas ophiolitica Marlborough Blue	E	E	Occurs from Marlborough in the north, to the Fitzroy River near Rockhampton in the south, in woodland or open woodland dominated by eucalypts, often on serpentinite substrates. Plants occur along hilly outcrops and in lower regions near creek systems.	**Unlikely**. Habitat for this species not represented in Project area.
Hakea trineura Three-veined Hakea	V	V	Occurs on serpentinite-derived soil, often with Broad-leaved Ironbark and *Corymbia xanthope* woodland over hummock grassland on hills.	**Unlikely**. Serpentine derived soils not represented in Project area.
Macrozamia serpentina		E	Occurs from Marlborough in the north, to the Fitzroy River near Rockhampton in the south, in woodland or open woodland dominated by eucalypts, often on serpentinite substrates. Plants occur along hilly outcrops and in lower regions near creek systems.	**Unlikely**. Habitat for this species not represented in Project area.
Marsdenia brevifolia	V	V	Occurs on serpentine rock outcrops or crumbly black soils derived from serpentine in eucalypt woodland, often with Broad-leaved Ironbark (*Eucalyptus fibrosa*) and *Corymbia xanthope*	**Unlikely**. Serpentine derived soils not represented in Project area.
Myrsine serpenticola		E	Known from gallery rainforest on serpentinic soils.	**Unlikely**. Rainforest habitat for this species not represented in Project area.
Neoroepera buxifolia	V	V	Known from two small areas between Marlborough and Yaamba, and between Rockhampton and Yeppoon, in Queensland. This species occurs along creek banks or in creek beds on serpentitite soils (Henderson, 1992; Batianoff et al., 2000) in riparian vine thicket, vine forest, melaleuca or eucalypt woodland or open forest with rainforest species in the understorey.	**Unlikely**. Serpentine derived soils not represented in Project area.
Olearia macdonnellensis	V	E	Occurs in eucalypt open forest in the Marlborough region of central Queensland, all records are from rocky serpentinite hills and ridges.	**Unlikely**. Habitat for this species not represented in Project area.

Species	Status		Habitat characteristics	Likelihood of occurrence^
	CTH	QLD		
Omphalea celata	V	V	Known from three sites in central east Queensland occurring in SEVT. Locations are Hazlewood Gorge, near Eungella; Gloucester Island, near Bowen; and Cooper Creek in the Homevale Station area, north-west of Nebo (TSSC, 2008)	**Unlikely**. Habitat for this species not represented in Project area.
Phaius australis Lesser Swamp-orchid	E	E	Commonly associated with coastal wet heath/sedgeland wetlands swampy grassland or swampy forest and often where Broad-leaved Paperbark or Swamp Mahogany (*Eucalyptus robusta*) is found (Sparshott and Bostock, 1993). It is restricted to the swamp-forest margins, where it occurs in swamp sclerophyll forest, swampy rainforest, or fringing open forest. It is often associated with rainforest elements or Cabbage Tree Palm (*Livistona australis*) (Benwell, 1994).	**Unlikely**. Habitat for this species not represented in Project area.
Pimelea leptospermoides	V	NT	occurs from near Marlborough to Rockhampton in Queensland on stony hillsides and sandy clay in Eucalyptus fibrosa and Corymbia xanthope open woodland and is widespread on serpentine soils (Batianoff et al., 2000)	**Unlikely**. Serpentine derived soils not represented in Project area.
Pultenaea setulosa	V	V	Occurs on serpentinite substrates in *Eucalyptus fibrosa* and/or *Corymbia xanthope* woodlands or open forests	**Unlikely**. Serpentine derived soils not represented in Project area.
Samadera bidwillii Quassia	V	V	Occurs in lowland rainforests or rainforest margins and occasionally open forests, woodlands and mangroves in lithosols, skeletal soils, loamy sands, sands, silts and sands with clay subsoils at 1 to 617m altitude in coastal regions (DNR 2000).	**Possible**. Habitat for this species represented in Project area; however, no individuals were recorded during field surveys.
Sannantha brachypoda		V	There is little information available on this species; however, it has been recorded at Apis Creek west of Marlborough although the majority of the records are to the south of the Capricorn Highway (i.e. Precipice and Humboldt National Parks). Records suggest SEVT and riparian corridors within Eucapypt woodlands as the preferred habitat.	Limited information available on habitat type for this species, however no specimens were detected during site surveys.
Solanum elachophyllum		E	Known only from limited collections in the Leichhardt pastoral district, occurring on cracking clay soils associated with Brigalow, Belah (*Casuarina cristata*), Macropteranthes or Dawson River Blackbutt.	**Possible**. Habitat for this species represented in Project area. Closest known population is 65 km west of the Project area.
Stackhousia tryonii		NT	Occurs on serpentinite soils in the Port Curtis area of central Queensland.	**Unlikely**. Serpentine derived soils not represented in Project area.

Notes:
EPBC Act –*Environment Protection and Biodiversity Conservation Act 1999* (Cth); E –Endangered; V – Vulnerable
NC Act –*Nature Conservation Act 1992* (QLD), E – Endangered; V – Vulnerable; N – Near Threatened; LC –Least Concern.
^Likelihood of occurrence: **known** = species recorded within the project area; **likely** = species identified by database searches as having geographical range overlapping the wider study area and suitable habitat is mapped within the project area; **possible** = species identified by database searches as having geographical range overlapping the wider study area and sub-optimal habitat or preferred habitat features are mapped within the project area; **unlikely** = species identified by database searches as having geographical range overlapping the wider study area and suitable habitat is not mapped within the proposed project area.

4.5.6.1 Potential Impacts

Remnant vegetation present within the mine disturbance area is currently disturbed by agricultural activities. Connectivity between remnant patches is greatly reduced due to extensive clearing for agriculture. Remnant riparian vegetation along watercourses currently provides connectivity across the landscape. Vegetation clearing will result in loss of remnant and regrowth vegetation within the mine disturbance area.

