11. Matters of National Environmental Significance

This section provides a summary of the assessment of matters of national environmental significance, in regards to the Project (Mine) and (Rail) during construction and operation. The assessment was undertaken in accordance with the requirements of the Terms of Reference (ToR) and a table cross-referencing these requirements is provided in Volume 4 Appendix C ToR Cross Reference Table. Volume 4 Appendix J Matters of National Environmental Significance Report informs this section.

11.1 Introduction

11.1.1 Overview

Assessment of the Project's potential to affect matters of NES has been achieved by integrating knowledge from desktop and field surveys. The technical report covering this assessment is provided as Volume 4 Appendix J Matters of National Environmental Significance (matters of NES). The assessment has enabled a description of the existing environment of the project Study Site to be developed and confirm the presence and prevalence of any matters of NES within the Project Study Area. Potential habitat mapping has informed likelihood of species occurrence within the mine and rail Study Areas.

In consideration of construction and operational activities of the mine and rail components of the Project, potential impacts have been identified and described with respect to flora and fauna species, their confirmed and potential habitat and vegetation communities that occur within (confirmed) or are considered likely to occur within, the Study Area (as per the criteria nominated under Section 11.1.3.3).

11.1.2 Framework for the Assessment

The controlling provisions for the Project under the EPBC Act were determined to be:

- Sections 12 and 15A (World Heritage properties)
- Sections 15B and 15C (National Heritage places)
- Sections 16 and 17B (Wetlands - Ramsar)
- Sections 18 and 18A (Listed threatened species and communities)
- Sections 20 and 20A (Listed migratory species) and
- Sections 24B and 24C (Great Barrier Reef Marine Park)

Assessment of potential to significantly impact these controlling provisions has been undertaken with regard for the DSEWPaC significance criteria, which are provided in *Matters of National Environmental Significance Significant impact guidelines 1.1* (hereafter, the 'Significant Impact Guidelines') (DEWHA 2009b).

The information provided herein is structured against these controlling provisions.

11.1.3 Methodology

Predictions of the extent of threat (risk), impact to protected matters and the benefits of any mitigation measures proposed should be based on sound science and quantified where possible. To this end a description of the existing environmental values of the Study Area was achieved using a combination of desktop assessments and field studies. The desktop assessment comprised a review of relevant literature, database searches and existing technical reports. Field studies were conducted to obtain ecological information relevant to the Project and to ground truth results from desktop assessments. Scientific and common names for flora and fauna described are consistent with those used in published sources described under Volume 2, Section 5 Mine Nature Conservation and Volume 3 Section 5 Rail Nature Conservation of this EIS. The areas of investigation referred to and defined in the aforementioned sections include:

- Project (Mine) Study Area: EPC 1690, EPC 1080 and proposed mine village, air strip and offsite infrastructure
- Project (Rail) Study Area: a 2 km wide investigation area that encapsulates the Project (Rail) infrastructure corridor (95 m) over the length of approximately 189 km between the Carmichael Mine and Moranbah Area

11.1.3.1 Desktop Assessment

Information relating to the terrestrial and aquatic ecological values of the Study Area was obtained from a variety of literature and database sources, including numerous state databases. The latter have been used to understand values of relevance to matters protected under state legislation. Details of the sources of relevance to matters protected under the EPBC Act are provided in Table 11-1.

Table 11-1 Summary of Desktop Sources

Source and name	Description of information source	Desktop Search extent	Limitations of use
DSEWPaC Protected Matters Search Tool and Environmental Reporting Tool (DSEWPaC 2010)	The Protected Matters Search identifies matters of NES and other matters protected by the EPBC Act that may occur within or relate to the Study Area. The tool predicts the potential presence of a species/ecological community in an area based on bioclimatic modelling, known distribution and habitat preferences. The DSEWPaC Environmental Reporting tool was also queried to provide information on invasive species that have the potential to occur, and nationally important wetlands within or near the Study Area.	For Rail Alignment a line search (approximating with the centreline of the Rail Study Area: -22.01, 146.37 - western extent; -22.10, 147.96 - eastern extent) with a 10 km buffer was searched. For Mine a point search (approximating with the centre of the Mine Study Area: -22.041, 146.364) with a 50 km buffer was searched.	This is a predictive tool only – it does not necessarily indicate that a species/ecological community occurs in a defined area. Presence of a species/ecological community is predicted based on a combination of bioclimatic modelling, known distribution and habitat preferences. In predicting species/community presence, it allows for field survey efforts to be targeted.
DSEWPaC Directory of Important Wetlands	The Directory identifies nationally important wetlands. The DSEWPaC Protected Matters Search Tool (see above) lists nationally important wetlands occurring within or related to prescribed search extents.	For Rail Alignment a line search (approximating with the centreline of the Rail Study Area: -22.01, 146.37 - western extent; -22.10, 147.96 - eastern extent) with a 10 km buffer was searched via the DSEWPaC Environmental Reporting Tool (see above). For mine a point search (approximating with the centre of the Mine Study Area: -22.041, 146.364) with a 50 km buffer was searched via the DSEWPaC Environmental Reporting Tool (see above)	NA - this mapping identifies the location of wetlands that satisfy at least one criterion agreed upon by the Australian and New Zealand Environment and Conservation Council (ANZECC) Wetlands Network in 1994.

Source and name	Description of information source	Desktop Search extent	Limitations of use
Birds Australia (http://www.birdsaustralia.com.au/our-projects/atlas-birdata.html accessed 16.03.2012)	Birds Australia maintains a database of bird records from across Australia.	For Rail Alignment a rectangular area was searched, approximating with the centreline of the Rail Study Area: -22.01, 146.37 - western extent; -22.10, 147.96 - eastern extent) with a 10 km buffer. For Mine a rectangular area was searched, such that the diagonal extending from the approximate centre of the Mine Study Area (22.041, 146.364) to each corner was 50 kms. The co-ordinates of the search were between latitudes -21.598 and -22.512, and longitudes 145.865 and 146.837.	This database catalogues known records of species in a defined area. The age and lack of spatial precision of species records may limit their value for inclusion in current studies in some instances.
DERM RE mapping (Version 6.0b) (DERM 2010a)	The Queensland DERM maps remnant vegetation using the RE classification system. REs are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil (Sattler and Williams, 1999). REs are classified under the Queensland VM Act as being endangered, of concern or least concern.	Mapping was obtained for the Study Area and the adjacent landscape in an electronic data layer for analysis in a Geographic Information System (GIS) environment.	RE mapping is informed by interpretation of landform, substrate, photo/satellite imagery and where available, field data. The mapping has undergone little or no ground-truthing in many parts of Queensland. Because of this, and the scale at which the mapping is created, RE mapping does not always accurately depict vegetation assemblages on the ground. As such, ground-truthing of REs is a fundamental aspect of field studies for ecological survey.
DERM Regrowth vegetation mapping (Version 2) (DERM 2010b)	Mapped ‘high value regrowth vegetation’ produced by DERM. Regrowth vegetation comprises non-remnant vegetation that has reached an advanced stage of growth and not been cleared since 31 December 1989.	Mapping obtained for the Study Area and adjacent landscape in an electronic data layer for GIS analysis.	Regrowth mapping is informed by statewide landcover and tree study (SLATS) foliage protective cover (FPC) and pre-clearing RE mapping. The mapping has undergone little or no ground-truthing in many parts of Queensland and like the RE mapping does not always accurately depict on the ground characteristics As such, ground-truthing is required.

Source and name	Description of information source	Desktop Search extent	Limitations of use
DERM Essential habitat mapping (Version 3) (DERM 2010a, 2011a)	Essential habitat is defined as 'vegetation in which a species that is endangered, vulnerable or near threatened under the NC Act has been known to occur' (DERM, 2011a). DERM maps Essential Habitat (and Essential Regrowth Habitat) in conjunction with remnant and regrowth vegetation mapping.	Mapping obtained for the Study Area and adjacent landscape in an electronic data layer for GIS analysis.	As Essential Habitat and Essential Regrowth Habitat mapping is underpinned by RE/regrowth mapping, the constraints associated with mapping scale and lack of ground-truthing are applicable to this information source.
DERM Wetland mapping (DERM 2011b)	Various mapping layers produced by DERM (including Wetland Protection Areas).	Mapping obtained for the Study Area and adjacent landscape in an electronic data layer for GIS analysis.	Wetlands are identified using the DERM AquaBAMM Methodology – the on-ground values of individual wetlands identified through this methodology have not necessarily been assessed, as designation is primarily based on existing literature and expert opinion. As such, designation does not reveal the value of these systems for local flora and fauna.
DERM Biodiversity Planning Assessment (BPA) mapping – Brigalow Belt bioregion and Desert Uplands bioregion (DERM 2009a DSEWPaC 2009a) and Biodiversity Planning Assessment expert panel reports	Identifies landscape scale biodiversity features at varying levels of significance (local, regional, state). The mapping methodology is underpinned by DERM's remnant vegetation (i.e. RE) mapping. Expert panel reports provide information on the landscape-scale values of bioregions, and in some instances identify bioregional priority taxa.	Mapping obtained for the Study Area and adjacent landscape in an electronic data layer for GIS analysis.	As BPA mapping is underpinned by RE mapping, the constraints associated with mapping scale and lack of ground-truthing is applicable to this information source.

Source and name	Description of information source	Desktop Search extent	Limitations of use
DERM *Burdekin Natural Resource Management Region Back on Track Actions for Biodiversity* report (DERM 2010c)	This document identifies priority species in the Burdekin Natural Resource Management (NRM) region, details the regional threatening processes impacting upon these species, and proposes a range of actions to address regional threats. Priority taxa are identified through the DERM Back on Track species prioritisation framework, in consultation with a range of stakeholders from the region. The document seeks to guide priority species conservation in the region over the next five years.	The document covers the entire Burdekin NRM region (in which a large portion of the Study Area occurs).	Some species/impacts listed in this document are not relevant to the Study Area, as the Burdekin NRM region encompasses a large area of central Queensland.
DERM Wildlife Online database (DERM 2011c)	The DERM Wildlife Online database maintains a catalogue of animal and plant species records from specific localities across Queensland. As well as common species, records of animals and plants listed as threatened under the NC Act are contained within the database.	A line search (approximating with the centreline of the Study Area: -22.01, 146.37 - western extent; -22.10, 147.96 - eastern extent) with a 10 km buffer was undertaken.	This database catalogues known records of species in a defined area. DERM recommend that independent verification of records should be undertaken to inform the accuracy and completeness of information catalogued within this database (i.e. field surveys).
DERM (Queensland Herbarium) HERBRECS specimen database (Queensland Herbarium 2011)	The HERBRECS database catalogues flora specimen records obtained throughout Queensland.	A rectangular area was searched, approximating with the centreline of the Study Area: -22.01, 146.37 - western extent; -22.10, 147.96 - eastern extent) with a 20 km buffer.	This database catalogues known records of species in a defined area. The age and lack of spatial precision of species records may limit their value for inclusion in current studies in some instances.
Queensland Museum Queensland Museum Data Search (Queensland Museum 2011)	The Queensland Museum catalogues vertebrate fauna specimen records obtained throughout Queensland.	A rectangular area was searched, approximating with the centreline of the Study Area: -22.01, 146.37 - western extent; -22.10, 147.96 - eastern extent) with a 10 km buffer.	This database catalogues known records of species in a defined area. The age and lack of spatial precision of species records may limit their value for inclusion in current studies in some instances.

Source and name	Description of information source	Desktop Search extent	Limitations of use
Burdekin Dry Tropics & Australian Government (Carter *et al.* 2008)	The report documents the diversity and distribution of freshwater fish species within the Burdekin Dry Tropics NRM Region.	The document covers the entire Burdekin Dry Tropics NRM region (in which the Study Area occurs).	Some species listed in this document are not relevant to the Study Area, as the Burdekin Dry Tropics NRM region encompasses a large area of central Queensland. Species distributions are described in terms of sub-catchments and distribution maps are useful to identify species with potential to occur.
DERM (Natural Resources and Environment Division) Expert Panel Reports: Burdekin Region (DERM 2009b, c, 2011d)	These three reports; aquatic fauna, aquatic flora and aquatic ecosystems, are part of the Aquatic Conservation Assessment for riverine and non-riverine wetlands in the Great Barrier Reef (GBR) catchment. The reports identify rare and threatened, priority and exotic species, species richness, and priority ecosystems and special features of the Burdekin region.	These documents assess the riverine and non-riverine wetlands of the Burdekin region	Some species listed in this document are not relevant to the Study Area, as the Burdekin catchment encompasses a large area of central Queensland.
Publically available Environmental Impact Statement (EIS) documents for projects in the wider region surrounding the Study Area.	EIS documents for projects in the region were sourced from the internet – namely the Alpha Rail EIS (Hancock Prospecting Pty Ltd, 2010) and the Galilee Coal EIS (Waratah Coal Pty Ltd, 2011).	The description of the existing environmental values of landscapes in which other major development projects are proposed to occur were assessed – namely with respect to results of surveys and detection of threatened species.	The project Study Areas of each of the EIS projects (listed at left) do not always correlate with the Study Area of this project. Consequently, this may limit the applicability of the information presented in these EIS documents to the current Study Area.

11.1.3.2 Field Surveys

Field surveys were conducted to identify the existing terrestrial and aquatic ecological values of the Study Area and to supplement and ground truth the information acquired from the desktop assessment, including verification of the likelihood of occurrence of EPBC Act listed flora and fauna species. Verification was based on direct observations of flora, fauna, fauna traces or suitable habitat for flora and fauna species. Desktop information was reviewed to identify areas to be targeted for field studies. Environmental conditions, habitats and biodiversity were assessed. Access and conditions (wet/dry) influenced location of field surveys.

Volume 2, Section 5 Mine Nature Conservation and Volume 3, Section 5 Rail Nature Conservation of this EIS describe in detail the approaches completed for all field surveys. How these surveys related to matters of NES is described in detail in Volume 4 Appendix J. Survey methods employed standardised approaches recognised by regulatory agencies for describing the existing environment and to inform the presence of any protected species.

Threatened Species Surveys

Surveys for threatened species were typically incorporated into the sampling methodologies applied for describing the Projects existing environment. Additional targeted assessments for known threatened species were completed as follows.

Peophila cincta cincta (black-throated finch (southern))

Targeted surveys in key habitats were undertaken for the black-throated finch (southern) (*Poephila cincta cincta*). These comprised the use of remote fauna cameras deployed at potential drinking sites and waterbody watches to identify any individuals drinking at the water source.

Waterbody watches were undertaken within the Study Area following the recommended methods outlined in the 'Background Paper' to the *Significant Impact Guidelines for the Endangered Black-throated Finch (southern) (Poephila cincta cincta)* (hereafter, the 'Black-throated Finch (southern) Significant Impact Guidelines') (DEWHA, 2009)[1]. Sites targeted included farm dams, natural water ways and stock troughs. Information recorded included the location (i.e. a waypoint and a description of the habitat), number of birds seen, time of day, weather conditions and other bird species present. In addition to the targeted waterbody watch surveys, slow traverses of tracks (by vehicle) were undertaken, with details of any black-throated finches (southern) observed during these traverses recorded. Full details of targeted black-throated finch (southern) survey effort are presented in Volume 2, Section 5 Mine Nature Conservation and Volume 3, Section 5 Rail Nature Conservation of this EIS.

In some areas of the Study Area no high quality suitable habitat for black-throated finch was identified. This coupled with limited access to much of the Study Area further limited the ability to be able to clarify the potential presence of this taxa across the entire Study Area. Accordingly, adopting a conservative approach field survey data has been used in conjunction with desktop research to assess impacts to this species.

[1] Note: SEWPAC indicated on 4 July 2011 that black-throated finch (southern) surveys conducted as part of EIS studies satisfied its requirements for presence/absence surveys for the subspecies(meeting between SEWPAC and GHD).

Paradelma orientalis (brigalow scaly-foot), Denisonia maculata (ornamental snake), Furina dunmalli (Dunmall's snake), and Egernia rugosa (yakka skink)

A number of listed reptile species were considered to potentially occur within the Study Area. The brigalow scaly-foot, ornamental snake, Dunmall's snake and yakka skink occur in vegetation communities that have been heavily impacted by historical land clearing (e.g. brigalow, *Acacia harpophylla*) and are listed for this reason. Specific microhabitats were targeted to search for these species (i.e. brigalow-gilgai formations, grass tussocks, sandstone slabs and cracking black clays). Targeted searches were also undertaken for the distinctive communal scat piles of the yakka skink.

Full details of targeted threatened reptile survey efforts are presented in Volume 2, Section 5 Mine Nature Conservation and Volume 3, Section 5 Rail Nature Conservation of this EIS.

Pristis microdon (freshwater sawfish)

Desktop searches indicate one threatened aquatic species, the freshwater sawfish (*Pristis microdon*) has been historically recorded in the Burdekin Catchment adjacent to the Study Area. However, the species highly unlikely to occur within the Study Area as there is no suitable habitat and there are significant barriers to connectivity (e.g. falls, dam) between the Burdekin Catchment and the Study and accordingly dedicated searches for this taxa were not required.

11.1.3.3 Likelihood of Occurrence Assessment

The information acquired through the desktop and field assessments was used to characterise the existing terrestrial and aquatic ecological values of the Study Area. For conservation significant flora and fauna species, a likelihood of occurrence assessment was undertaken to filter listed threatened or migratory species that could potentially occur at the site to focus assessment on those taxa that are known, likely or may occur at the site, which was used to inform the impact identification process. Determination of likelihood of occurrence considered information relating to:

- Habitat preferences
- Distribution
- Relative abundance
- Previous records from the region
- Database records, including those as registered by the DSEWPaC Species Profile and Threats (SPRAT) Database (DSEWPaC 2011b)
- The occurrence of suitable habitat at the Study Area based on field observations
- The confirmed presence of conservation significant species at the Study Area

A likelihood of occurrence ranking was attributed to each conservation significant species, based on the following framework:

- **Unlikely to occur**: species has not been recorded in the region (no records from desktop searches) **AND/OR** current known distribution does not encompass Study Area **AND/OR** suitable habitat is generally lacking from the Study Area.
- **May occur**: species has not been recorded in the region (desktop searches) although species' distribution incorporates Study Area **AND** potentially suitable habitat occurs at the Study Area.
- **Likely to occur**: species has been recorded in the region (desktop searches) **AND** suitable habitat is present at the Study Area.

- **Confirmed present**: species recorded during field surveys at the Study Area.

A precautionary approach was applied to attribute likelihood of occurrence. Information from field observations, desktop research and database searches informed the outcomes.

11.1.3.4 Potential Habitat Mapping for Threatened Species and Communities

In consideration of the extensive size of the Study Area and the inability to access many parts during the field surveys, a mapping methodology has been adopted whereby potential habitat for threatened species and communities is mapped within the Study Area and in the adjacent wider landscape. Threatened species and communities that are mapped through this process are those considered as likely to occur or are confirmed as present within the Study Area based on the likelihood of occurrence assessment outlined above. Mapping has taken into consideration the known distribution, ecology and preferred habitat characteristics of each species and TEC to which it has been applied.

11.1.3.5 Impact Assessment and Mitigation

In consideration of construction and operational activities of the mine and rail components of the Project, potential impacts have been identified and described with respect to flora and fauna species, their confirmed and potential habitat and vegetation communities that occur within (confirmed) or are considered likely to occur within, the Study Area (as per the criteria nominated under Section 11.1.3.3). Mitigation measures to avoid/minimise/offset impacts to identified matters of NES resulting from the construction and operational activities associated with the Project have been proposed.