This may include an ecological community that is listed as Endangered under both the EPBC Act and the VM Act. In addition, regional ecosystems listed as Of Concern and Least Concern under the VM Act will be impacted within the mine disturbance area.

Approximately 55 ha of remnant vegetation will be impacted from within the proposed mine disturbance area. Vegetation communities to be impacted by clearing within the mine disturbance area are listed in Table 4-6.

Table 4-6 Vegetation communities to be cleared

RE	VM Act status	EP Act status	Description*	Potential Disturbance Area
11.3.25	Least Concern	Of Concern	*E. camaldulensis* or *E. tereticornis* open forest to woodland. Occurs on fringing levees and banks of major rivers and drainage lines of alluvial plains throughout the region. Soils are very deep, alluvial, grey and brown cracking clays.	<1 ha
11.4.2	Of Concern	Of Concern	*Eucalyptus* spp. and/or *Corymbia* spp. grassy or shrubby woodland on Cainozoic clay plains	52 ha
11.4.9	Endangered	Endangered	*Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains	<1 ha

The extent of vegetation clearing associated with the haul road and TLF development will be dependent on the selected TLF option. Of the five TLF options under consideration, only Option 1 will result in clearing (~2 ha) of Endangered REs (11.4.9). Option 4 TLF will potentially result in the clearance (~2 ha) of Of Concern RE (11.3.4 and 11.11.10a/11.3.36). Options 2, 3 and 5 will potentially result in the clearance of small areas of Least Concern REs.

Other potential impacts on terrestrial flora within the Project area may include establishment and spread of weed species and soil erosion and sedimentation.

4.5.7 Fauna

A desktop review was carried out on the Project area and surrounds using information from the relevant Commonwealth and State wildlife databases:

- Commonwealth EPBC Act Protected Matters Search Tool (DotEE) (to confirm potential presence of listed species) (20 km radius surrounding Project area); and
- EHP's WildNet (Wildlife Online) database and Species Profile Search results (20 km radius surrounding Project area).

A total of 144 species of terrestrial vertebrate are known or predicted to occur within a 20 km radius of the Project area, comprising 2 frogs, 12 reptiles, 114 birds and 16 mammal species.

Amongst the fauna previously recorded within or near the Project on the WildNet database are eight species of conservation significance.

This includes five threatened (EVNT) fauna species:

- Red Goshawk (*Erythrotriorchis radiatus*) - Vulnerable under the NC Act and Endangered under the EPBC Act;
- Squatter Pigeon (southern race) (*Geophaps scripta*) - Vulnerable under the EPBC Act and NC Act;
- Black-breasted Button-Quail (*Turnix melanogaster*) - Vulnerable under the EPBC Act and NC Act;
- Koala (*Phascolarctos cinereus*) - Vulnerable under the EPBC Act and NC Act; and
- Pale Imperial Hairstreak (*Jalmenus eubulus*) - Vulnerable under the NC act.

An additional two bird species listed as Migratory under the EPBC Act have been recorded from the wider Project area previously: Rufous Fantail (*Rhipidura rufifrons*) and Spectacled Monarch (*Symposiarchus trivirgatus*).

A single species listed only as Special Least Concern has also been recorded: Short-beaked Echidna (*Tachyglossus aculeatus*).

No Essential Habitat has been mapped for any listed fauna species in the vicinity of the Project.

The Protected Matters Online Search Tool has predicted the potential occurrence within the Project area of an additional 13 bird species, six mammal species, three reptiles and one sawfish species listed as Critically Endangered, Endangered or Vulnerable under the EPBC Act. The majority of these species are also listed as EVNT under the NC Act (refer Table 4-7). A further 13 bird species and a single reptile are listed as Migratory under the EPBC Act are also predicted to occur in the Project area. This assessment does not consider a number of marine and oceanic species listed under the EPBC Act which have been predicted to occur in the Protected Matters Online Search Tool. The Project area does not encompass habitat for these species.

The Project does not occur within or adjacent to any Ramsar sites, but is approximately 8 km from where the Styx River becomes Broad Sound, an internationally important area for migratory shorebirds including Red-necked Stint (*Calidris ruficollis*), Sharp-tailed Sandpiper (*Calidris acuminate*) and Marsh Sandpiper (*Tringa stagnatilis*). Broad Sound is also of national significance for the Great Knot (*Calidris tenuirostris*), supporting one of the largest aggregations of this species on Australia's east coast.

4.5.7.1 Field Surveys

Initial field-based investigations were conducted at various locations within and adjacent to Project area during March 2011, September 2012 and February 2012. There were 236 fauna species recorded during these surveys (Meyer, 2012).

This includes four species that are listed as EVNT under the NC Act or the EPBC Act including:

- Squatter Pigeon (southern race);
- Eastern Curlew (*Numenius madagascariensis*) - listed as vulnerable under the NC Act and Critically Endangered and Migratory under the EPBC Act;
- Ornamental Snake (*Denisonia maculata*) - listed as vulnerable under both the NC Act and EPBC Act; and
- Koala.

Of the EVNT species recorded, Squatter Pigeon was recorded within the Project area. Ornamental Snake was recorded approximately 4 km north of the Project area.

Six bird species listed as Migratory under the EPBC Act (also Special Least Concern under the NC Act) were also recorded during the 2011 and 2012 surveys, including:

- Glossy Ibis (*Plegaidis falcinellus*);
- Rufous Fantail;
- Whimbrel (*Numenius phaeopus*);
- Fork-tailed Swift (*Apus pacificus*);
- Caspian Tern (*Sterna caspia*);
- Oriental Cuckoo (*Cuculus saturatus*); and
- Rainbow Bee-eater (*Merops ornatus*).

The surveys also recorded Short-beaked Echidna (*Tachyglossus aculeatus*) which is listed as Special Least Concern under the NC Act.

Habitat information provided by the 2011 and 2012 fauna assessments indicated the wider area surrounding the Project may provide suitable habitat for the following conservation significant species: Yellow Chat (*Epthianura crocea*), Australian Painted Snipe (*Rostratula australis*), Yakka Skink (*Egernia rugosa*), Black-breasted Button-quail, Northern Quoll (*Dasyurus hallucatus*), Red Goshawk (*Erythrotriorchis radiatus*), Collared Delma (*Delma torquata*) and the Pale Imperial Hairstreak Butterfly (*Jalmenus eubulus*).

Table 4-7 Likelihood of occurrence of conservation significant and terrestrial migratory fauna

Species	Status* NC Act	Status* EPBC Act	Habitat preference	Likelihood of occurrence
Known				
Ornamental Snake (*Denisonia maculata*)	V	V	Occurs in low-lying areas with deep-cracking clay soils that are subject to seasonal flooding, and adjacent areas of clay and sandy loams. The species is found in woodlands and shrublands, such as Brigalow, and in riverine habitats, and lives in soil cracks and under fallen timber (Ehmann 1992; and Wilson 2015). Potential habitat is associated with REs 11.3.3, 11.4.3, 11.4.6, 11.4.8, 11.4.9 and 11.5.16 or where they occurred before clearing. (DSEWPaC 2011).	**Known.** One individual was recorded during the 2011 survey within Brigalow woodland and adjacent to a cleared gilgai area. Potential habitat occurs within the Project area associated with Brigalow and Belah woodlands and gilgai areas.
Squatter Pigeon - southern subspecies (*Geophaps scripta scripta*)	V	V	Dry grassy eucalypt woodlands and open forests, also Callitris and Acacia woodlands. Most birds live in sandy sites near permanent water (Frith 1982; Blakers et al. 1984; and Crome and Shields 1992). Often around cattle yards and other disturbed areas.	**Known.** Several individuals were recorded within and adjacent to the Project area during the 2011 surveys and extensive habitat exists within the Project area associated with grassy woodlands.
Fork-tailed Swift (*Apus pacificus*)	S	M	An aerial non-breeding summer visitor, may occur over any habitat type, including cleared land and infrastructure.	**Known.** Wide ranging aerial species which migrates from the northern hemisphere to Australia. Less common than the previous species. May be aerial visitor to the Project area in the summer months as suitable foraging habitat occurs over much of the Project area. This species was recorded during the 2011 surveys.
Rufous Fantail (*Rhipidura rufifrons*)	S	M	Generally, occur in dense vegetation, mainly in rainforests, but also in wet sclerophyll forests and other dense vegetation such as mangroves, drier sclerophyll forests, woodlands, parks and gardens (Higgins et al. 2006).	**Known.** Recorded within during the 2011 surveys within the Brigalow woodland.
Short-beaked Echidna (*Tachyglossus aculeatus*)	S		Occurs throughout Australia in almost all terrestrial habitats except for intensively managed farms. It shelters in logs, crevices, burrows and leaf litter (Menkhorst and Knight 2004; Augee 2008).	**Known.** Observed from previous surveys and abundant suitable habitat occurs within the Project area.

Species	Status*		Habitat preference	Likelihood of occurrence
	NC Act	EPBC Act		
Glossy Ibis (*Plegadis falcinellus*)	S	M	Terrestrial wetlands, preferring inland freshwater wetlands with abundant aquatic flora (Pringle 1985; and Marchant and Higgins 1990).	**Known.** Dams in the Project area provide habitat for this species and species recorded during previous surveys.
Whimbrel (*Numenius phaeopus*)	S	M	Occurs on coastal mudflats, coral cays, estuaries, sewage ponds and sometimes flooded grasslands or paddocks (Pizzey and Knight 2007).	**Known.** Recorded from the wider Project area during previous fauna surveys.
Koala (*Phascolarctos cinereus*)	V	V	Feed almost entirely on eucalypts (Martin et al. 2008); most likely in riverine and riparian habitats.	**Known.** Recorded within the Project area during the 2011 and 2012 surveys. Suitable habitat exists within areas of remnant Eucalyptus woodlands within the Project area.
Likely				
Red Goshawk (*Erythrotriorchis radiatus*)	E	V	Endemic to northern and eastern Australia in coastal and subcoastal areas with large home ranges of up to 200 km^2. Occurs in woodlands and forests and prefers mosaic habitats that hold a large population of birds and permanent water. Riparian areas are heavily favoured (Marchant and Higgins 1993).	**Likely.** One Wildlife Online database record. The Project area and surrounds provides potential habitat and this species may utilise Project area for foraging and potentially nesting.
Grey-headed Flying-fox (*Petropus poliocephalus*)	C	V	Nomadic species that generally roosts at sites near water and within 50 km of the coast generally with rainforest, paperbark or casuarina species. Generally, occurs further south but regular roost site found near Finch Hatton (Eungella area) in recent years (Roberts et al. 2008).	**Likely.** No database records from the wider area. However, potential for the species to forage in the Project area during eucalypt flowering periods. Although there is no known roost habitat in or near the Project area, the site may provide some seasonal flowering resources for foraging.
Ghost Bat (*Macroderma gigas*)	V		One of the largest microbat species in the world. Roosts in shallow caves, abandoned mines and rock piles. Australia's only carnivorous bat (Churchill 2008).	**Likely.** No records from wider area but potential foraging habitat within the Project area.
Greater Glider (*PtauroidesvVolans*)	LC	V	May occur in a range of eucalypt dominated habitats from coastal areas to ranges. Needs large hollow-bearing trees for daytime roosting.	**Likely.** Habitat generally variable but some potential habitat available.