The significance of residual impacts, post-mitigation, was evaluated with consideration to the DSEWPaC significance criteria, which are provided in *Matters of National Environmental Significance Significant impact guidelines 1.1* (hereafter, the 'Significant Impact Guidelines') (DEWHA 2009b).

In considering impact to listed taxa and communities, assessment was also made to identify relevant matters for impact assessment in relation to the following:

- An important population – for listed vulnerable threatened species
- Habitat critical to survival – for listed threatened species
- Important habitat – for migratory species

Full definition of these categories as they have been applied to this assessment is provided in Volume 4 Appendix J (matters of NES).

11.1.4 Offsets as they Relate to Matters of National Environmental Significance

Habitats and species that are likely to be permanently affected as a result of habitat losses or groundwater influences will require offsetting. Volume 1, Section 10 Offsets Strategy provides a considered offset strategy for the Project and offsets are not described in detail within this section. They are summarised as they relate to matters of NES.

In addressing offsets for the Project consideration has been given to relevant offset policy requirements. The offset requirements specific to the Commonwealth and State offset polices are detailed in Volume 1, Section 10 Offsets Strategy. As they relate to matters of NES is considered herein.

11.1.5 Project Activities Relevant to this Assessment

The Project will require the development of both permanent and temporary infrastructure. To achieve a conservative assessment of impacts temporary impacts are expected to be realised at the site for 10 years and operational impacts are considered to be permanent unless otherwise defined.

The construction phase of the Project (Mine and Rail) will involve the following activities:

- Development of the Mine Infrastructure Area (MIA) – predominantly occurs within non-remnant vegetation (based on field-verified RE mapping)
- Development of an airport – wholly occurs within non-remnant vegetation
- Development of a workforce accommodation village – wholly occurs within non-remnant vegetation
- Development of offsite infrastructure – including an industrial area and water supply infrastructure
- Construction of a rail corridor with a width of 95 m – footprint includes clearing of remnant vegetation
- Construction of a rollingstock maintenance yard, maintenance roads, and infrastructure at passing loops for operational requirements (including sub-stations for electrification and signalling and power supply rooms) – footprint includes clearing of remnant vegetation
- Construction of temporary construction camps – footprint includes some remnant vegetation
- Construction of construction plant (comprising flashbutt welding plant, concrete batch plants, ballast stacking and casting yard for bridge structures) – footprint includes some remnant vegetation

Collectively, the temporary and permanent infrastructure comprises the Project footprint for the construction phase of the Project. The operation phase of the Project (Mine and Rail) will involve the following activities:

- Underground mining staged through development with subsidence of mined areas expected to occur
- Open cut mining staged through development and rehabilitation of pits over the duration of the mine life
- Management of overburden through development and rehabilitation of waste areas over the duration of the mine life
- Development and maintenance of clean water diversion drains to be established along the boundary of the Study Area, and separating clean inflows from dirty water areas
- Spanning of the Carmichael River at one site to achieve access to the southern part of the Study Area
- Diversion of Eight Mile Creek
- Use of a rail corridor (95 m wide) (fenced and inclusive of maintenance/service road, passing loops and bad order sidings)
- Use and maintenance of rollingstock maintenance yard, maintenance roads, and infrastructure at a passing loop for operational requirements

The mine will be operational for approximately 90 years with staged development of the open cut and underground pits. Site rehabilitation following construction and completion of mining activities at each phase of the project will also be staged over the duration of the mine life.

Site works across all phases of the Project (Mine and Rail) will require the clearing of remnant vegetation, spanning or removal of watercourses and/or standing water bodies, and fragmentation of the landscape, amongst other impacts. These will result in impacts across the site of:

- Clearing and fragmentation of lands
- Removal of water resources and alteration of groundwater from drawdown
- Water required for construction and operational purposes will be sourced from onsite dams or from offsite sources with water course diversions established early in the Project lifecycle and any water leaving site captured within staging dams, treated and recycled
- Alteration of topography associated with subsidence over underground mining pits and mounding of spoil
- Potential introduction of weeds and exotic pests

Each of these impacts will reduce local biodiversity and may potentially affect regional biodiversity and consideration has been given to the significance of these impacts as they relate to matters of NES.

11.2 Word Heritage Areas, National Heritage Places and the Great Barrier Reef Marine Park

11.2.1 Introduction

A number of geographies within Queensland provide unique environmental, cultural or heritage features. In recognition these areas have been afforded legislative protection. Any project that may interfere with the values for which any protected site has been recognised must ascertain the potential for impact and identify mitigation measures.

The Study Area occurs in central Queensland within the Burdekin and Fitzroy Basin Catchments, approximately 320 km upstream of the Great Barrier Reef World Heritage Area and the Great Barrier Reef Marine Park. The vast majority of the Study Area is within the Brigalow Belt bioregion save the extreme western extent of the Study Area which captures the boundary of the Desert Uplands bioregion.

As a result of the high location in the catchment and seasonality in rainfall, flows within the Study Area are restricted to the wetter months, November to March, with many streams and drainage channels drying entirely and larger rivers sustaining only pools or low flows by the winter months (June/July). The Burdekin River Gorge and falls and the Burdekin Falls Dam have influenced the ecology of the catchment by restricting aquatic fauna movement from the eastern coastal area to the upper catchment areas.

11.2.2 Description of Environmental Values

The two closest world heritage properties to the Study Area are the Great Barrier Reef World Heritage Area (GBRWHA) and the Wet Tropics World Heritage Area (WTWHA). The Study Area is located

over 300 km south of the Wet Tropics World Heritage Area with no direct land or aquatic links to the Study Area. The Study Area is also located over 300 km due west and approximately 320 km upstream of the Great Barrier Reef World Heritage Area and the Great Barrier Reef Marine Park. The Carmichael River bisects the proposed mine site and joins a network of river systems which eventually enter the marine coastal waters of Queensland.

The Great Barrier Reef (GBR), a unique reefal mosaic that spans more than 348,000 km^2 of the continental shelf of Queensland. The GBR is recognised globally for its biodiversity, size, prevalence of endemic species, aesthetic and cultural values. In 1981 it was inscribed on the World Heritage List against the following criteria:

- Outstanding example representing a major stage of the earth's evolutionary history given the GBR is the largest single collection of coral reefs in the world
- Outstanding example representing significant ongoing geological processes, biological evolution and man's interaction with his natural environment given the GBR represents a mature system which has been in existence for millions of years
- Containing unique, rare and superlative natural phenomena, formations and features and areas of exceptional natural beauty
- Providing habitats where populations of rare and endangered species of plants and animals survive

The GBR is also of indigenous cultural importance for Aboriginal and Torres Strait Islanders. Non-indigenous heritage values are also represented and include mapped historic shipwrecks which occur throughout the reef mosaic. These, along with its biological diversity, represent features that are of outstanding national heritage value to Australia which led to the GBR being registered as a place of National Heritage in May 2007.

Prior to inscription upon the World Heritage or National Heritage registers the GBR was recognised as an environment requiring special management to provide sustainable use with appropriate protection. In 1975 the Great Barrier Reef Marine Park was designated and the GBR Marine Park Authority established as a management agency chartered with the responsibility of management of activities within the Marine Park. The Marine Park covers more than 344,400 km^2 of the GBRWHA and extends 2,300 km along the Queensland coast and encompasses most of the waters from low water mark on the mainland coast (Hutchings *et al.* 2008). A number of coastal areas, such as the operational port environments, are excluded from the Marine Park. This provides opportunity for targeted, intensive management of those environments against the activities which are conducted within those areas. Responsibility for which rests with the various port management agencies operating in Queensland.

The GBR is a multiple use multiple jurisdiction environment managed with an overriding conservation objective to maintain the values of the reef. In this regard, the Marine Park Authority works with the Queensland Government, its agencies and port authorities to achieve effective management of the Great Barrier Reef. Given the alignment of the values for which the GBR is designated as a Marine Park, a World Heritage Area and a National Heritage Place, assessment of each these matters is considered within this Section.

11.2.3 Potential Impacts and Mitigation Measures

The DSEWPaC Projected Matters Search Tool did not identify any world heritage properties or National Heritage Places of relevance to the Project.

The WTWHA is located over 300 km north of the Study Area with no direct terrestrial, aquatic or biodiversity links to the Study Area. No influences from the Project are predicted to occur on the WTWHA and this area has not been considered further within this assessment.

The Tree of Knowledge and curtilage at Barcaldine is the closest National Heritage Place to the Study Area. It is located approximately 200 km south-west of the western extent of the Study Area. No direct or indirect influences on this Place will occur as a consequence of the Project and this Place has, therefore, not been considered further.

The GBRWHA is located over 300 km downstream of the Study Area and although connected aquatically via watercourses, substantial watercourse and overland barriers exist between the ocean and the Study Area, including the Burdekin River dam. Significant controls will be established to manage onsite and offsite water and sediment quality impacts. These measures will mitigate potential for offsite impacts to aquatic values that could affect the downstream reefal environment. The distance from the GBR and the extant barriers would impede site conditions from having an influence on the values for which the reef is protected. No impacts associated with the Project will result in a substantial and measurable change in the hydrological regime of the GBRWHA waters and, therefore, no effects on the Marine Park are predicted either. Accordingly no impacts to the ecological, cultural or social values which the Great Barrier Reef is recognised will occur as a result of the Project.

The Project will not impact upon any World Heritage Areas, National Heritage Places or the Great Barrier Reef Marine Park.

11.3 Wetlands of International Importance

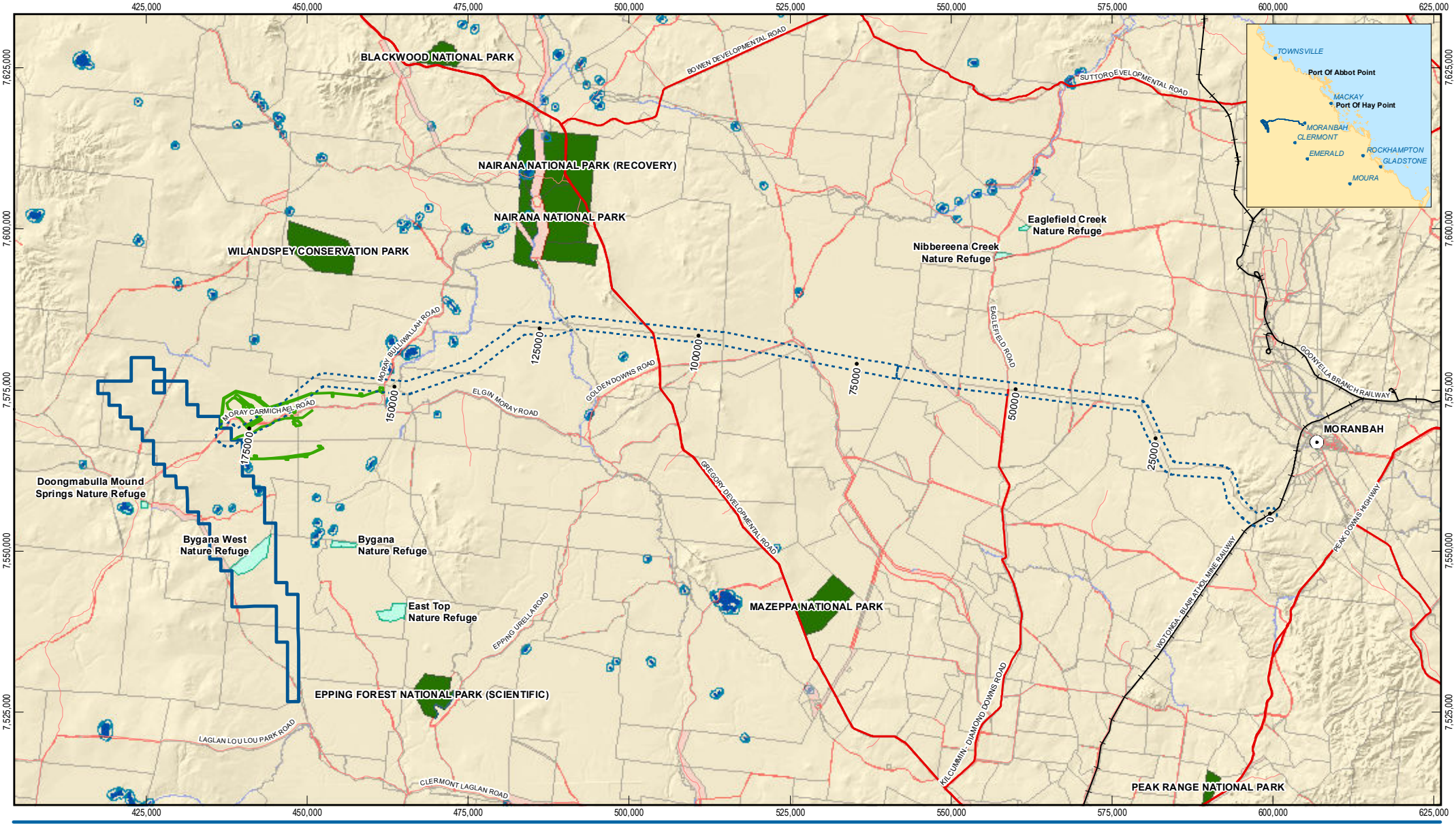
11.3.1 Introduction

Wetlands that are representative, rare or unique with regard to their biodiversity, size, geomorphology or location for the conservation of biodiversity are recognised under the EPBC Act as a matter of NES. A number of different water body types are recognised as wetlands, including permanent water bodies, seasonal or intermittent lakes, human-made and subterranean hydrological systems. Listed and protected wetlands have met criteria to be afforded Ramsar status and any action that may influence the values for which the wetland has been recognised must be assessed to ascertain the potential for impact and identify mitigation measures.

11.3.2 Description of Environmental Values

The DSEWPaC Protected Matters Search Tool indicated that the Coongie Lakes Ramsar site in South Australia (located approximately 800 km south-west of the Study Area) is of relevance to the Project as the Study Area occurs near the extreme north-east of the Cooper Creek Catchment, which drains in a south-westerly direction towards north-east South Australia (Coongie Lakes and Lake Eyre). The Study Area lies within the Burdekin River and Fitzroy River catchments and no surface waters within the Cooper Creek Catchment are located within the Study Area or surrounds. Accordingly the Coongie Lakes Ramsar site is not connected to the Study Area.

Although not indicated to be of relevance to the Project via the DSEWPaC Protected Matters Search Tool, a wetland of international importance (Ramsar Wetland) that occurs approximately 380 km east of the Study Area (Figure 11-1), outside the Burdekin River catchment, is that associated with the Shoalwater and Corio Bays Areas. Substantial overland barriers exist between the Study Area and the Shoalwater and Corio Bays Areas. Substantial watercourse barriers also exist between the ocean and the Study Area, including the Burdekin River dam. The distance from the protected area and barriers would impede site conditions from having an influence on these coastal wetland protected values.



1:800,000 (at A4)

0 5 10 15 20 25

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Town
- State Road
- Local Road
- Other Railway
- Mine (Onsite)
- Mine (Offsite)
- Study Area
- Cadastral Parcel
- Road Reserve
- Watercourse Reserve
- National Park
- Great Barrier Reef Wetland Protection Area
- Great Barrier Reef Wetland Protection Trigger Area
- Nature Refuge

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Conservation Significant Areas

Figure 11-1

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Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DERM: DEM (2008), DCDB (2010), GBR Wetland Protection Areas (2010), Nature Refuge (2010), National Park (2010); DME: EPC1690 (2010)/EPC1080 (2011); © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Roads (2007); Adani: Alignment Opt9 Rev3 (2012); GHD: Northern Missing Link (2011); Gassman/Hyder: Mine (Offsite) (2012). Created by: JB, CA

11.3.3 Potential Impacts and Mitigation Measures

Ramsar wetlands are located to the south and east of the Study Area. Substantial overland and watercourse barriers exist between the Study Area and these protected sites. The Study Area lies within the Burdekin River and Fitzroy River catchments and no surface waters within the Cooper Creek Catchment are located within the Study Area or surrounds. Accordingly the Coongie Lakes Ramsar site is not connected to the Study Area. The substantial distance between the Study Area coupled with onsite environmental management actions and barriers to downstream affects, including the Burdekin River dam, would impede site conditions from having an influence on the Shoalwater and Corio Bays Areas coastal wetland protected values.

No areas of internationally important wetland will be lost, destroyed or substantially modified as a result of the Project nor will the hydrological regime of those distant wetlands be interfered with. None of the biodiversity for which distant wetlands are recognised will be impacted by Project activities as the Project will not affect the geography of any Ramsar protected wetlands nor will it act to introduce invasive species to any wetland sites. Accordingly, no impacts to Ramsar wetlands are predicted to occur as a result of this Project.

11.4 Impact on a Listed Threatened Species and Ecological Communities

11.4.1 Description of Environmental Values

11.4.1.1 Listed Threatened Flora

Desktop and field assessments detected only one EPBC Act-listed threatened flora species within the Project Area, the waxy cabbage palm (*Livistona lanuginosa*). This species is, however, restricted to the Carmichael River channel and was not predicted to occur in the Study Area based on the Protected Matters Search Tool. A likelihood of occurrence assessment for all species (predicted, previously detected) was undertaken for both the mine and the rail geographies. Details from each of those assessments are provided in detail in Volume 2, Section 5 Nature Conservation and Volume 3, Section 5 Nature Conservation of this EIS and summarised in Volume 4 Appendix J matters of NES. The likelihood of occurrence assessment indicated that the following EPBC Act-listed threatened flora species may occur at the Study Area, based on distribution and/or presence of potentially suitable habitat:

- *Acacia ramiflora* – vulnerable EPBC Act
- *Dichanthium queenslandicum* – vulnerable EPBC Act

Neither of these species were recorded during field surveys. Each of these taxa may occur based on its known geographic distribution and the presence of suitable habitat. Landforms and Regional Ecosystems known to support these taxa do occur within the Study Area and, accordingly, suitable habitat is considered to be present within the Study Area.

11.4.1.2 Listed Threatened Fauna

A likelihood of occurrence assessment for EPBC Act listed threatened fauna species was undertaken and details are provided in Volume 2, Section 5 Nature Conservation and Volume 3, Section 5 Nature

Conservation of this EIS. Those species considered known, likely or which may occur at the site are discussed in detail in Volume 4 Appendix J matters of NES with information summarised herein.

Listed Threatened Fauna – Confirmed Present

A number of EPBC Act listed threatened fauna species have been previously recorded or are predicted to occur within the desktop search extent encompassing the Mine and Rail Study Areas. Of these, two were confirmed present during field surveys:

- Black-throated finch (southern) (*Poephila cincta cincta*)
- Squatter pigeon (southern) (*Geophaps scripta scripta*)
- Koala (*Phascolarctos cinereus*) (combined populations of Queensland, New South Wales and the Australian Capital Territory)

Squatter Pigeon (Southern) (Vulnerable EPBC Act)

The squatter pigeon (southern) is a ground-dwelling pigeon, listed as vulnerable under the EPBC Act. This species' distribution extends from central Queensland as far north as the Burdekin-Lynd divide to the south-east of the state (DSEWPaC, 2011c). At present the total population size of the squatter pigeon (southern) is estimated to be around 40,000 breeding birds, with both the extent and the population size considered to be stable (DSEWPaC, 2011c). The squatter pigeon (southern) is locally abundant at some locations in the northern part of its current distribution and is considered to be common in cattle grazed country north of the Tropic of Capricorn (DSEWPaC, 2011c).