Species	Status*		Habitat preference	Likelihood of occurrence
	NC Act	EPBC Act		
Potential				
Yakka Skink (*Egernia rugosa*)	V	V	Occurs in dry forests, woodlands and rocky areas (Wilson 2015). Variety of drier forests and woodlands (usually on well drained, coarse gritty soils) including Poplar Box on alluvial soils, low ridges, Callitris on sands, Belah (Ehmann 1992; Cogger 2000; and Wilson 2015). Also occur in highly degraded sites and where there are log piles and rabbit warrens (EPA 2003).	**Potential.** Potentially suitable habitat in Project area associated with open forest and woodlands with suitable shelter and cover. No database records occur in the vicinity of the Project area.
Northern Quoll (*Dasyurus hallucatus*)	C	V	Formerly occurred in a variety of habitats across northern Australia and Queensland. Now most common in rocky eucalypt woodland and open forest within 200 km of the coast (Menkhorst and Knight 2004).	**Potential.** Potential denning, shelter and foraging habitat associated with woodland and open forest occurs in the wider Project area, particularly to the south and west. No database records from the wider area occur for this species.
Australian Painted Snipe (*Rostratula australis*)	V	E	Terrestrial shallow wetlands, ephemeral and permanent, usually freshwater but occasionally brackish. They also use inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains (Marchant and Higgins 1993). Most likely in alluvial areas but could also occur in gilgaied areas.	**Potential.** May be occasional visitor to dams in the Project area but in general the habitats available are unsuitable. Very uncommon species that occurs erratically over eastern and northern Australia. No database records.
Caspian Tern (*Hydroprogne caspia*)	S	M	Mostly coastal habitats but also inland terrestrial wetlands including lakes, reservoirs and large rivers (Higgins and Davies 1996).	**Potential.** Dams within the Project area are small but do provide potential habitat for this species.
Spectacled Monarch (*Symposiachrus trivirgatus*) Black-faced Monarch (*Monarcha melanopsis*)	S	M	Both species generally occur mostly in dense vegetation, mainly in rainforests, but also in wet sclerophyll forests and other dense vegetation such as mangroves, drier sclerophyll forests, woodlands, parks and gardens (Higgins et al. 2006).	**Potential.** There are several database records for these species from the wider Project area. In general, the there is potential for some suitable foraging and breeding habits within the wider Project area.

Eastern Osprey (*Pandion cristatus*)	S	M	Mainly coastal habitats but can occur on inland rivers and lakes (Debus 2012).	**Potential.** Some suitable within or surrounding the Project area.
Pale Imperial Hairstreak (*Jalmenus eubulus*)	V		Species is confined to vegetation communities containing mature Brigalow which the larvae feed on (Valentine and Johnson 2012).	**Potential.** Potential habitat for this species within the wider Project area and two database records from the wider area.
Oriental Cuckoo (*Cuculus optatus*)	S	M	Rainforest, vine thickets, wet sclerophyll forest and open forest and woodland (Higgins 1999).	**Potential**. Potential habitat occurs in the project area associated worth woodlands and open forests.
Satin Flycatcher (*Myiagra cyanoleuca*)	S	M	Satin Flycatchers are mostly found in eucalypt forest, favouring wet forests, moist gullies and watercourses (Higgins et al. 2006).	**Potential.** This species may utilise the Project area during autumn/spring migrations but generally migrates along coastal areas. There is some potentially suitable foraging habitat within the Project area associated with taller woodlands and open forests.
Collared Delma (*Delma torquata*)	V	V	Occurs in soil cracks on heavy stoney soils west of Brisbane. In region known from Poplar Box on alluvial soils. Known from REs on land zones 3, 9 and 10 including 11.3.2, 11.9.10, 11.10.1 and 11.10.4.	**Potential.** Limited potential suitable habitat occurs in the Project area. No database records.
Black-breasted Button Quail (*Turnix melanogaster*)	V	V	The Black-breasted Button-quail is restricted to rainforests and forests, mostly in areas with 770-1200 mm rainfall per annum (They prefer drier low closed forests, particularly semi-evergreen vine thicket, low microphyll vine forest, araucarian microphyll vine forest and araucarian notophyll vine forest They may also be found in low, dense acacia thickets and, in littoral area, in vegetation behind sand dunes (Smith & Mathieson 2004).	**Potential** Limited suitable habitat exists in the Project area. No database records.
Large-eared Pied Bat (*Chalinolobus dwyeri*)	V	V	Species is closely associated with the presence of sandstone escarpment country for roost sites.	**Potential.** Although no database record exist for the Project area, there is potential suitable foraging and roosting habitat within the wider Project area.

Species	Status*		Habitat preference	Likelihood of occurrence
	NC Act	EPBC Act		
Unlikely				
Curlew Sandpiper (*Calidris ferruginea*)	S	CE, M	Mainly occur on intertidal mudflats in sheltered coastal areas and also around non-tidal swamps, lakes and lagoons near the coast. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters (Higgins & Davies 1996).	**Unlikley.** Limited habitat available in the Project area.
Great Knot (*Calidris tenuirostris*)	S	CE, M	Typically prefers sheltered coastal habitats, with large intertidal mudflats or sandflats including inlets, bays, harbours, estuaries and lagoons. The Great Knot rarely occurs on inland lakes and swamps (Higgins & Davies 1996)	**Unlikley.** Limited habitat available in the Project area.
Bar-tailed Godwit (*Limosa lapponica*)		CE, M	Found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It has been sighted in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. It is rarely found on inland wetlands or in areas of short grass, such as farmland.	**Unlikley.** Limited habitat available in the Project area.
Black-throated Finch (southern) (*Poephila cincta cincta*)	E	E	Occurs in grassy open woodlands near water. Prefers areas of intact woodlands with a variety of native grasses for year round feeding. Nests in large trees, sometimes in tree hollows and arboreal termite nests.	**Unlikely.** No suitable habitat exists in the Project area. No database records. EPBC online search only.
Star Finch (*Neochmia ruficaunda ruficauda*)	E	E	Occurs mainly in dense, damp grasslands bordering wetlands and watercourses, as well as open grassy woodlands near permanent water. Forages for seeds in tall native grasses (Higgins et al. 2006).	**Unlikely.** Habitat in the project area is generally unsuitable. Although once widespread this species is now very rare. No database records.

Species	Status*		Habitat preference	Likelihood of occurrence
	NC Act	EPBC Act		
Water Mouse (*Xeromys myoides*)	V	V	The water mouse had been documented in three distinct locations (Northern Territory, central coastal Queensland, south-east Queensland). Within these areas, they require similar habitat including mangroves and the associated saltmarsh, sedgelands, clay pans, heathlands and freshwater wetlands.	**Unlikely.** No suitable habitat exists in the Project area. No database records. EPBC online search only.
Yellow Chat (*Epthianura crocea*)	E	CE	The Yellow Chat (Dawson) inhabits marine plain wetlands that are subject to extensive seasonal inundation and varying degrees of both fresh and saltwater (tidal) influence. They typically occuppy portions of the marine plain that have a network of shallow drainage channels and depressions supporting a mosaic of vegetation that consists of grassland dominated by *Sporobolus virginicus* and/or *Paspalum distichum*, dense beds of rush or sedge and areas of bare or sparsely-vegetated mud and/or shallow water.	**Unlikely.** No suitable habitat exists in the Project area. No database records. EPBC online search only.

4.5.7.2 State Significant Species

In addition to EPBC Act-listed taxa, land within and adjacent to the disturbance area is known or likely to provide habitat for a number of State-listed species, including Koala and Short-beaked Echidna.

The Short-beaked Echidna (listed as 'Special Least Concern' under the NC Act) appears to be widely distributed and common within well-vegetated parts of the broader Project area. This includes parts of the mine disturbance area, where riparian vegetation and non-riparian woodland provide foraging habitat for this species.

Koala has been recorded within the Project area and, given the presence of suitable habitat (particularly remnant riparian eucalypt woodland), are likely to occur within the disturbance area. Suitable habitat for koala includes areas of remnant Narrow-leaved Ironbark woodland and riparian vegetation (including Forest Red Gum) along Deep Creek, an un-named tributary of Deep Creek, and Tooloombah Creek.

Though not recorded during previous surveys, land within and adjacent to the proposed disturbance area may also provide habitat for other state-significant species including the vulnerable Powerful Owl (*Ninox strenua*). If occurring within the disturbance area, habitat for the vulnerable Powerful Owl could include riparian open forest and vine-thicket along Deep Creek and/or Tooloombah Creek.

4.5.7.3 Other Significant Faunal Values

With extensive clearing of native vegetation in the Styx Basin and elsewhere in the northern Brigalow Belt, remaining areas of woodland and forest habitat within Project area are of considerable importance to native fauna at the local and regional level (as indicated in the *Biodiversity Planning Assessment for the Brigalow Belt*, DERM, 2008). Of particular importance in this regard are areas of riparian woodland/ forest linking more extensive areas of remnant vegetation in the west and east of the Styx River catchment including riparian vegetation along Deep Creek and Tooloombah Creek which bisect the proposed disturbance area. Other areas of riparian vegetation within the proposed disturbance area may also be of some importance for local movement of fauna within the upper Styx River catchment.

4.5.7.4 Potential Impacts

Despite extensive clearing and disturbance of vegetation previously carried out for grazing land uses, land within the proposed mine disturbance area provides habitat for a wide range of threatened fauna species.

Potential impacts of the proposed mine on threatened fauna species are identified as:

- Loss and fragmentation of habitat due to clearing;
- Degradation of remaining vegetation habitat due to edge effects associated with clearing;
- Degradation of habitat downstream of the proposed mine due to contaminated runoff;
- Introduction and/or spread of invasive plant or animal species;
- Direct mortality of fauna during vegetation clearing;

- Disturbance of fauna due to increased light and noise pollution; and
- Increased accidental mortality of fauna due to increased vehicular traffic.

Of these impacts, habitat loss and fragmentation are likely to be the most significant impacts that may occur as a result of Project activities. Establishment of the proposed mine will result in the loss and fragmentation of habitat known or likely to be utilised by conservation significant fauna within the mine disturbance area.

Clearing of riparian vegetation within the proposed disturbance area may also further inhibit fauna movement between areas of remnant vegetation in the west and east of the Project area, although connectivity between these areas of remnant vegetation is currently very limited. It is proposed, that riparian vegetation will be avoided, where possible, to minimise impacts on fauna movement corridors.

The establishment and spread of pest plant and animal species may impact on native fauna species and their habitat. Clearing of vegetation may result in fauna mortality, particularly less mobile or slow-moving species. It is proposed that a spotter-catcher will be present during clearing activities to minimise fauna impacts.

Increased accidental mortality on roads and disturbances created by increased noise and light pollution may also occur; however, it is expected that these impacts will be minimal.

Contaminated runoff may result in the bioaccumulation of toxins which may affect the health of higher order predators feeding on fish and other aquatic fauna within Deep Creek and the Styx River. In addition, contamination of sediments could pose a threat to migratory shorebirds feeding on tidal flats near the mouth of the Styx River. Treatment of water discharged from the mine site will be undertaken to minimise water quality impacts.

It is expected that potential impacts on fauna species can be appropriately managed through implementation of fauna control strategies to avoid or minimise environmental harm.