Three main threats to the squatter pigeon (southern) exist:

- Loss of habitat due to clearing for agricultural or industrial purposes
- Degradation of habitat by grazing herbivores
- Excessive predation, particularly by foxes and cats (DSEWPaC, 2011c)

Squatter Pigeons (Southern) at the Study Area

Squatter pigeons (southern) were recorded on one occasion during the September survey of the Rail Study Area and on 39 separate occasions across both spring and autumn surveys of the Mine Study Area.

This subspecies was typically encountered on tracks in open woodland habitat featuring a complex grassy understorey. Group size ranged from a single bird to 20 birds. Distribution of the squatter pigeon (southern) is likely to be limited across the Study Area by the availability of drinking water. Full details of squatter pigeon (southern) sightings are presented in Volume 2, Section 5 Nature Conservation and Volume 3, Section 5 Nature Conservation of this EIS.

Squatter pigeons (southern) observed at the Study Area are shown in Plate 11-1, while examples of habitat from which the subspecies were recorded are presented in Plate 11-2.

Plate 11-1 Squatter Pigeons (Southern) Recorded from Central Part of Mine Study Area (May 2011)

Plate 11-2 Habitat from which Squatter Pigeon (Southern) Was Recorded

open eucalypt woodland along ephemeral creek (April 2011)

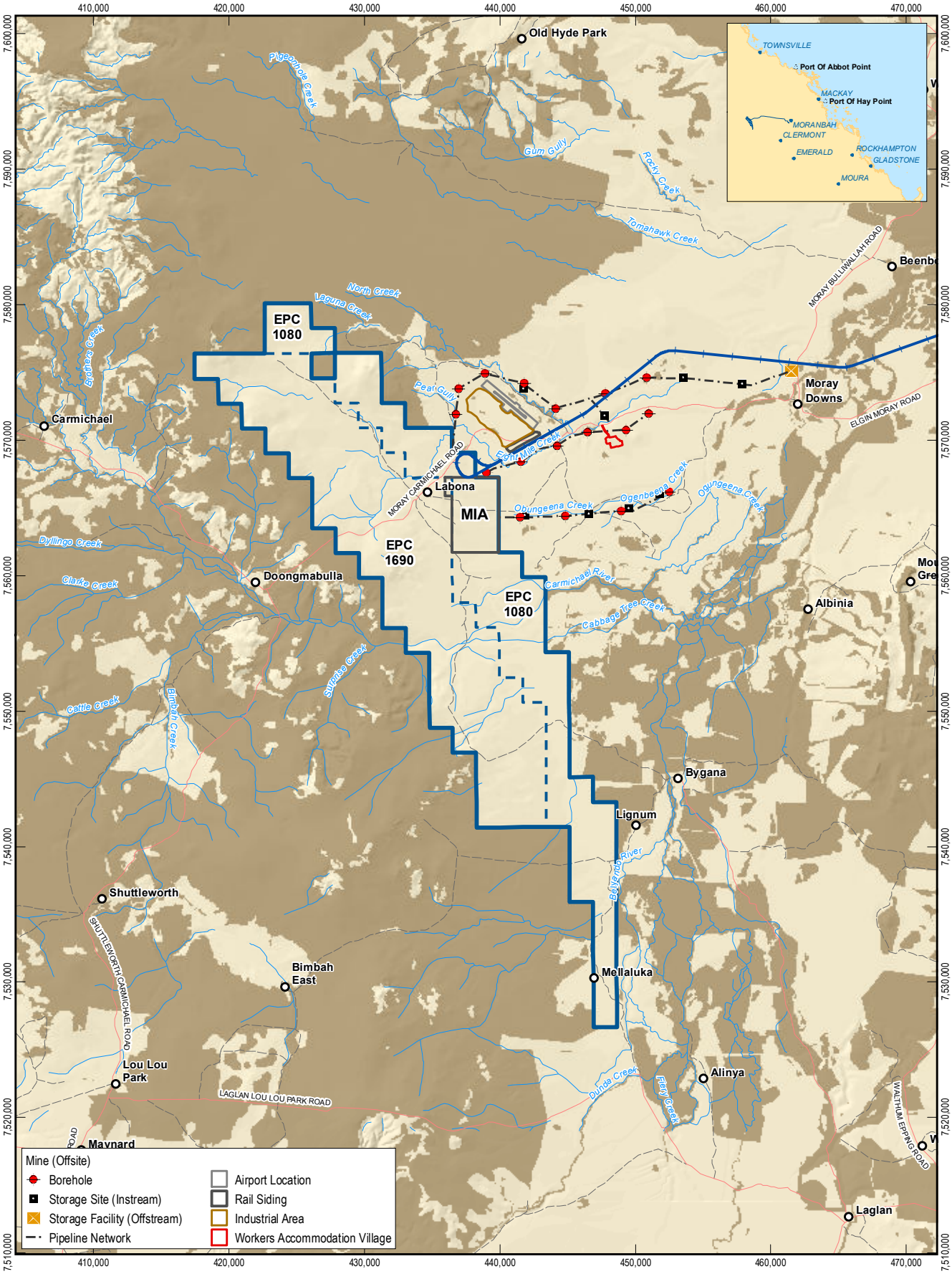
open ironbark woodland with native grass understorey (April 2011)

The presence of potentially suitable habitat (mapped for Mine by way of example in Figure 11-2) extends beyond the Project and suggests that the squatter pigeon (southern) is likely to be present in much of the wider landscape, particularly to the west where remnant vegetation dominates the landscape. However, much of the landscape surrounding the Study Area is dominated by non-remnant vegetation with fragmented remnant vegetation often restricted to watercourses. Habitat utilisation and abundance is likely to be influenced by availability of water and prevalence of predators (especially cats and foxes).

The limited number of squatter pigeon (southern) sightings observed during field surveys are unlikely to be a true representation of the species abundance within the Study Areas and surrounding landscape. This species is likely to be common in suitable habitat within the Study Areas, and is likely to be present where suitable habitat occurs in the landscape beyond the Study Areas. Across its range the subspecies is thought to occur as a continuous, inter-breeding population, with no single populations identified as being important for its long-term survival or recovery (DSEWPaC, 2011v).

With respect to the Significant Impact Guidelines (DEWHA, 2009b), it is not considered that squatter pigeons (southern) at the Study Area are part of an 'important population' (of an EPBC Act-listed vulnerable species). That is, squatter pigeons (southern) at the Study Area are not considered to be a part of a population that is necessary for a species' long-term survival and recovery, including populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal
- Populations that are necessary for maintaining genetic diversity
- Populations that are near the limit of the species range (DEWHA, 2009b).



LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Potential Squatter Pigeon (Southern) Habitat - Based on DERM Certified Regional Ecosystems Version 6.0b

1:400,000 (at A4)

0 2.5 5 7.5 10

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

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Potential Squatter Pigeon (southern) Habitat beyond the Mine Study Area

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Figure 11-2

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Data Source: DERM: Regional Ecosystems v6.0 (2010); DME: EPC 1690 (2010), EPC 1080 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); GHD: Potential Habitat (2012). Created by: BW, CA

Black-throated Finch (Southern)

The black-throated finch (southern) is listed as endangered under the EPBC Act and has experienced a large decline in range in recent decades (DSEWPaC, 2011d). Where it was once previously found throughout eastern and central Queensland north of the New South Wales border, it is now only known from the Townsville region and scattered sites in central Queensland (DSEWPaC, 2011d).

The subspecies inhabits grassy open woodland and open forest habitats characterised by trees belonging to the genera Eucalyptus, Corymbia, Acacia and Melaleuca (DSEWPaC, 2011d). Generally it occurs in habitats near watercourses or waterbodies - almost all recent records of the subspecies south of the tropics have been in riparian areas (DSEWPaC, 2011d). Three critical habitat resources are required to support the subspecies:

- Water sources (both natural and artificial)
- Grass seeds (a mosaic of species that provide forage throughout the year (particularly during the wet season)
- Trees that provide suitable nesting habitat (DEWHA, 2009; DSEWPaC, 2011d)

Black-throated Finch (Southern) at the Study Area

- No black-throated finches (southern) were detected during any surveys of the Rail Study Area but are considered likely to occur within that environment given suitable habitat prevalence
- No black-throated finches (southern) were detected during the Spring 2010 survey of the Mine Study Area
- Black-throated finches (southern) were recorded on 34 separate occasions during subsequent Autumn and Spring 2011 surveys of the Mine Study Area

Plate 11-3 shows black-throated finches (southern) observed at the Study Area.

Figure 11-3 displays the locations of black-throated finch (southern) sightings from the Study Area. Figure 11-4 and Figure 11-5 display potential habitat at the Rail and Mine Study Areas respectively based on RE mapping. Records obtained from the Study Area are towards the south-western extent of the subspecies' current known (i.e. post-1998) distribution.

Full details of black-throated finch (southern) sightings are presented in Volume 4, Appendix N1 Mine Terrestrial Ecology Report. In summary,

- Group size ranged from a single bird to approximately 40 birds
- Finches were typically observed drinking at dams/stock troughs, or flushed from tracks by vehicles whilst foraging on the ground
- Black-throated finches (southern) were occasionally observed in the presence of other finch species – namely the double-barred finch (*Taeniopygia bichenovii*) and the plum-headed finch (*Neochmia modesta*)

While black-throated finch (southern) sightings were generally confined to the northern and southern parts of the Study Area, it is considered possible that the subspecies occurs over a larger extent of the Study Area. This is based on the similarity of habitat to that in which the subspecies was recorded being present through much of the Study Area, and the fact that this habitat retains connectivity to that in which the subspecies was recorded.

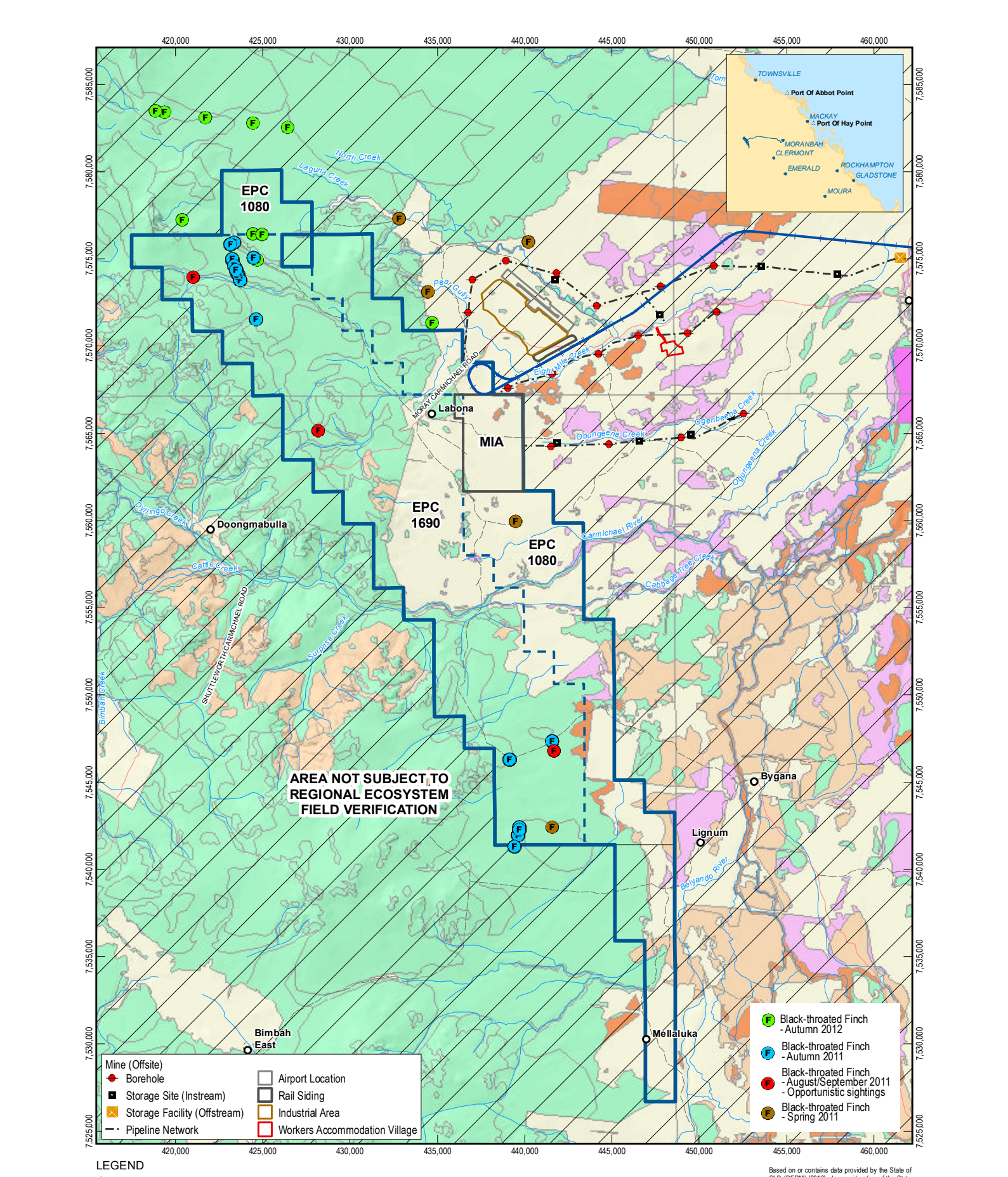
Plate 11-3 Black-throated Finches (southern) during Field Surveys in Study Area

Stock troughs near Bygana West Nature Refuge (April 2011)

Farm infrastructure near southern boundary of Bygana West Nature Refuge (April 2011)

Farm dam at north of Study Area (May 2011)

North-west of Study Area (May 2011)



LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area

Regional Ecosystems v6.1

- Endangered - Dominant
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- Of Least Concern
- Non-remnant

1:275,000 (at A4)
0 1 2 3 4 5
Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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Location of Black-throated Finch (southern) Sightings - Project Area

Figure 11-3

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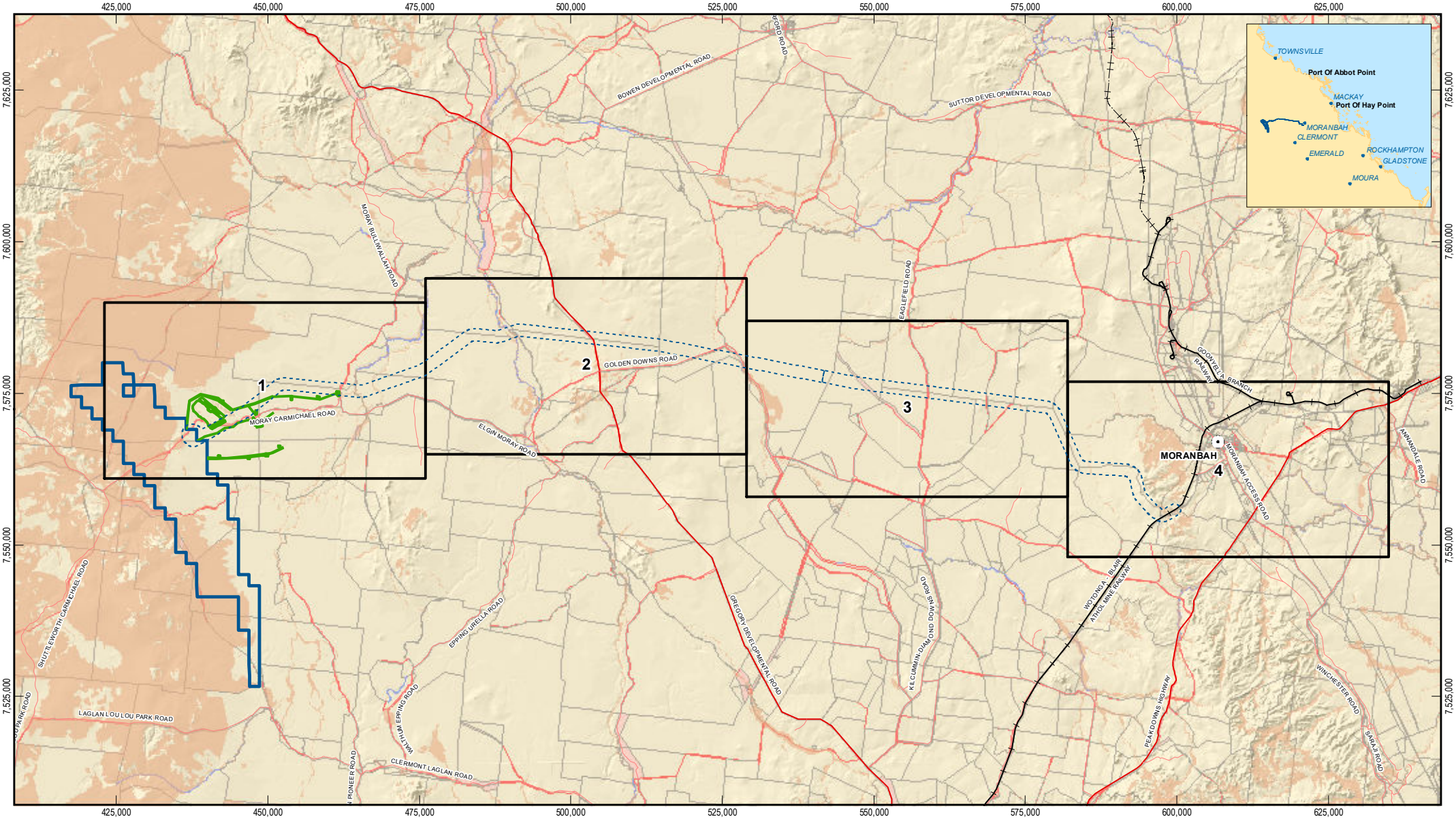
Data Source: DME: EPC 1690 (2010), EPC 1080 (2011); DERM: Regional Ecosystems v6.1 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); GHD: Black Throated Finch Sightings (2011-2012). Created by: BW, CA



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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Town
- State Road
- Local Road
- Other Railway
- Cadastral Parcel
- Road Reserve
- Watercourse Reserve
- Mine (Onsite)
- Mine (Offsite)
- Study Area
- Potential Black-Throated Finch (Southern) Habitat - Based on DERM Certified Regional Ecosystems Version 6.0b

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Carmichael Coal Mine and Rail Project

Potential Black-throated Finch (southern) Habitat at the Rail Study Area and the Surrounding Landscape