4.6 Noise and Vibrations

The noise environment in the vicinity of the Project can be characterised as 'very rural', with only mild sources of activity noise, mostly local activity at dwellings and plant and machinery used for agriculture and livestock. The Bruce Highway cuts through the proposed MLA area and the North Coast Rail Line is located approximately 1.5 km from the northern boundary of the proposed MLA area. These are likely to have an influence on the acoustic environment; however, traffic is intermittent on both road and rail. Environmental noise (wildlife, flora, wind) is the predominant noise in the absence of human environment noise.

Vibration due to construction and blasting activities has the potential to effect services such as buried pipework, electrical and telecommunication cables.

4.6.1 Potential Impacts

Noise emissions have the potential to impact upon neighbouring properties, communities and local wildlife through disruption. At this stage, there is little existing noise emission data; however, noise levels will be monitored prior to commencement of the project to quantify typical noise levels. Noise monitoring will be established within the project area concentrating near noise sensitive receptors. The locations of noise sensitive receptors in the vicinity of the Project that may be impacted by noise emissions from Project activities are shown in Figure 4-12.

Potential noise and vibration impacts are expected to occur from use of mobile equipment including haul trucks, graders and front end loaders, activities including drilling and blasting and infrastructure such as coal processing plant, conveyors, transport corridor, rail loop, and the proposed TLF.

Noise emissions will be managed in accordance with the guidelines outlined by EHP in the *Application requirements for activities with noise impacts* guideline (EHP, 2016c). Emissions will be monitored during the construction process and during operation of the mine and TLF. Mitigation measures to reduce noise emissions will be identified during the EIS process. A complaint resolution process will also be implemented for all potential impacts from the proposed project.

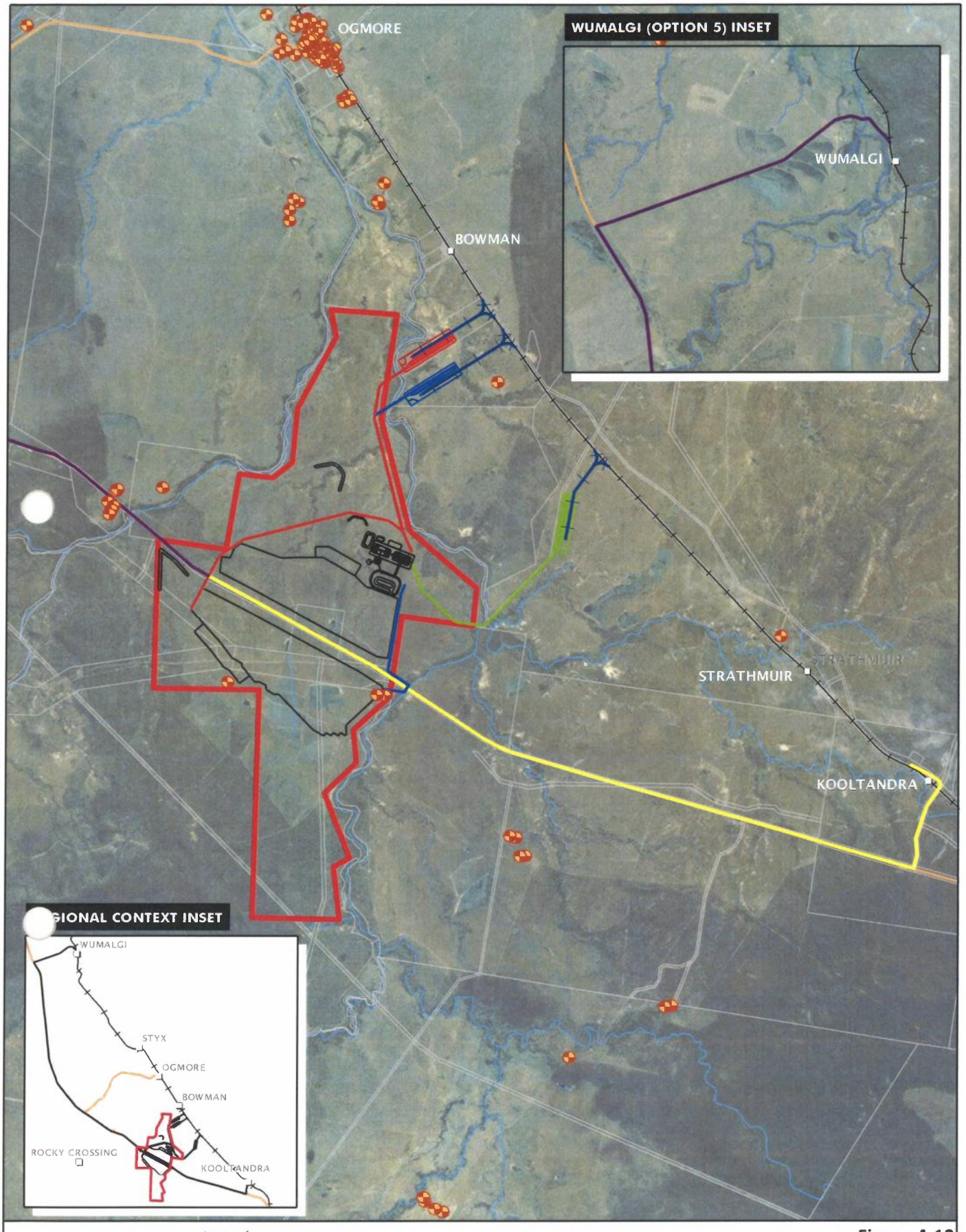


Figure 4-12
Sensitive receptors

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4.7 Air Quality

No quantitative air quality data is available for the Project area. However, air monitoring data is available for a similar rural site at Mount Larcom, located 30 km northwest of Gladstone. This site was investigated by DERM (2009a) from January 2009 through to May 2009 as part of the *Clean and Healthy Air for Gladstone* project. Low levels of industrial emissions were detected from Gladstone, and therefore the data is likely to represent an upper bound of typical pollutants that might be found in the Project area.