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Figure 11-4
Series Index

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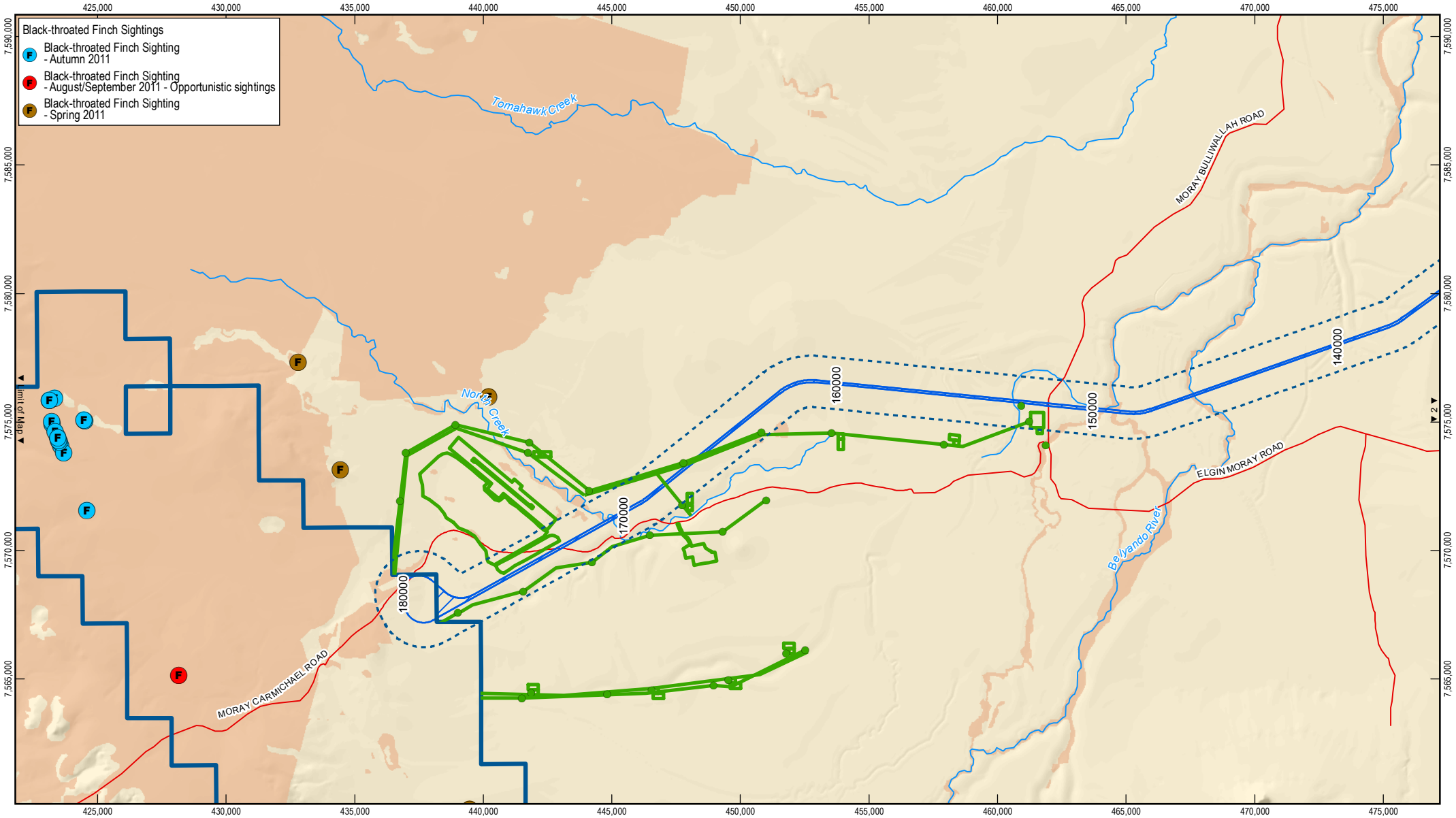
Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DERM: DEM (2008), DCDB (2010); DME: EPC1690 (2010)/EPC1080 (2011); © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Roads (2007); GHD: Potential Black-throated Finch Habitat, Sightings (2011); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: BW, CA



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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Town
- Road
- Other Railway
- Watercourse
- Mine (Onsite)
- Mine (Offsite)
- Mine (Offsite)
- Rail (West)
- Rail (East)
- Study Area
- Potential Black-Throated Finch (Southern) Habitat - Based on DERM Certified Regional Ecosystems Version 6.0b

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Carmichael Coal Mine and Rail Project

Potential Black-throated Finch (southern) Habitat at the Rail Study Area and the Surrounding Landscape

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Figure 11-4
Sheet 1 of 4

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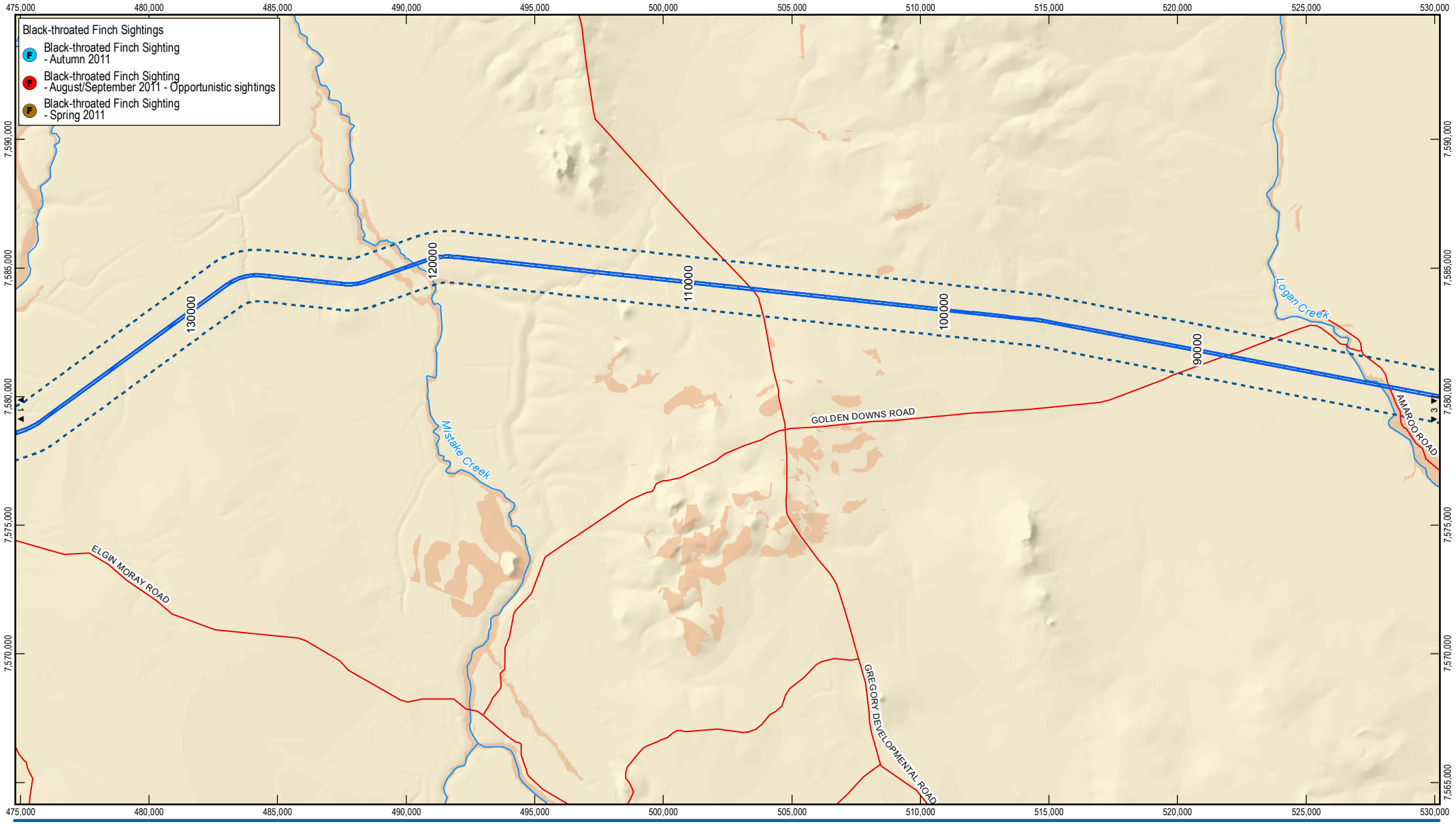
Data source: DERM: DEM (2008), © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Roads, Watercourse (2007); GHD: Potential Black-throated Finch Habitat, Sightings (2011); Adani: Alignment Opt9 Rev3 (2012); DME: EPC1690 (2010) / EPC1080 (2011); Gassman/Hyder: Mine (Offsite) (2012). Created by: MR, CA



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Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND
- Town
- Road
- Other Railway
- Watercourse
- Mine (Onsite)
- Mine (Offsite)
- Mine (Offsite)
- Rail (West)
- Rail (East)
- Study Area
- Potential Black-Throated Finch (Southern) Habitat - Based on DERM Certified Regional Ecosystems Version 6.0b

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
Potential Black-throated Finch (southern) Habitat at the Rail Study Area and the Surrounding Landscape

Job Number 41-25215
Revision B
Date 19-11-2012

Figure 11-4
Sheet 2 of 4

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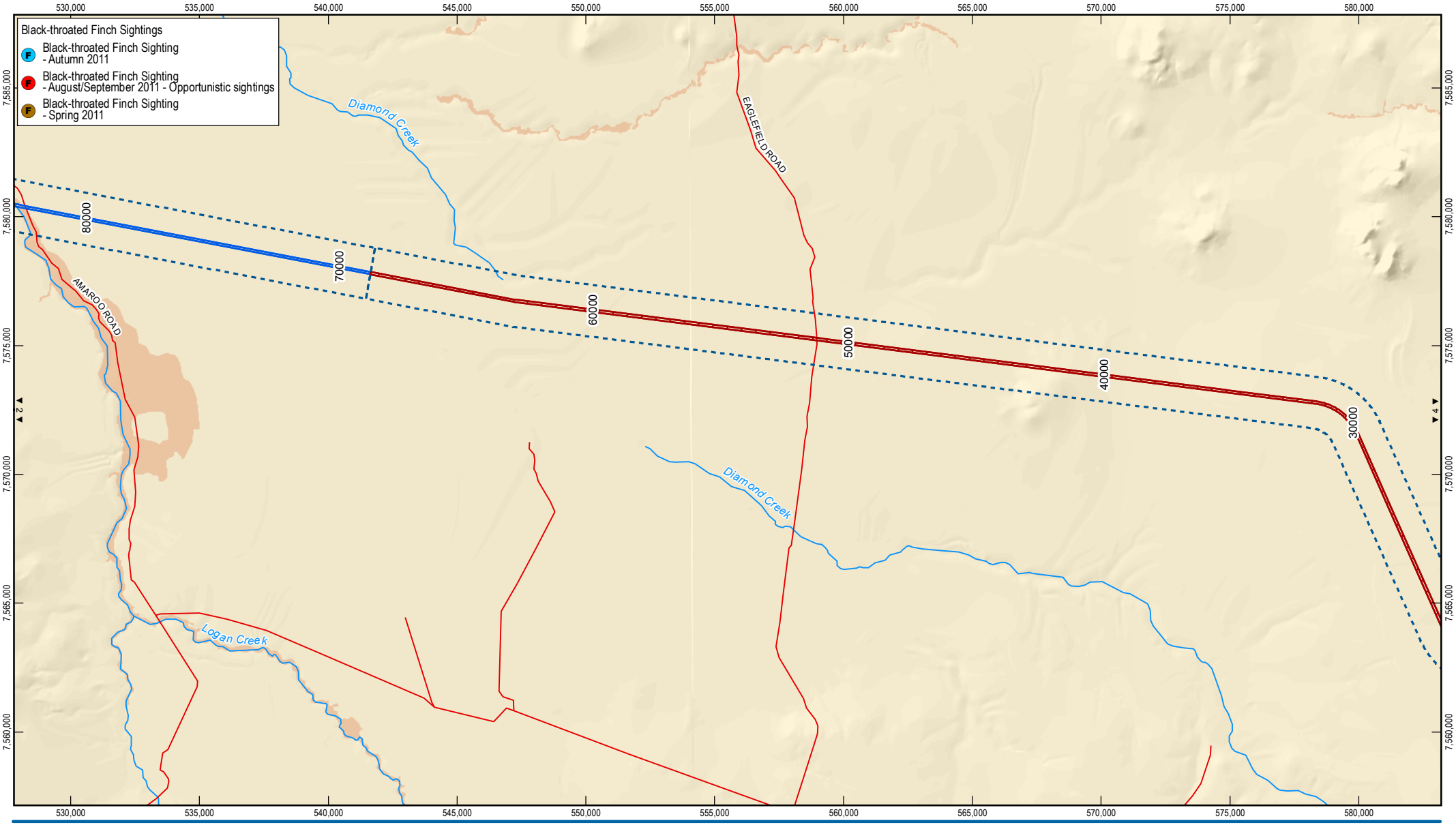
Data source: DERM: DEM (2008), © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Roads, Watercourse (2007); GHD: Potential Black-throated Finch Habitat, Sightings (2011); Adani: Alignment Opt9 Rev3 (2012); DME: EPC1690 (2010) / EPC1080 (2011); Gassman/Hyder: Mine (Offsite) (2012). Created by: MR, CA



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Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND
- Town
- Road
- Other Railway
- Watercourse
- Mine (Onsite)
- Mine (Offsite)
- Mine (Offsite)
- Rail (West)
- Rail (East)
- Study Area
- Potential Black-Throated Finch (Southern) Habitat - Based on DERM Certified Regional Ecosystems Version 6.0b

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
Potential Black-throated Finch (southern) Habitat at the Rail Study Area and the Surrounding Landscape

Job Number 41-25215
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Figure 11-4
Sheet 3 of 4

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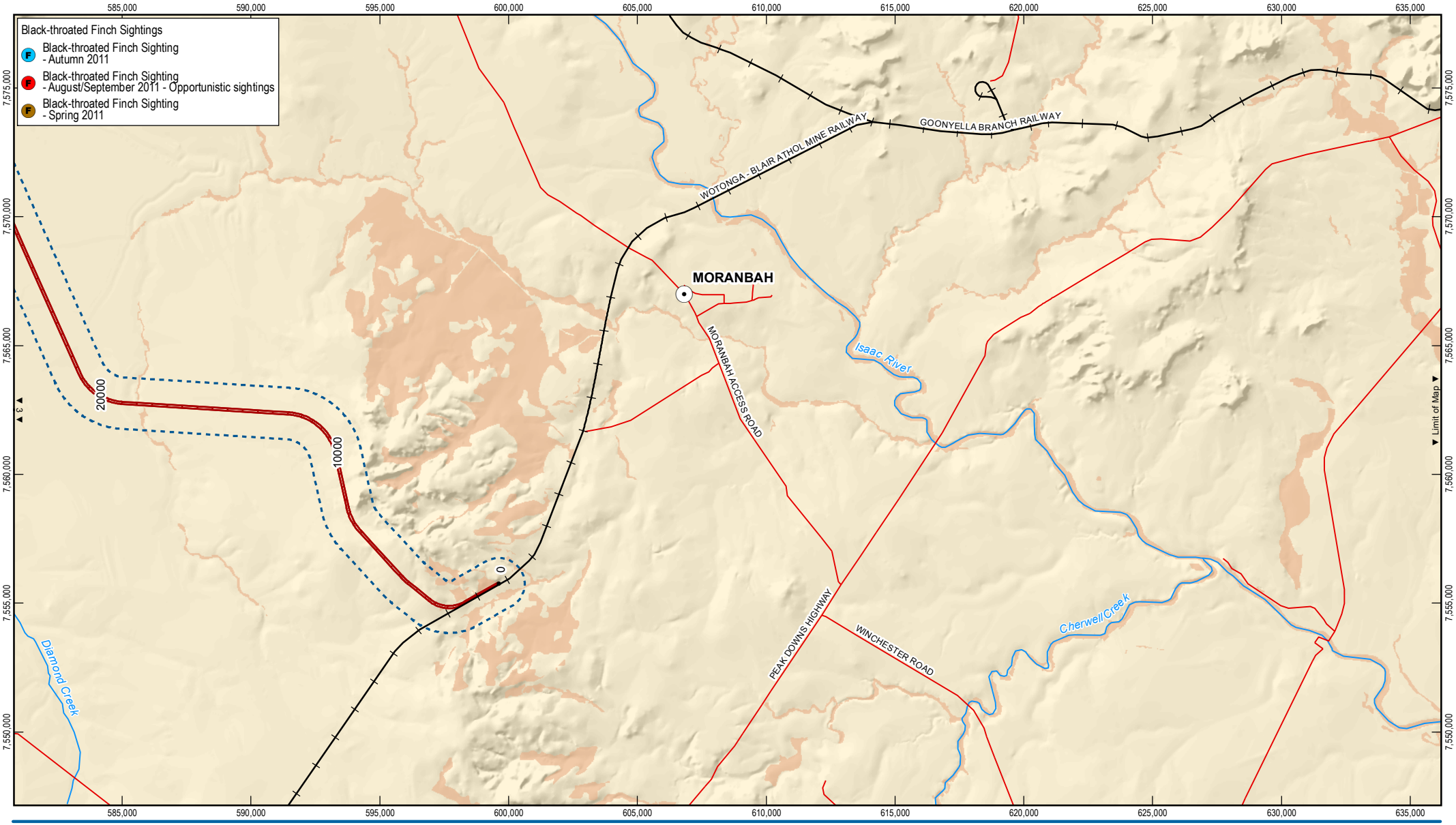

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Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND
- Town
- Road
- Other Railway
- Watercourse
- Mine (Onsite)
- Mine (Offsite)
- Mine (Offsite)
- Rail (West)
- Rail (East)
- Study Area
- Potential Black-Throated Finch (Southern) Habitat - Based on DERM Certified Regional Ecosystems Version 6.0b

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
Potential Black-throated Finch (southern) Habitat at the Rail Study Area and the Surrounding Landscape

Job Number 41-25215
Revision B
Date 19-11-2012

Figure 11-4
Sheet 4 of 4

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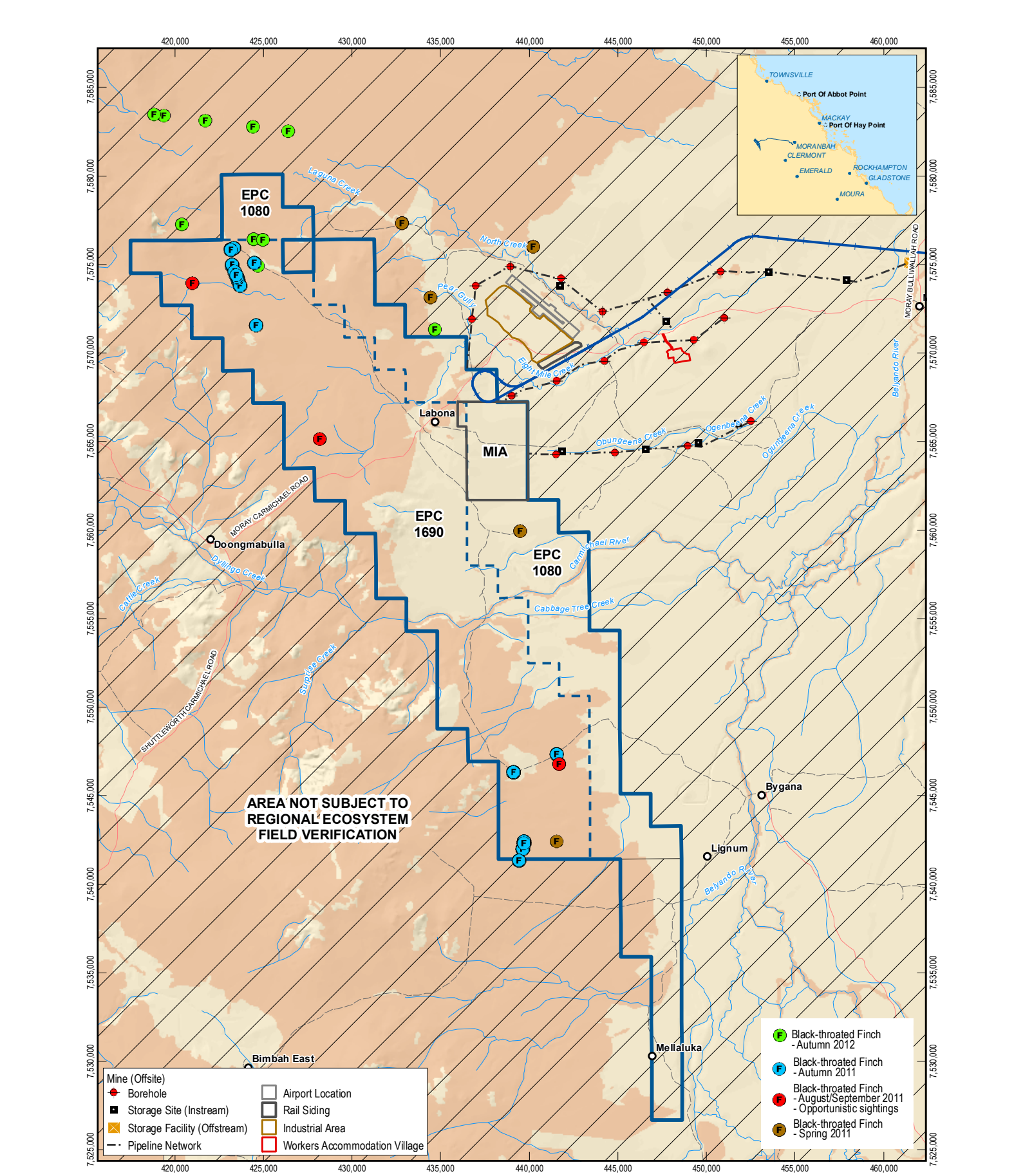
Data source: DERM: DEM (2008), © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Roads, Watercourse (2007); GHD: Potential Black-throated Finch Habitat, Sightings (2011); Adani: Alignment Opt9 Rev3 (2012); DME: EPC1690 (2010) / EPC1080 (2011); Gassman/Hyder: Mine (Offsite) (2012). Created by: MR, CA



LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Potential Black-Throated Finch (Southern) Habitat - Based on Field Verified Regional Ecosystems within the Mine Site and DERM Certified Regional Ecosystems Version 6.0b outside the Mine Site

1:275,000 (at A4)
0 1 2 3 4 5
Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Potential Black-throated Finch (southern) Habitat - Project Area

Job Number 41-25215
Revision D
Date 19-11-2012

Figure 11-5

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Data Source: DME: EPC 1690 (2010), EPC 1080 (2011); DERM: Regional Ecosystems v6.0 (2010); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); GHD: Black Throated Finch Sightings (2011 - 2012), Potential Habitat (2011). Created by: BW, CA

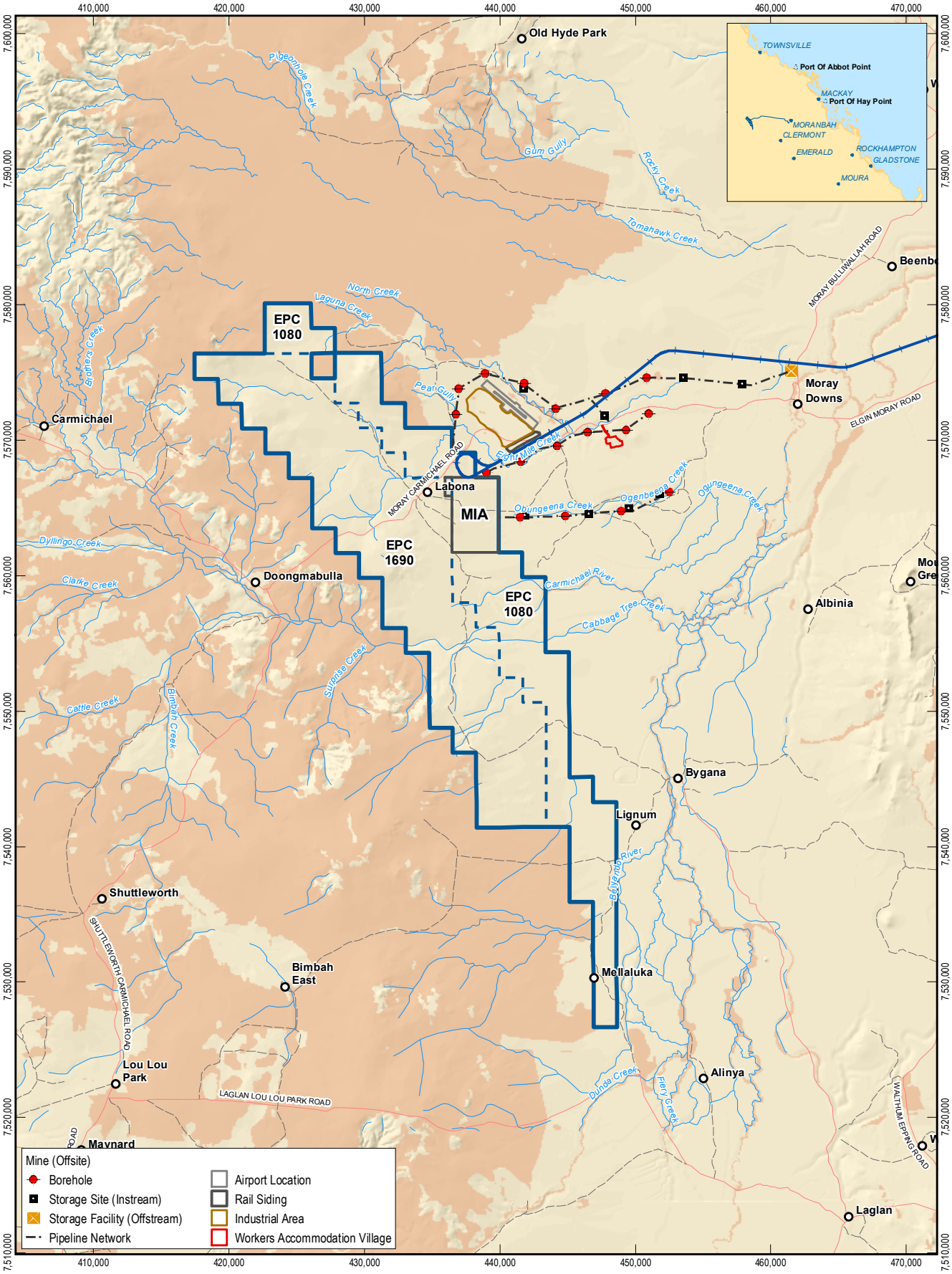
Habitat utilisation beyond the Study Area (mapped as Figure 11-6 based on REs) will be largely based upon the degree of connectivity/fragmentation of potential habitat patches, and the presence of the three critical habitat resources required by the subspecies (mosaic of native grasses, nesting trees and access to water). No surveys have been undertaken to identify whether the black-throated finch (southern) is utilising habitats in the landscape around the Study Area. The subspecies has been recorded (post-1998) by the Black-throated Finch Recovery Team within approximately 10-20 km of the Study Area (at Doongmabulla Station) (DSEWPaC, 2011d).

Figure 11-7 shows black-throated finch (southern) important areas at and near the Study Area. These important areas are located within the Mine Study Area, and no sightings were recorded within the Rail Study Area. These important areas were identified by applying a 5 km buffer to sighting records from the Study Area, and selecting potential habitat, based on those (field verified) REs from which the subspecies has been recorded in north Queensland since 1994 (as presented by the Black-throated Finch Recovery Team, 2007) within the 5 km buffer. The approximate extent of important areas for the subspecies in the Study Area is 18,652 ha.

Based on the (currently available) information acquired from desktop and field studies, and in consideration of the Significant Impact Guidelines, (DEWHA, 2009), it is considered that the mine Study Area supports a 'population' of the black-throated finch (southern), noting that a 'population' of an (EPBC Act) endangered species is defined in the Significant Impact Guidelines as 'the occurrence of the species in a particular area', where occurrence relates to:

- *A geographically distinct regional population, or collection of local populations, or*
- *A population, or collection of local populations, that occurs within a particular bioregion* (DEWHA, 2009c).

The Study Area is within approximately 50 km of a cluster of 'important areas' (i.e. habitat within five km of a post-1995 sighting) for the subspecies exhibited in the *Whole of range important areas* map presented in the black-throated finch (southern) (DEWHA, 2009). As such, it is possible that the population at the Study Area is part of a collection of local populations.



LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Potential Black-Throated Finch (Southern) Habitat - Based on DERM Certified Regional Ecosystems Version 6.0b

1:400,000 (at A4)

0 2.5 5 7.5 10

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project

Job Number	41-25215
Revision	B
Date	19-11-2012

Potential Black-throated Finch (southern) Habitat beyond the Mine Study Area

Figure 11-6

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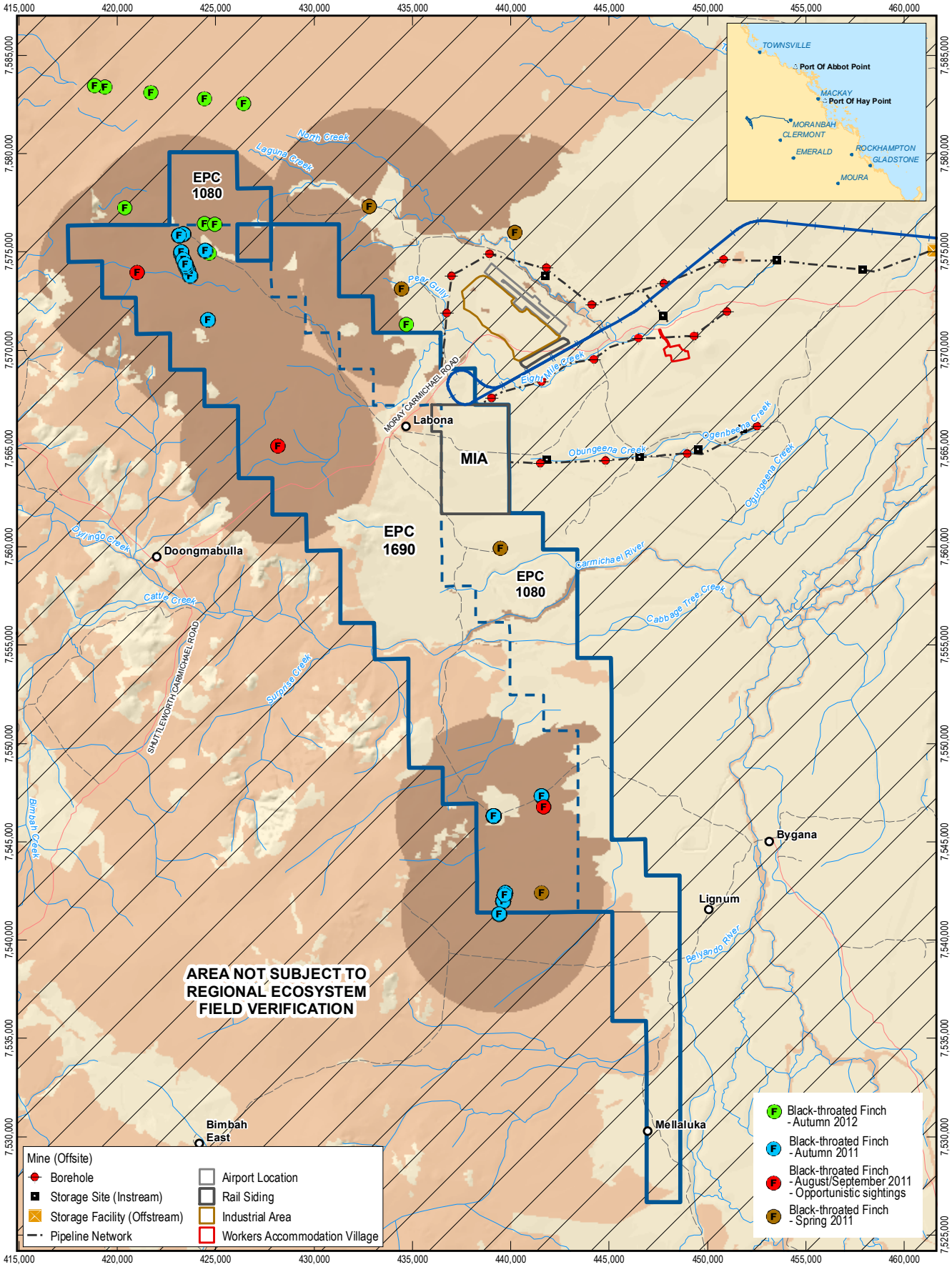
Data Source: DERM: Regional Ecosystems v6.0 (2010); DME: EPC 1690 (2010), EPC 1080 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); GHD: Potential Habitat (2012). Created by: BW, CA



LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Potential Black-Throated Finch (Southern) Habitat - Based on Field Verified Regional Ecosystems within the Mine Site and DERM Certified Regional Ecosystems Version 6.0b outside the Mine Site
- Black-Throated Finch Important Area -Based on SEWPAC Significant Impact Guidelines

1:275,000 (at A4)
0 1 2 3 4 5
Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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Black-throated Finch (southern) Important Areas

Job Number 41-25215
Revision C
Date 19-11-2012

Figure 11-7

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Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: DME: EPC 1690 (2010), EPC 1080 (2011); DERM: Regional Ecosystems v6.0 (2010); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); GHD: Black Throated Finch Sightings, Potential Habitat, Important Areas (2011). Created by: BW, CA

Koala (Combined populations of Queensland, New South Wales and Australian Capital Territory)

The koala (combined populations of Queensland, New South Wales and Australian Capital Territory) (vulnerable EPBC Act, special least concern NC Act) is a tree dwelling marsupial that has a widespread distribution in both coastal and inland environments (SEWPAC, 2012). The natural range of this species extends from north-east Queensland to the south-east corner of South Australia. However, the koala's distribution is not continuous across this range and it occurs in a number of populations that are separated by cleared land or unsuitable habitat (SEWPAC 2012c). Koalas occupy a range of habitats including temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated eucalypt species (SEWPAC 2012c). In central Queensland, the species occurs in scattered populations within eucalypt woodlands generally along watercourses. Koalas in the Brigalow Belt bioregion also typically occur in low densities and have large home ranges (SEWPAC 2012c). Over a 20 year period from 1990, estimated koala populations within the Brigalow Belt bioregion have suffered a decline of 30 to 40 per cent.

The koala's diet is typically restricted to foliage of *Eucalyptus spp*. or related genera. However, the diet of individual koalas is usually limited to obtaining most of their nutrition from one or a few tree species present at a site. Species-level preferences may also vary between regions or seasons (SEWPAC, 2012). Female koalas can potentially produce up to one offspring a year, giving birth between October and May, however research indicates that breeding averages are more likely to range between 0.3-0.8/year (SEWPAC, 2012).

Generally, the home ranges of individual koalas can extensively overlap, however, these can be quite variable depending on the quality of the habitat and the location. Research undertaken at Blair Athol in central Queensland, approximately 140 km south-east of the Project Area, estimated home ranges at 135 ha for an individual male and 101 ha for females.

No evidence of the koala was detected during the Spring 2010 and Autumn 2011 surveys. One koala was recorded on the Mine Study Area on one occasion during spotlighting within the south-eastern part of the Project Area (EPC 1080 Study Area) during the Spring 2011 survey. This individual was recorded within an open eucalypt woodland environment representing the '*Ironbark-box grassy woodlands and open woodlands on grey sand plains'* habitat type within the Project Area.

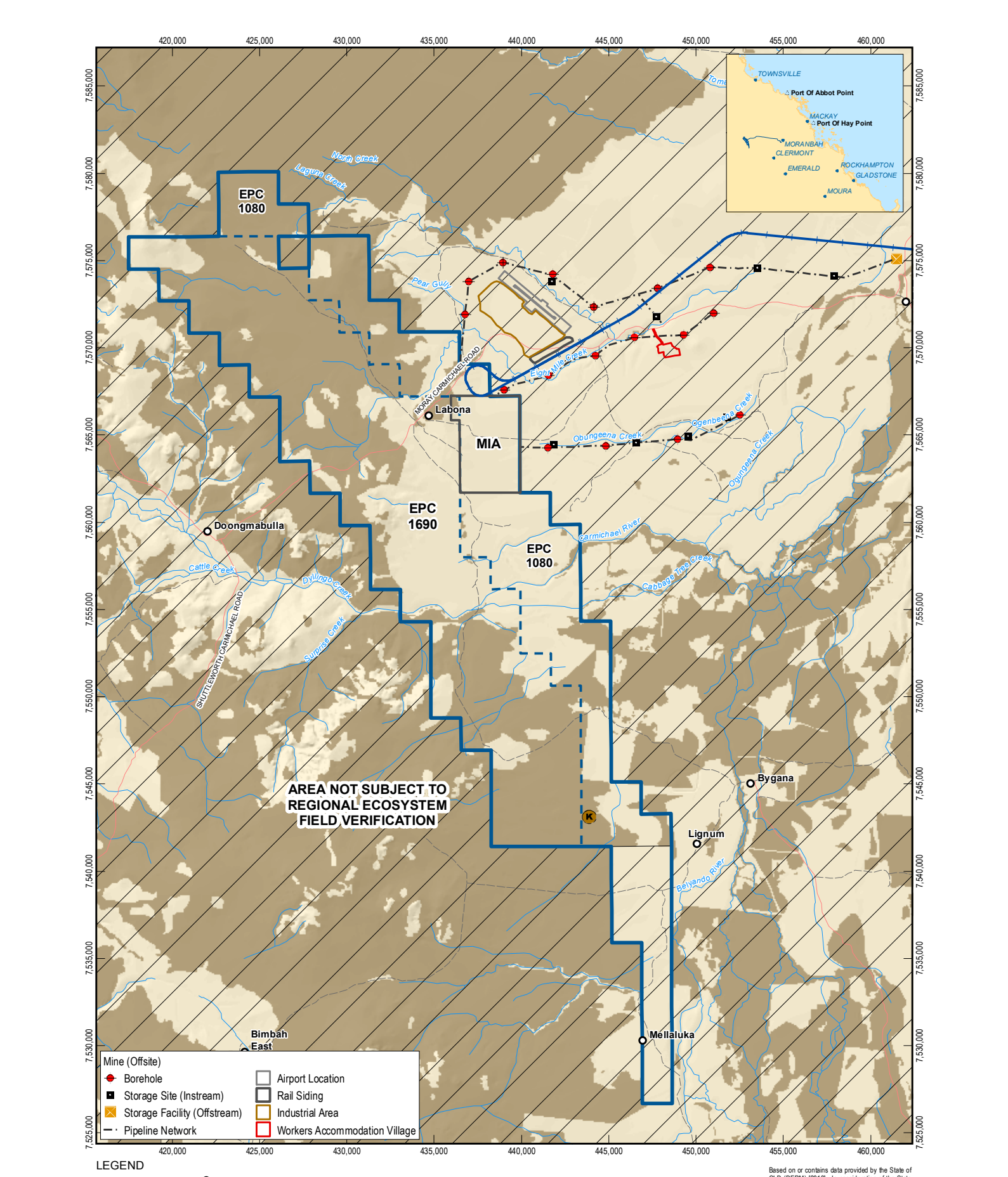
It is likely that the species occurs at low densities in remnant open eucalypt woodland across the Project Area. The Bygana West Nature Refuge in the southern part of the Project Area was proclaimed, amongst other reasons, as it contains suitable koala habitat. Furthermore, mature river red gum woodland along the Carmichael River within the '*Open forest and woodland fringing watercourses and relict stream channels, and alluvial plains subject to flooding*' represents additional potential koala habitat in the Project Area. The location of the koala observed within the Project Area and an indication of potential habitat that might be utilised by this species within the Project Area is presented in Figure 11-8.

To map potential habitat for the koala beyond the Project Area, (DERM certified) REs characterised by open eucalypt woodland and open eucalypt forest vegetation fringing watercourses were identified and mapped. Potential koala habitat beyond the Project Area is presented in Figure 11-9. The presence of potentially suitable habitat beyond the Project Area suggests that the koala is likely to be present in low densities in the wider landscape (excluding to the east where non-remnant vegetation dominates the landscape). Habitat utilisation and abundance is likely to be influenced by availability

of preferred eucalypt species, abundance of predators (especially dogs), climate change and drought (SEWPAC, 2012).