The main air emissions from mining operations are caused by wind borne dust, haul road generated dust, materials handling, stockpiles and transfers. As part of the EIS, a detailed air quality assessment will be conducted and the results of the assessment will be used to develop effective air quality mitigation measures.

4.7.1 Potential Impacts

Sensitive receptors in the vicinity of the Project are likely to include residences (houses and homesteads), farm sheds and working areas, and broader farmland areas. The locations of potential residential receptors identified during preliminary assessments are shown on Figure 4-12. Potential impacts to sensitive receptors will be determined during the development of the EIS

The majority of air pollutants from such sources will include particles less than 10 µm (PM_{10}) and 2.5 µm ($PM_{2.5}$), visibility reducing particles (generally range from 0.1 to 2.5 µm) and other pollutants such as carbon monoxide and sulphur oxides. Air pollutants as a result of industrial processes are expected to be negligible given the distance of the Project area from any large industrial sites.

Greenhouse gas emissions may be generated from equipment and vehicles during construction activities and from mine and stockyard operations. Management procedures for the use and maintenance of all equipment and vehicles used on construction sites will be developed and implemented to mitigate this impact. Regular monitoring and inspection of vehicles and equipment will be undertaken to ensure they are in sound working order.

Potential impacts of the Project on air quality and sensitive receptors will be fully evaluated during monitoring and dispersion modelling to be conducted as part of the EIS. The assessment will determine baseline dust conditions to provide additional information for the prediction of potential impacts. Mitigation measures that will be considered include the use of water trucks for dust suppression, progressive rehabilitation, water sprays on crushers and conveyor transfer points.

The EIS will consider direct greenhouse gas emissions associated with the construction and operation of the project infrastructure and will also consider indirect emissions associated with coal consumption. Measures to reduce greenhouse gas emissions will be identified and integrated into the operational procedures as part of the EIS process.

Given the size of the project and isolated nature of potential emission generation, the impacts on air quality associated with construction activities are expected to be low.

4.8 Waste Management

The Project will generate waste materials in a number of categories during construction and operation. These wastes will be managed to minimise adverse impacts on environmental values and environmental nuisance as a result of mining activities.

Commercial and industrial waste is generated from a range of activities including mining. Construction and demolition waste is generated from works such as building, alteration or demolition of structures including infrastructure such as roads, rail, sewage, water or electricity infrastructure. It is expected that the Project will generate waste materials in these categories during both construction and operational activities and disposal of these wastes will be subject to the provisions of Queensland waste legislation.

4.8.1 Potential Impacts

Waste material have the potential to impact the receiving environment through contaminating soil, habitat and water resources. In addition, the amenity of sensitive receptors may be impacted due to visibility of waste materials in the environment. While waste produced during the construction phase will be of a relatively short duration (when compared to the operational phase), waste will continue to be produced during the operation and decommissioning phases of the Project.

Potential impacts may include:

- Land contamination;
- Human and environmental health impacts;
- Degradation of vegetation communities and fauna habitat;
- Deterioration of surface water and groundwater quality;
- Airborne pollutants and odour;
- Impacts on existing and future land uses; and
- Reduction in visual amenity and residential amenity.

During the EIS process, potential waste facilities will be identified and an assessment will be undertaken to determine if the facility has the capacity to receive Project wastes. The EIS will also identify management measures, which target the reduction of generated wastes and ensure the onsite wastes do no enter the environment and minimise subsequent impacts.

4.9 Safety and Health

The Proponent will implement a rigorous SHMS which will set out a framework and detail safety procedures to manage the safety and health of its employees and contractors. The SHMS will comply with relevant legislation, standards and codes of practice.

A Project Risk Register and appropriate controls, including training, engineering, design, procedural and physical controls will be in place to manage any onsite hazards.

4.9.1 Potential Impacts

The Project safety and health related impacts are synonymous to open cut coal mining activities. The workers and sensitive receptors may potentially be impacted from exposure to particulates and gases/vapours, noise, mining accidents and vehicle collisions. Potential impacts include illness, injury and death.

4.10 Cultural Heritage

The Cultural Heritage bodies for the Project area are the Darumbal Enterprises Pty Ltd and Barada Kabalbara Yetimarala People. The Darumbal People have a current Native Title claim over the area where the TLF Options 1 – 4 are proposed and the Barada Kabalbara Yetimarala People have a current Native Title claim over the area where the mine pits and ancillary infrastructure are proposed. The area associated with TLF Option 5 has not had a Native Title claim determined as yet.

A search of the Australian Heritage Place Inventory and Aboriginal Cultural Heritage Database and Register did not identify any listed area within the immediate Project area.

The activities associated with exploration and mining within the Project site have been assessed as 'category 5', being activities causing additional ground surface disturbance. Category 5 activities generally carry a high risk of harm to cultural heritage values and should not proceed without cultural heritage assessment.

In accordance with the cultural heritage duty of care, an archaeological inspection was conducted within the MLA area during preliminary exploration drilling undertaken in June/July 2011. A single Indigenous cultural heritage site was identified within the MLA area. The site comprised an 'isolated find' of a single stone artefact generally considered to be of very low scientific value. No other archaeological sites were recorded during the inspection of drill pad sites.

The Project area can be described as largely flat, featureless and cleared of vegetation. There is minimal change in relief across the site. The only significant drainage features are networks of small ephemeral waterways that run in a southwest direction across the site.

Typically, such landscapes tend to be of low to very low archaeological sensitivity, reflecting very sparse past occupation. That is, it is unlikely that archaeological sites would be found in such terrain, because in the past they were rarely used as camping places and were generally only visited sporadically.