- The koala is considered to have 'scattered populations throughout Queensland' and no defined 'important populations' have been listed by SEWPAC (2012b). With respect to the Significant Impact Guidelines (DEWHA, 2009c), it is not considered that the occurrence of a koala at the Project Area defines it as part of an 'important population' (of an EPBC Act listed vulnerable species). That is, koalas at the Project Area are not considered to be a part of *a population that is necessary for a species' long-term survival and recovery, including populations identified as such in recovery plans, and/or that are:*
- *Key source populations either for breeding or dispersal*
- *Populations that are necessary for maintaining genetic diversity, and/or*
- *Populations that are near the limit of the species range* (DEWHA, 2009c)

Based on the low estimated density of koalas within the Brigalow Belt and the availability of similarly suitable habitat in the landscape surrounding the Project Area, it is not considered that the Project Area represents *habitat critical to the survival of the species.*



LEGEND

- Koala Sighting - Spring 2011
- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Potential Koala Habitat - Based on Field Verified Regional Ecosystems within the Mine Site and DERM Certified Regional Ecosystems Version 6.0b outside the Mine Site

1:275,000 (at A4)
0 1 2 3 4 5
Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

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Koala Records and Potential Habitat at the Project Area

Job Number 41-25215
Revision A
Date 19-11-2012

Figure 11-8

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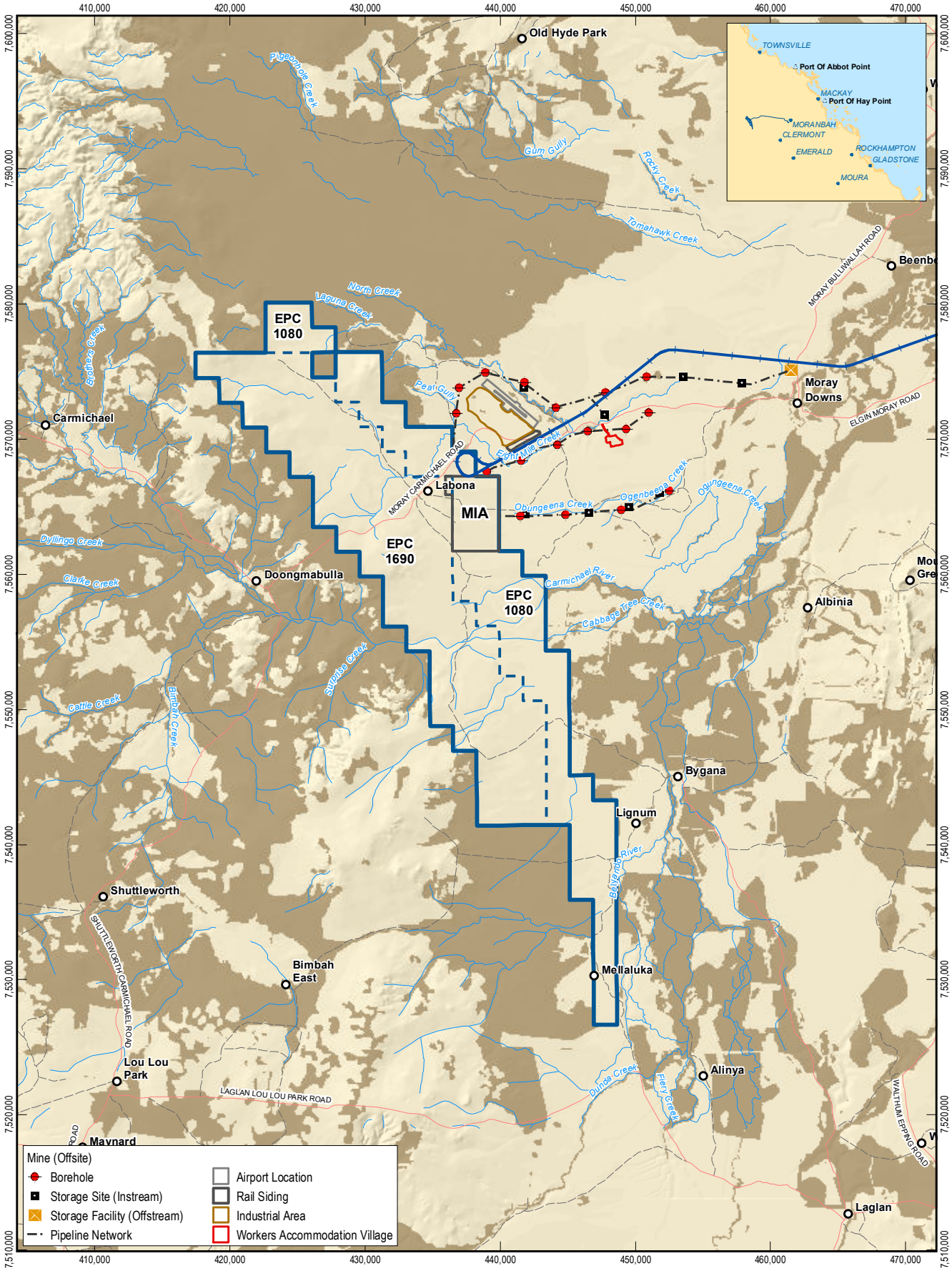

LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Potential Koala Habitat - Based on DERM Certified Regional Ecosystems Version 6.1b

1:400,000 (at A4)

0 2.5 5 7.5 10

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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Potential Koala Habitat
Beyond Project Area

Job Number 41-25215
Revision A
Date 19-11-2012

Figure 11-9

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Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: DERM: Regional Ecosystems v6.1 (2011); DME: EPC 1690 (2010), EPC 1080 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); GHD: Potential Habitat (2012). Created by: BW, CA

Listed Threatened Fauna – Likely to Occur

The following EPBC Act listed threatened species are likely to occur at the Study Area, based on distribution, presence of potentially suitable habitat and previous records from the region:

- Ornamental snake (*Denisonia maculata*) – vulnerable EPBC Act; vulnerable NC Act – Likely to occur across both mine and Rail Study Areas
- Northern quoll (*Dasyurus hallucatus*) – endangered EPBC Act; not listed NC Act – Likely to occur across Rail Study Area
- Yakka skink (*Egernia rugosa*) - vulnerable EPBC Act; vulnerable NC Act – Likely to occur across Mine Study Area

Although these taxa are considered likely to occur within the Study Area, field survey efforts targeted at these taxa did not detect any of these threatened species within the Study Area. These species occur in low densities and are cryptic and failure to detect their presence is not considered an indication of their absence. Rather, it is considered likely that these species occur at the Study Area, based on their known distribution; the presence of suitable habitat and the fact that they have been previously recorded within approximately 50 km of the Study Area. A number of habitat and vegetation types across the Study Area may provide habitat for these listed threatened species. Mapping of these habitats is provided in Volume 4 Appendix J matters of NES and was used in assessment of potential to significantly affect these species.

With respect to the Significant Impact Guidelines (DEWHA, 2009b), it is not considered that the Study Area supports an 'important population' of the EPBC Act-listed vulnerable northern quoll, ornamental snake or yakka skink, in so much as:

- None of these species was detected at the Study Area during targeted surveys
- The Study Area is not considered to constitute habitat for key source populations (breeding/dispersal), especially given the availability of similarly suitable habitat in the surrounding landscape
- The Study Area does not occur at or near the limit of either the snake or skinks distributional range

The northern quoll, ornamental snake or yakka skink, should they occur at the Study Area, are not considered to be a part of *a population that is necessary for a species' long-term survival and recovery, including populations identified as such in recovery plans, and/or that are:*

- *Key source populations either for breeding or dispersal*
- *Populations that are necessary for maintaining genetic diversity, and/or*
- *Populations that are near the limit of the species range* (DEWHA, 2009b).

Based on the fact that none of these species was detected at the Study Area, and that similarly suitable habitat for all three species is present in the landscape surrounding the Study Area, it is not considered that the Study Area represents *habitat critical to the survival of the species* for the northern quoll, yakka skink or ornamental snake (refer Volume 4, Appendix N1 Mine Terrestrial Ecology Report and Volume 4, Appendix AA Rail Ecology Report for further discussion on the ornamental snake and yakka skink at the Mine Study Area, and northern quoll and ornamental snake at the Rail Study Area, respectively).

Listed Threatened Fauna – May Occur

The likelihood of occurrence assessment indicated that the following EPBC Act listed threatened species may occur within the Study Area, based on distribution and/or presence of potentially suitable habitat:

- Dunmall's snake (*Furina dunmalli*) – vulnerable EPBC Act, vulnerable NC Act – may occur at Rail Study Area, unlikely to occur at Mine Study Area
- Greater long-eared bat (*Nyctophilus timoriensis*) (south-eastern form) – vulnerable EPBC Act, vulnerable NC Act – may occur at Rail Study Area, unlikely to occur at Mine Study Area
- Brigalow scaly-foot (*Paradelma orientalis*) – vulnerable EPBC Act, vulnerable NC Act – may occur at Rail Study Area, unlikely to occur at Mine Study Area
- Red goshawk (*Erythrotriorchis radiatus*) – vulnerable EPBC Act, endangered NC Act – may occur at both Rail and Mine Study Areas
- Australian painted snipe (*Rostratula australis*) – vulnerable EPBC Act, vulnerable NC Act – may occur at both Rail and Mine Study Areas

These species were not detected during field studies at the Study Area. They may occur based on the presence of suitable habitat, however, with respect to the Significant Impact Guidelines (DEWHA, 2009b), it is not considered that the Study Area supports an 'important population' of any of these EPBC Act listed species, in so much as:

- None of the taxa were detected at the Study Area, nor have they been previously recorded within 50 km of Mine Study Area, or within 10 km of rail Study Area (desktop assessment)
- The Study Area is not considered to constitute habitat for key source populations (breeding/dispersal), especially given the availability of similarly suitable habitat in the surrounding landscape
- The Study Area does not occur at or near the limit of either species' range

Should any of these taxa occur at the Study Area, they are not considered to be a part of *a population that is necessary for a species' long-term survival and recovery, including populations identified as such in recovery plans, and/or that are:*

- *Key source populations either for breeding or dispersal*
- *Populations that are necessary for maintaining genetic diversity, and/or*
- *Populations that are near the limit of the species range* (DEWHA, 2009b).

Based on the fact that none of these species were detected at the Study Area (nor have they been recorded from the desktop search extent), and that similarly suitable habitat for these species is present in the landscape surrounding the Study Area (refer Volume 2, Section 5 Mine Nature Conservation and Volume 3, Section 5 Rail Nature Conservation for further discussion on these species, including likelihood of occurrence assessment), it is not considered that the Study Area represents *habitat critical to the survival of the species* for these species.

Listed Threatened Fauna – Unlikely to Occur

The likelihood of occurrence assessment indicated that the following EPBC Act listed threatened fauna species, none of which were recorded during field surveys, are unlikely to occur based on current knowledge of their distribution and/or the lack of suitable habitat within the Study Area:

- Retro slider (*Lerista allanae*) – endangered EPBC Act – unlikely to occur at Rail Study Area, not detected in Mine Study Area search
- Fitzroy River turtle (*Rheodytes leukops*) – vulnerable EPBC Act – unlikely to occur at Rail Study Area, not detected in Mine Study Area search
- Star finch (*Neochmia ruficauda ruficauda*) (eastern and southern) – endangered EPBC Act, – unlikely to occur at either Rail or Mine Study Areas
- Northern hairy-nosed wombat (*Lasiorhinus krefftii*) – endangered EPBC Act – unlikely to occur at either Rail or Mine Study Areas
- Greater bilby (*Macrotis lagotis*) – vulnerable EPBC Act – unlikely to occur at mine Study Area, not detected at Rail Study Area
- Paradise parrot (*Psephotus pulcherrimus)* – extinct EPBC Act –extinct in the wild and, therefore, not likely to occur at either Study Areas

Based on the fact that none of these species were detected at the Study Area (and that suitable habitat for these species is generally lacking from the Study Area (refer Volume 2, Section 5 Mine Nature Conservation and Volume 3, Section 5 Rail Nature Conservation of this EIS), none of these taxa are considered likely to occur at the Study Area and impacts are not expected to occur to these species. These species have, therefore, not been considered further within the impact assessment.

11.4.1.3 Listed Threatened Ecological Communities

Ecological communities are naturally occurring biological assemblages that comprise a particular habitat type. Threatened Ecological Communities (TECs) are ecological communities that have been assessed under the EPBC Act and assigned to one of five categories related to the status of the threat to the community, i.e. conservation dependant, vulnerable, endangered, critically endangered and extinct in the wild.

Four TECs listed under the EPBC Act were identified as having potential to occur in the Study Area from desktop results. All four TECs are classified as endangered. The TECs are as follows:

- Brigalow (*Acacia harpophylla)* dominant and co-dominant
- The community of native species dependant on natural discharge of groundwater from the Great Artesian Basin (GAB)
- Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions
- The Brigalow TEC was identified as occurring in the Study Area from field surveys and vegetation mapping. None of the Natural Grasslands TEC, the Semi-evergreen Vine Thicket TEC nor GAB dependent species occur within the Study Area. All TECs are, however, described in more detail below.
- One additional EPBC Act listed TEC, Weeping Myall Woodland, was identified in the Project ToR for consideration in this assessment although it did not present in the EPBC search for the area. This species was not identified through the desktop assessment (i.e. predicted to occur or previously recorded in desktop search extent), nor was it confirmed present during field investigations. This TEC is not present within the Project Area and the SEWPAC mapping for this community locates the far north eastern boundary approximately 200 km to the east and south of

the Project Area; no direct or indirect impacts are predicted to occur to this TEC and it is not considered further in this assessment.

Brigalow (Acacia harpophylla Dominant and Co-dominant)

The Brigalow TEC comprises vegetation communities dominated or co-dominated by brigalow (*Acacia harpophylla*). Within Queensland, 16 REs are described as forming part of this TEC. All of these REs are located in either the Brigalow Belt, South-East Queensland or Mulga Lands bioregions – none are located in the Desert Uplands.

Of the REs listed as forming part of the TEC, only the REs 11.3.1, 11.4.8 and 11.4.9 occur within the Study Area. Ground truthing has determined that approximately 1355 ha of these REs are present within the Rail Study Area and 267 ha of these REs are present within the Mine Study Area. In the Rail Study Area the majority of this brigalow is located west of Gregory Development Road, with several small patches occurring close to Mistake Creek and approaching the Belyando River. The distribution of Brigalow TEC within the Study Area and in the context of the wider landscape is presented in Figure 11-10.

The Community of Native Species Dependant on Natural Discharge of Groundwater from the Great Artesian Basin

Native flora, fauna (including fish) and invertebrate species form a community dependant on natural discharge of groundwater from the Great Artesian Basin (abbreviated to 'GAB discharge spring wetlands') TEC (Fensham *et al.*, 2010). This dependency restricts distribution of the TEC to the GAB. Surveys confirmed that this TEC is not present within the Study Area. However, impacts to regional aquifers as a result of groundwater draw down have the potential to impact this TEC.

The nearest GAB discharge spring is the Doongmabulla wetland, a cluster of 11 springs located within a four kilometre radius of each other along the Carmichael River, approximately ten kilometres upstream (west) from the western boundary of the Study Area (Fensham pers. comm., 2012). This wetland has an area of five hectares, and contains six flora species of conservation significance, including two species known to be endemic to the Doongmabulla spring (the herb *Erygynium fontanum* and the grass *Sporobolus pamelae*). It has been given a GAB discharge spring wetland conservation ranking of 1a (the highest), based on the presence of endemic species (Fensham *et al*., 2010).

The main threatening processes for this TEC are aquifer draw down (due primarily to uncapped bores, but also to mining activities), excavation of springs, exotic flora and fauna invasion and stock damage, access by tourism, and impoundments (Fensham *et al*., 2010).

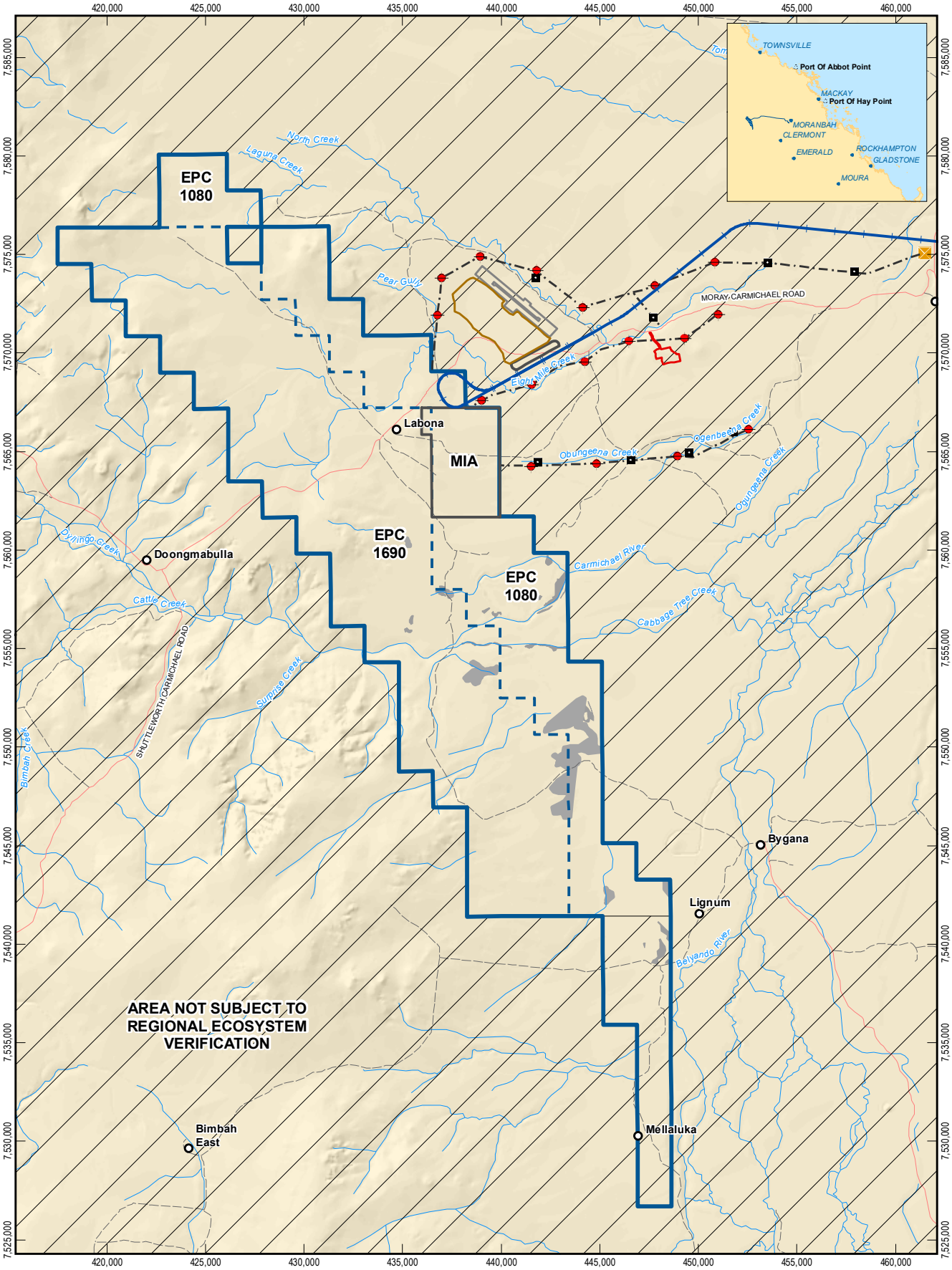
Natural Grasslands of the Queensland Central Highlands and the Northern Fitzroy Basin

This TEC is comprised typically of native tussock grasslands composed of perennial native grass species. This TEC can occur over a diversity of habitats as influenced by factors such as rainfall, soil, geology and previous land use. This TEC is found on fine textured soils derived from either basalt or fine-grained sedimentary rocks, on flat or gently undulating rises. This ecological community is endemic to Queensland, extending from Collinsville in the north to the Carnarvon National park in the south. It broadly occurs where the Fitzroy River Basin and the Brigalow Belt North coincide. This TEC has been heavily affected by disturbance and degradation and there are very few patches of undisturbed natural grasslands remaining.