Natural vegetation for the study area has been cleared for farming and much of the area has been ripped.

4.10.1 Potential Impacts

Potential impacts on cultural heritage values within the MLA are expected to be low given the low archaeological sensitivity of the landscape and the very low scientific value of the artefact find. It is considered that further surveys are unlikely to reveal many more finds considering the low archaeological sensitivity of the general landscape.

The site of the artefact find will be avoided and left undisturbed where possible. Should further development be proposed at this site in future, the find will be salvaged by a qualified archaeologist and in consultation with the Aboriginal parties for the area.

4.11 Socio-Economics

The agriculture, forestry and fishing sector (which can be assumed to be predominately beef cattle) is the main employer in the local area of the Project. Although well known for its cattle production, the region has a more diverse and mature economy, with employment levels highest in retail trade, health care, manufacturing, construction, transportation and public administration.

The Project will positively contribute to the local (Ogmore, Marlborough and St Lawrence) and regional area with increased direct employment opportunities and indirect opportunities through the ongoing requirement for services and support.

During construction and operations, the Project will require the hiring of 200 and 250 full-time employees, respectively. Given the relatively small scale of the Project, and considering the majority of employees will be local it's not expected that adverse social impacts will arise as a result of the Project.

4.11.1 Potential Impacts

Local procurement will generate local business activity and generate indirect employment. A significant proportion of the goods and services are expected to be sourced from Mackay and Rockhampton, and will therefore benefit Central Queensland. Mackay in particular has a large pool of mine contractors and an established capacity to serve the coal mining industry.

The mine will have a relatively small but negative impact on cattle production. Five properties will potentially lose grazing land. These properties represent a relatively small proportion of grazing land in the Styx Basin and the local area.

Neighbouring cattle properties may be impacted by dust, which may reduce pasture production and its palatability, particularly during dry periods when the dust is not washed off on a regular basis. Given the extensive nature of cattle production systems in the area the actual impact on pasture production and cattle productivity is expected to be low. Furthermore, any decline in cattle production will be low relative to the economic benefits derived from the Project.

Most impacts are considered to be minimal primarily due to the relative isolation of the Project; the predominantly non-resident workforce; and the limited number of residents living in the vicinity of the Project.

The impacts on Indigenous people are regarded as low for the same reasons as above (isolated Project, size and predominantly non-resident workforce), and because few of the traditional owners are believed to reside in the local area.

4.12 Traffic and Transportation

The Project construction and operational activities will require the transport of plant and equipment, construction material, heavy vehicles and oversized loads and employees from various locations. The transport methods are being assessed and negotiations are underway with local landholders and Queensland Rail to access and to utilise the existing North Coast Rail Line that is located adjacent to the mine site to transport product coal to the port. The preferred option is to transfer coal internally to a rail loop and TLF, or by transporting coal via truck to nearby rail sidings which will be upgraded as required. Locating the TLF at an external rail siding will require truck haulage along the Bruce Highway to Wulmagi to the north of the MLA area or via the Bruce Highway to Kooltandra to the south of the MLA area.

Access to the south and north pits (i.e. either side of the Bruce Highway) is proposed via a level crossing. The location and design of the crossing is currently under investigation as part of the Project's feasibility assessment.

4.12.1 Potential Impacts

The increased traffic in the Project area and in the wider region has the potential to result in a number of potential impacts. The Bruce Highway will be the major road that will be utilised for the Project activities. Depending on which TLF option is selected one or more local roads may also be utilised by haul trucks. A traffic impact assessment will be conducted as part of the EIS process to identify and mitigate potential traffic impacts.

At this stage of the project design, no estimates are available for the likely number and type of transport trips required for the project. Procedures for the movement and transport of vehicles and personnel during the construction and operation of the mine will be prepared to ensure that these traffic movements do not cause unnecessary damage to local or regional roads. Traffic movement on local roads will be minimised where practicable and restricted in areas of high sensitivity.

A Road Use Management Plan (RMP) and Traffic Management Plan (TMP) will be developed in conjunction with relevant State and local road authorities. The RMP and TMP will be adopted by the Project's management team and will be implemented by the workforce and contractors delivering goods to or removing goods from the site to ensure that Project traffic movements do not cause unnecessary damage to local or regional roads.

5 Stakeholder Engagement

The Proponent will prepare a consultation program prior to the commencement of construction activities to ensure Project stakeholders have access to relevant information, are able to voice their concerns and suggestions in relation to the Project and its impacts, and participate as valued partners in the development and operation of the mine. Affected and interested stakeholders to be included in consultation include:

- Property owners within and immediately adjacent to the mine footprint;
- Mining and petroleum tenement holders within and immediately adjacent to the Project;
- Local and regional service providers;
- Livingstone Shire Council, Isaac Regional Council and Rockhampton Regional Council,
- State government agencies;
- Commonwealth government agencies;
- Community interest groups/non-government organisations;
- Emergency service groups; and
- Aboriginal parties (Darumbal Enterprises Pty Ltd and Barada Kabalbara Yetimarala People – Area A).

The consultation program will include:

- Establishing mechanisms for providing access to Project information and communicating key information to stakeholders;
- Establishing a grievance and dispute resolution mechanism for employees, contractors and other stakeholders; and
- Involving stakeholders in the identification of social impacts, the preparation of social mitigation strategies, the monitoring of mitigation strategies and an annual process of review (to be described in detail in the draft Social Impact Management Plan).

The above control strategies will be described in detail in the EIS and appropriate management strategies outlined in the EIS commitments chapter. The management measures, will be consistent with the Queensland Government Coordinator-General Social Impact Assessment Guideline 2013 and the tools provided by the International Council on Mining and Metals (ICMM).

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