The Natural Grassland TEC only occurs within the Northern Bowen Basin subregion of the Brigalow Belt bioregion (TSSC, 2008). No constituent REs, and thus the Natural Grassland TEC, are mapped within the Northern Bowen Basin subregion of the Study Area. However, this TEC may occur adjacent to the eastern extent of the rail Study Area.

Semi-evergreen Vine Thickets of the Brigalow Belt (North and South) and Nandewar Bioregions

Semi-evergreen vine thicket TEC is an extreme form of dry seasonal rainforest characterised by trees with microphyll sized leaves and the presence of bottle trees (*Brachychiton* spp.) as emergents (DSEWPaC 2011n). Ten REs comprise the SEVT TEC in Queensland. None of these REs are mapped within the Study Area nor were they identified during field surveys. This TEC is not considered likely to be present within the Study Area and is, therefore, not considered further in the impact assessment.



LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Brigalow Threatened Ecological Community
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

1:275,000 (at A4)
0 1 2 3 4 5
Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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Brigalow Threatened Ecological Community - Project Area

Job Number 41-25215
Revision B
Date 19-11-2012

Figure 11-10

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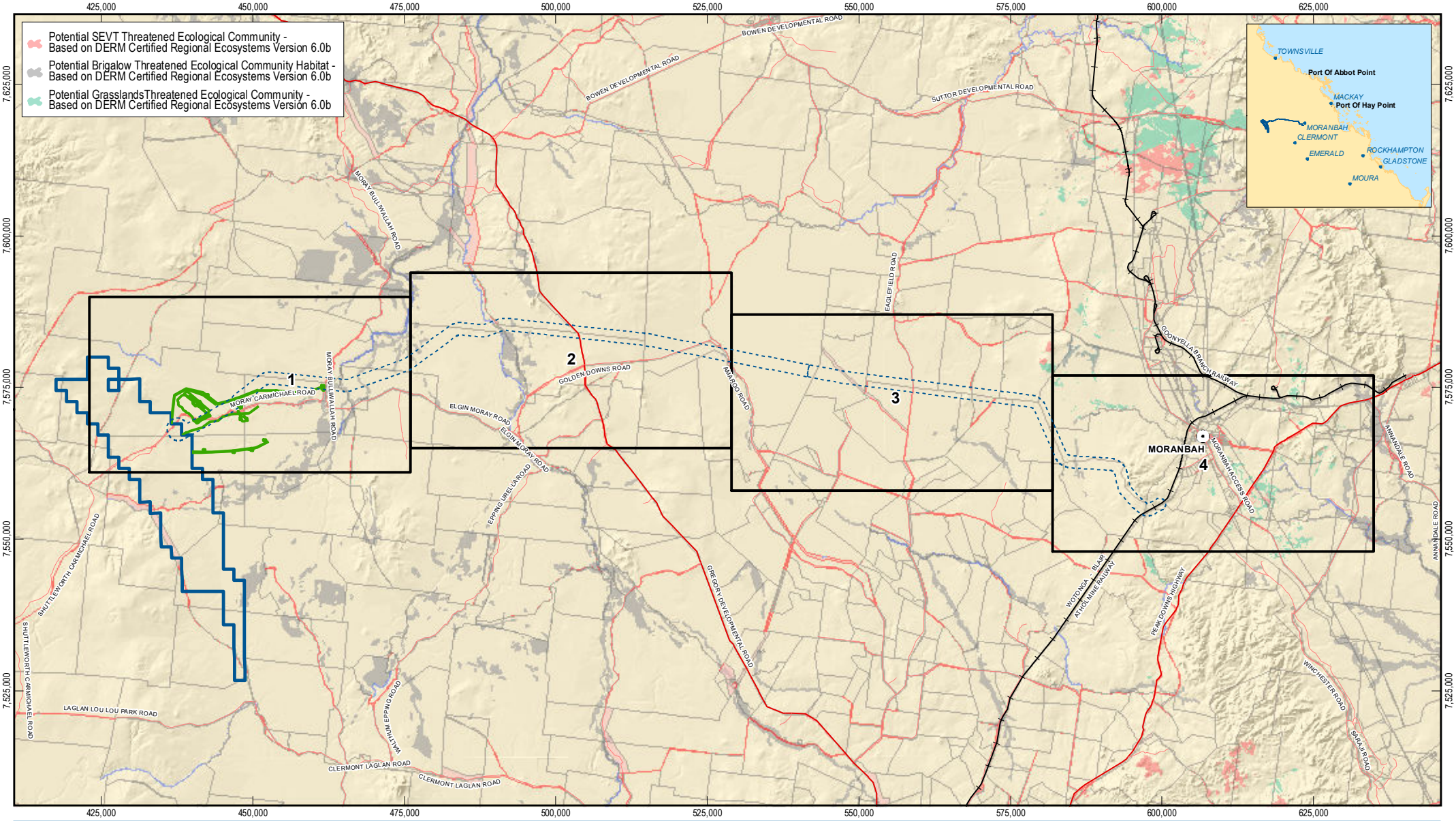
Data Source: DME: EPC 1690 (2010), EPC 1080 (2011); DERM: Threatened Ecological Communities (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: BW, CA



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0 5 10 15 20 25

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Town
- State Road
- Local Road
- Other Railway
- Cadastral Parcel
- Road Reserve
- Watercourse Reserve
- Mine (Onsite)
- Mine (Offsite)
- Study Area

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Carmichael Coal Mine and Rail Project

Potential Threatened Ecological Communities Within the Study Area and Surrounding Landscape

Job Number 41-25215
Revision C
Date 19-11-2012

Figure 11-11
Series Index

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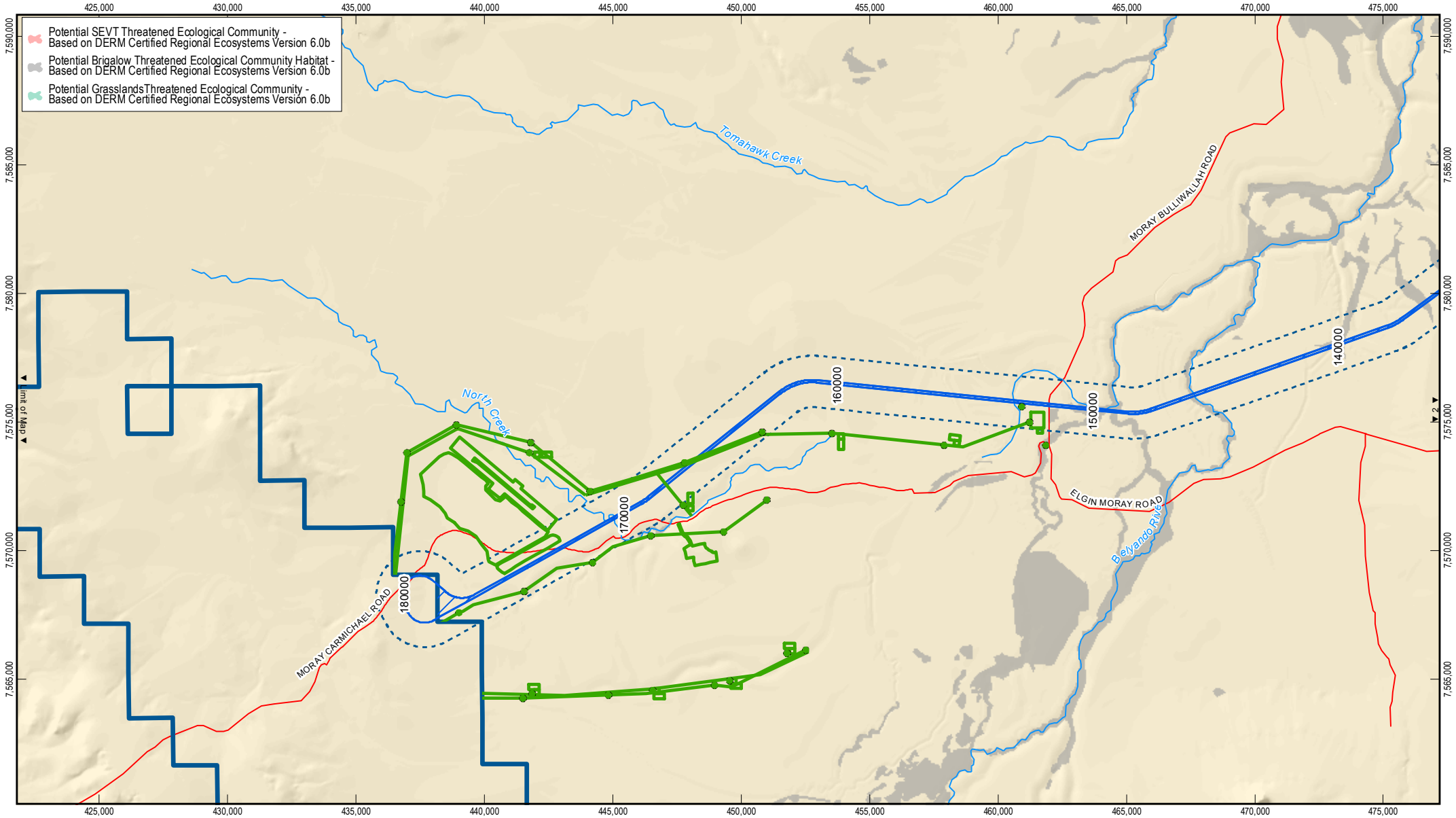
Data source: DERM: DEM (2008), DCDB (2010); DME: EPC1690 (2010)/EPC1080 (2011); © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Roads (2007); Adani: Alignment Corridors Opt9 Rev3 (2012); GHD: Northern Missing Link (2011); Gassman/Hyder: Mine (Offsite) (2012). Created by: BW, CA



1:200,000 (at A4)

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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Town
- State Road
- Local Road
- Watercourse
- Other Railway
- Mine (Onsite)
- Mine (Offsite)
- Mine (Offsite)
- Rail (West)
- Rail (East)
- Study Area

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Carmichael Coal Mine and Rail Project

Potential Threatened Ecological Communities within the Rail Study Area and Surrounding Landscape

Job Number 41-25215
Revision C
Date 19-11-2012

Figure 11-11
Sheet 1 of 4

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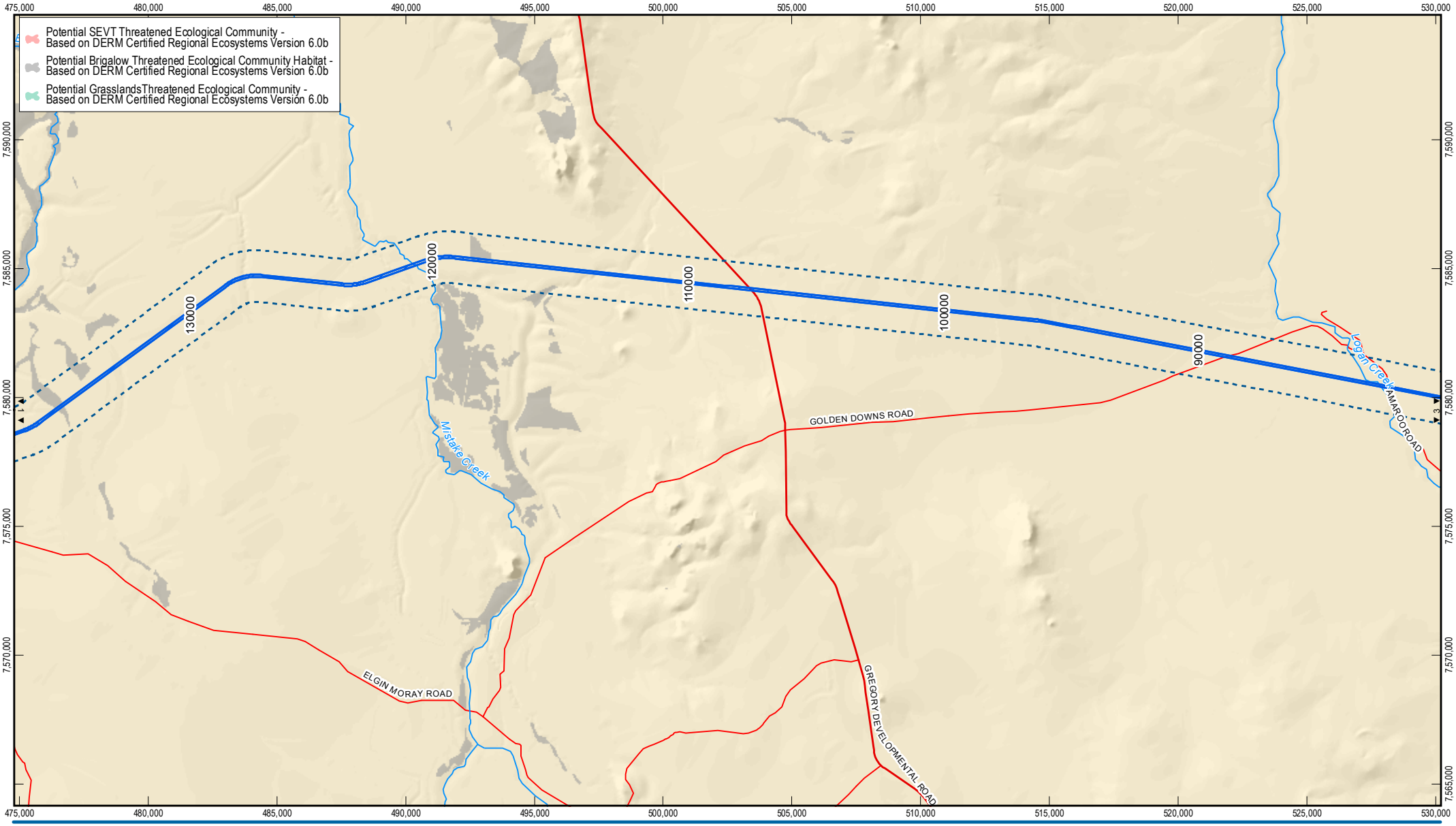
Data source: DERM: DEM (2008), © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Roads, Watercourse (2007); GHD: Potential Threatened Ecological Communities (2012); Adani: Alignment Opt9 Rev3 (2012); DME: EPC1690 (2010) / EPC1080 (2011); Gassman/Hyder: Mine (Offsite) (2012). Created by: MR, CA



1:200,000 (at A4)
0 1 2 3 4 5
Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Town
- State Road
- Local Road
- Watercourse
- Other Railway
- Mine (Onsite)
- Mine (Offsite)
- Mine (Offsite)
- Rail (West)
- Rail (East)
- Study Area

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Potential Threatened Ecological Communities within the Rail Study Area and Surrounding Landscape

Job Number 41-25215
Revision C
Date 19-11-2012

Figure 11-11
Sheet 2 of 4

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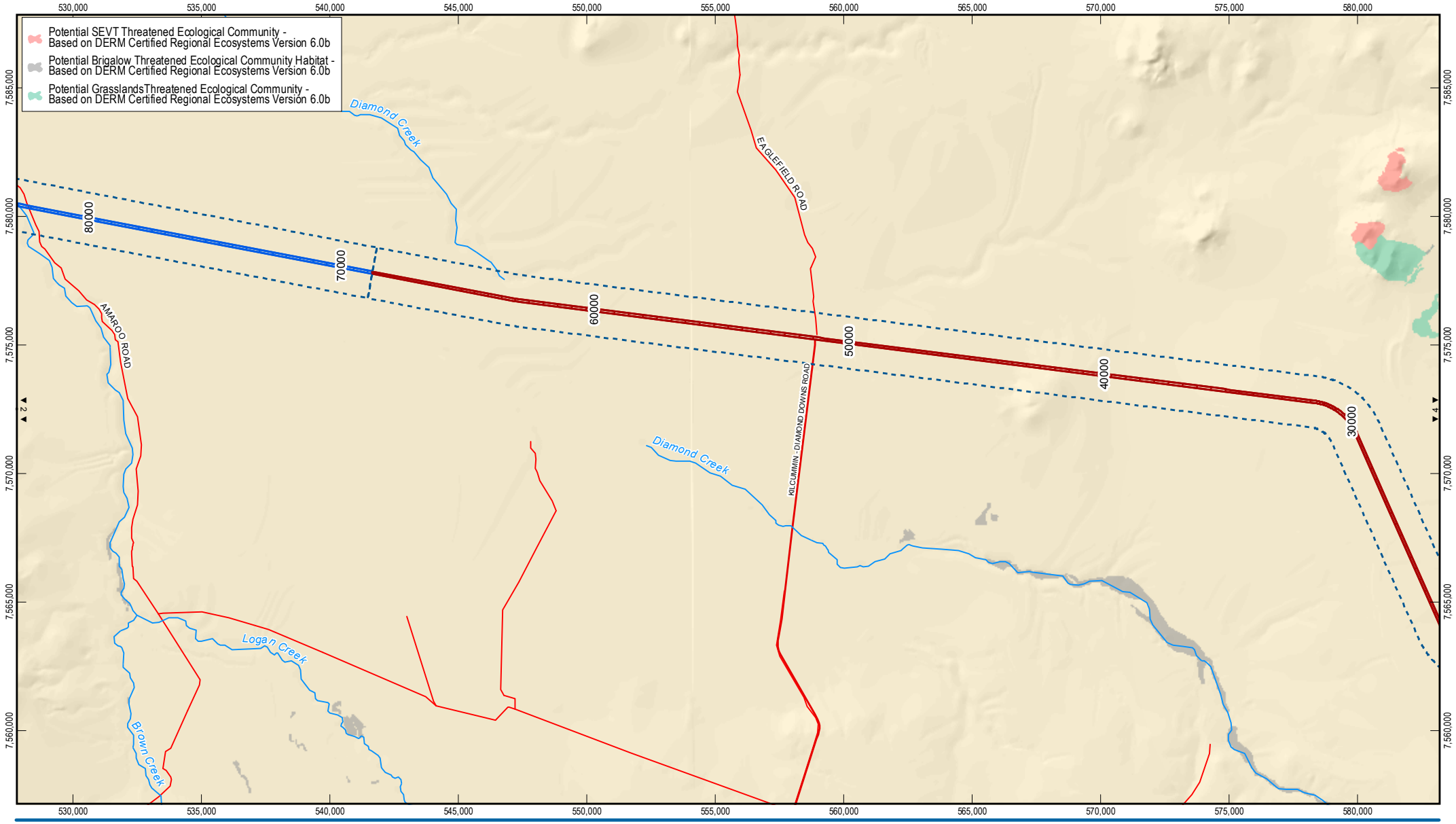

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Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Town
- State Road
- Local Road
- Watercourse
- Other Railway
- Mine (Onsite)
- Mine (Offsite)
- Mine (Offsite)
- Rail (West)
- Rail (East)
- Study Area

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Potential Threatened Ecological Communities within the Rail Study Area and Surrounding Landscape

Job Number 41-25215
Revision C
Date 19-11-2012

Figure 11-11
Sheet 3 of 4

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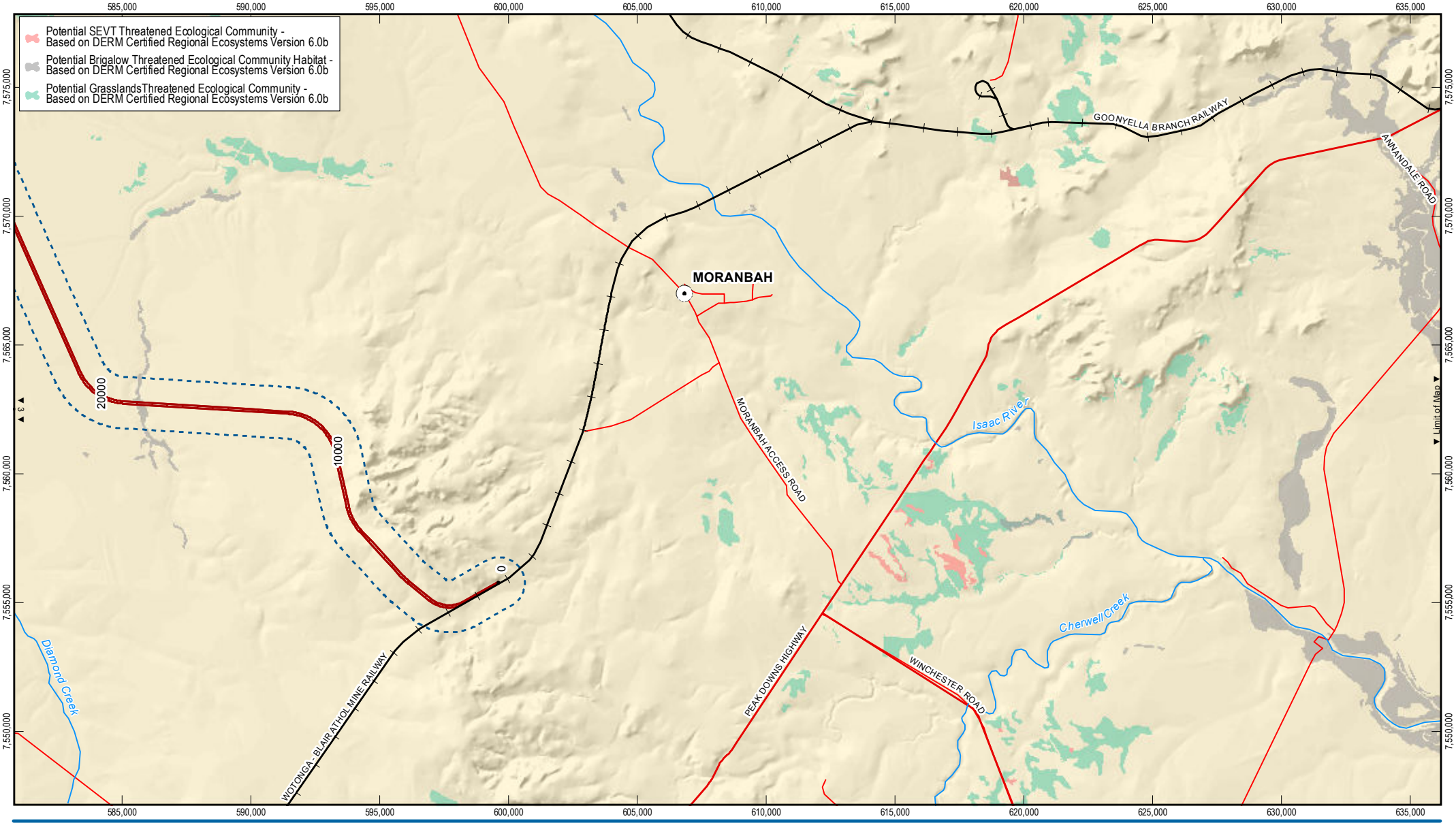

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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Town
- State Road
- Local Road
- Watercourse
- Other Railway
- Mine (Onsite)
- Mine (Offsite)
- Mine (Offsite)
- Rail (West)
- Rail (East)
- Study Area

Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project

Potential Threatened Ecological Communities within the Rail Study Area and Surrounding Landscape

Job Number 41-25215
Revision C
Date 19-11-2012

Figure 11-11
Sheet 4 of 4

G:\41\25215\GIS\Maps\MXD\400_Ecology\41-25215_469_200k_rev_c.mxd Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DERM: DEM (2008), © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Roads, Watercourse (2007); GHD: Potential Threatened Ecological Communities (2012); Adani: Alignment Opt9 Rev3 (2012); DME: EPC1690 (2010) / EPC1080 (2011); Gassman/Hyder: Mine (Offsite) (2012). Created by: MR, CA

11.5 Potential Impacts and Mitigation Measures

11.5.1 Summary of Matters of NES for Assessment

As described under Section 11.4, the following protected matters of NES are known, likely to occur or may occur within the Study Area:

- Threatened flora
  - Waxy cabbage palm (*Livistona lanuginosa*) – threatened EPBC Act; not predicted to occur in Study Area, detected in field assessments
  - *Acacia ramiflora* – vulnerable EPBC Act; May occur across Study Area
  - King bluegrass (*Dichanthium queenslandicum*) – vulnerable EPBC Act; May occur across Rail Study Area, Unlikely to occur across Mine Study Area
- Threatened Species
  - Black-throated finch (southern) (*Poephila cincta cincta*) – endangered EPBC Act; Known to occur at Mine and Likely to occur at Rail Study Area
  - Squatter pigeon (southern) (*Geophaps scripta scripta*) – vulnerable EPBC Act; Known to occur across both Mine and Rail Study Areas
  - Koala (*Phascolarctos cinereus*) (combined populations of Queensland, New South Wales and the Australian Capital Territory) –vulnerable EPBC Act; Known to occur across both Mine and Rail Study Areas
  - Ornamental snake (*Denisonia maculata*) – vulnerable EPBC Act; Likely to occur across both Mine and Rail Study Areas
  - Northern quoll (*Dasyurus hallucatus*) – endangered EPBC Act; Likely to occur across Rail Study Area
  - Yakka skink (*Egernia rugosa*) - vulnerable EPBC Act; Likely to occur across Mine Study Area
- Threatened Ecological Communities
  - Brigalow (*Acacia harpophylla* dominant and co-dominant) – endangered under EPBC Act; Known to occur in Mine and Rail Study Areas
  - The community of native species dependant on natural discharge of groundwater from the Great Artesian Basin (GAB) – endangered under EPBC Act; Known to occur west of Mine Study Area, may be subject to indirect impacts

These protected matters have potential to be impacted by processes described under Section 11.1.5 as a result of the Project progressing.

11.5.1.1 Conceptual Summary of Potential Impacts

Potential impacts to terrestrial and aquatic ecology values associated with the Project have been summarised into four broad categories which include:

- Clearing of vegetation
- Disturbances of watercourses and changes to surface water flows
- Increased anthropogenic activity leading to disturbance

- Introduction of weeds and feral pest species

These are described in detail in Volume 2, Section 5 Mine Nature Conservation and Volume 3, Section 5 Rail Nature Conservation of the EIS and considered in reference to matters of NES following and within Volume 4 Appendix J. Under Volume 2, Section 5 and Volume 3, Section 5 detailed consideration to approaches to minimise potential impacts were considered, including minimising potential footprint, setback options and construction sequencing. These measures are considered to have been adopted into the assessment here such that impacts identified are those which cannot be avoided. To achieve the impact assessment for matters of NES the rail and mine study components are addressed separately. The impacts from each will be realised across different time frames and will impact matters of NES in different ways. Therefore, to accurately understand impacts the construction and operational phase work impacts on matters of NES are considered for the rail and mine footprint independently. Collective or cumulative impacts as a result of both aspects of the Project progressing are, however, noted where appropriate.

11.5.1.2 Rail Construction

Impacts

Collectively the temporary and permanent infrastructure comprises the Project footprint for the construction phase of the Project. The extent of the Project footprint is presented in Figure 11-12.

Construction of the rail infrastructure will result in clearing of a 95 m by 189 km corridor within the Rail Study Area and rail infrastructure will be established. The Project's construction process will be intensive for the first three years with impacts moving progressively along the rail alignment ahead of the laying of track.

Potential impacts arising from vegetation clearing during the construction phase may include:

- Loss of remnant vegetation in the form of REs, flora habitat and vegetation community extents
- Loss of habitat (roosting, shelter, foraging, breeding) for native fauna including conservation significant fauna
- Degradation of terrestrial and aquatic habitat adjacent to and downstream of cleared areas
- Landscape fragmentation, reduction in connectivity and reduced capacity for fauna dispersal
- Fauna mortality

REs to be impacted that may also meet TEC criteria have been identified. The total area of potential TEC's to be cleared from within the construction footprint includes:

- 37.4 ha of REs potentially consistent with the Brigalow (*Acacia harpophylla* dominant and co-dominant).

The total impact to potential habitat for EPBC Act listed fauna and to TEC communities or flora species as a result of the proposed constriction activities for the Rail Project is summarised in Table 11-2.

Table 11-2 Impact to EPBC Act Listed Threatened Matters from Rail Construction

EPBC Act listed fauna species	EPBC Act status	Total clearing extent*
Confirmed present		
squatter pigeon (southern) *Geophaps scripta scripta*	vulnerable	145.7 ha
Brigalow *(Acacia harpophylla* dominant and co-dominant) TEC	endangered	37.4 ha
Likely to occur		
Ornamental snake *Denisonia maculata*	vulnerable	229.5 ha
Northern quoll *Dasyurus hallucatus*	endangered	64.7 ha
Black-throated finch (southern) *Poephila cincta cincta*	endangered	143.2 ha
May occur		
Yakka skink *Egernia rugosa*	vulnerable	229.5 ha
Dunmall's snake *Furina dunmalli*	vulnerable	82.4 ha
Brigalow scaly-foot *Paradelma orientalis*	vulnerable	164.8 ha
Greater long-eared bat *Nyctophilus corbeni*	vulnerable	143.2 ha
Red goshawk *Erythrotriorchis radiatus*	vulnerable	47.6 ha
Australian painted snipe *Rostratula australis*	vulnerable; marine; migratory (CAMBA)	194.6 ha
Acacia ramiflora	vulnerable	66 ha
King bluegrass *Dichanthium queenslandicum*	vulnerable	0 ha

*total clearing extent is based on the broad vegetation community/ fauna habitat types as they apply to each species. Exceptions are with black throated finch (which has had its mapped potential habitat refined through mapping only those REs that known records of species have been obtained) and the squatter pigeon (which has had its habitat mapped based on REs characterised by open woodland and forest vegetation).

Mitigation and Management Measures

Management and mitigation measures associated with the rail construction are detailed in Volume 3, Section 5 of this EIS and are identified within the Project EMP (Volume 3, Section 13) and within Volume 4 Appendix J matters of NES Report. Key measures to mitigate impacts to matters of NES are summarised here. The total extent of vegetation clearing, and in particular remnant vegetation, required for the rail construction phase has been minimised in the design phase of the Project (Rail) through avoidance. The Project (Rail) alignment has as far as is practicable (and in consideration of other environmental, social and technical constraints) been located in areas that have been previously cleared or degraded by both past and current land use practices (refer Volume 1 Section 2 Introduction for discussion on Project alternatives).

- Clearance extent will be restricted to only that necessary for the Project. Rehabilitation of cleared areas is to occur as soon as practically possible after cleared areas are no longer required.
- Vegetation clearing will be undertaken in a sequential manner to allow mobile fauna to disperse away from clearing areas. A fauna species relocation plan will be developed to facilitate relocation of fauna individuals according to species requirements (particularly if conservation significant fauna species are encountered during clearing activities).
- Fencing, waste management, speed limits, fire controls, light spill controls, dust suppression, pest and weed controls, management of sewage and other potentially harmful wastes and pollutants will be utilised onsite to minimise direct or indirect impacts to fauna or pollution of the environment.
- Design must incorporate stormwater management infrastructure and mechanisms to minimise the change in flow regime of watercourses where appropriate and mitigate potential pollution. This may include holding tanks and/or gross pollutant traps.
- A Project Erosion and Sediment Control Plan will be implemented to limit degradation of aquatic habitat. Stream flow should be maintained to provide connectivity between aquatic habitats and facilitate aquatic fauna passage.

11.5.1.3 Rail Operation

Impacts

The operational footprint of the rail infrastructure is wholly contained within the construction footprint. The permanent infrastructure will include:

- Rail corridor (95 m wide) (fenced and inclusive of maintenance/service road, passing loops and bad order sidings)
- Rollingstock maintenance yard

This will enable transport of up to 100 Mtpa to the designated port facility and operate 24 hours, 7 days a week. No clearing of vegetation (outside of the construction phase) is expected to occur within the operation phase of the Project (Rail) other than that required for maintenance of infrastructure and access tracks.

Potential impacts arising from activities during the operation phase may include:

- Localised behavioural disruption to fauna from increased activities

- Spread or introduction of weeds, wastes or pollutants affecting the quality of terrestrial or aquatic habitat
- Fauna mortality as a result of interaction with trains

The rail infrastructure will create a permanent linear barrier across the landscape for fauna movement. This will be established within the construction phase and mitigation measures will be applied. However, this fragmentation impact will be realised for the operational life of the rail and will influence the use of the landscape by fauna. This influence is expected to have a localised effect on fauna movements, however, at a regional scale it is unlikely that this fragmentation will result in adverse impacts given that the environment is pre-adapted and currently functions as a fragmented landscape from the existing fragmented nature of the surrounding landscape from historical clearing and grazing practices.

Management and Mitigation

Measures to mitigate and ameliorate potential impacts that may occur during the operation of the rail will include:

- Spanning of watercourses to not interfere with floodplain hydraulics or aquatic habitat connectivity.
- Sediment traps will be established at strategic locations to protect waterbodies from sediment and pollutants.
- Fauna corridors will be used to promote fauna use. Consideration will be given to fauna/fish passage requirements and design will adopt criteria which promote fauna use.
- Fencing, waste management, speed limits, fire controls, pest and weed controls, vehicle maintenance and pollutant and waste/hazardous substance management plans will be utilised onsite to minimise direct or indirect impacts to flora or fauna or pollution of the environment.
- The rail will be fenced to restrict ability of fauna to move across the rail line.
- The railway infrastructure will not be lit, excepting for the balloon loop and maintenance facility. This will mitigate lighting impacts on fauna behaviour for the majority of the length of the corridor. It is expected that fauna will avoid areas such as the loop or maintenance facility, or will habituate to those disturbances.
- Noise and dust generated through operations is transient and predicted to be within acceptable guideline/criteria limits.
- Maintenance personnel and vehicle movements will be localised and confined to the operational footprint.

These management actions seek to avoid or reduce impacts and will be implemented and controlled through an Operational Management Plan for the rail Project. In consideration of the localised nature of impacts and the management of these impacts through an integrated suite of management actions, impacts to fauna are considered to be low and localised. Standardised monitoring and auditing of the application and performance of management and mitigation strategies will be undertaken, with corrective actions implemented where required. Losses of vegetation that cannot be ameliorated will be realised during the construction phase and no additional losses that may require offset are expected to occur during the operational phase.

11.5.1.4 Mine Construction

Impacts

The construction phase of the mine Project will involve the following activities:

- Development of MIA – predominantly occurs within non-remnant vegetation (based on field-verified RE mapping)
- Development of the mine offsite infrastructure including a workers accommodation village, an industrial area, a permanent airport and water supply infrastructure

It is understood that:

- Construction will be undertaken during conditions to minimise potential erosion and sediment control impacts as far as practicable
- Construction affected water will be captured and treated prior to discharge and/or reuse
- Water required for construction will be sourced from onsite dam and offsite sources)
- Sanitation for construction crew will be treated to A standard and recycled onsite or discharged

The majority of the 1921 ha to be affected during the MIA mine construction phase is cleared land and typified by non-remnant vegetation, with the exception of 24 ha of remnant vegetation located at north-western most part of the MIA footprint. For construction of the offsite infrastructure, 3227 ha of non-remnant vegetation and 86 ha of remnant vegetation is proposed to be cleared. Field studies indicated that cleared land was typically of relatively low ecological value. Cleared areas were generally not found to provide a suite of habitat resources for conservation significant terrestrial ecological values (i.e. threatened species, migratory species, TECs etc.), although three black-throated finch (southern) and squatter pigeon (southern) sightings were made at water bodies surrounded by non-remnant vegetation, including at one site which was near the proposed location of the mine village.

To achieve construction of the mine facilities lands will be cleared and infrastructure will be built. Potential impacts arising from vegetation clearing during the construction phase may include:

- Loss of vegetation and fauna habitat (including roosting, foraging and breeding areas)
- Degradation of terrestrial and aquatic habitat adjacent to and downstream of cleared areas
- Landscape fragmentation, reduction in connectivity and reduced capacity for fauna dispersal
- Fauna mortality
- Introduction of weed and pest species, wastes or contaminants

Impacts identified under Section 11.5.1.2 are analogous to those that would be realised under Mine Construction. Detailed assessment of all potential impacts is provided in Volume 4 Appendix J. These are summarised herein. Land clearing for construction will affect approximately 30 ha of potentially suitable habitat for the black-throated finch (southern) (confirmed present at Study Area) the squatter pigeon (southern) (confirmed present at Study Area) and the koala (confirmed present at Study Area), approximately 57 ha of potentially suitable habitat for the yakka skink (likely to occur at Study Area) and approximately 27 ha of potentially suitable habitat for the ornamental snake (likely to occur at Study Area). In addition to conservation significant species, these vegetation communities provide habitat features for a variety of common woodland bird, reptile and mammal species.

Alteration of the topography of the landscape to achieve development of the MIA will result in changes to surface flows and geomorphology. The existing open grazing land will be compacted and developed and, as such, the resultant land will have a higher potential for runoff. Individuals and/or populations of some of the species recorded from the terrestrial and aquatic environments across the MIA will be lost from the local environment due to clearing and watercourse disturbance proposed for the construction phase of the mine Project. The total impact to potential habitat for EPBC Act listed fauna species and to TEC communities or flora as a result of the proposed construction activities for the Project is summarised in Table 11-3.

Table 11-3 Impact to EPBC Act Listed Threatened Matters from Mine Construction

EPBC Act listed matters	EPBC Act status	Total clearing extent*
Confirmed present		
Squatter pigeon (southern) *Geophaps scripta scripta*	vulnerable	30 ha
Black-throated finch (southern) *Poephila cincta cincta*	endangered	30 ha
Koala *Phascolarctos cinereus*	vulnerable	30 ha
Likely to occur		
Ornamental snake *Denisonia maculata*	vulnerable	27 ha
Yakka skink *Egernia rugosa*	vulnerable	57 ha
May occur		
Red goshawk *Erythrotriorchis radiatus*	vulnerable	24 ha
Australian painted snipe *Rostratula australis*	vulnerable; marine; migratory (CAMBA)	One artificial waterbody
Acacia ramiflora	vulnerable	0 ha

*total clearing extent is based on the broad vegetation community/ fauna habitat types as they apply to each species. Exceptions are with black throated finch (which has had its mapped potential habitat refined through mapping only those REs that known records of species have been obtained) and the squatter pigeon (which has had its habitat mapped based on REs characterised by open woodland and forest vegetation).

Management and Mitigation

Management and mitigation measures applied to Rail construction and operation are appropriate to also be applied to Mine construction works. Design will minimise the extent of land to be cleared for the construction of the MIA, airport, workforce accommodation village and offsite infrastructure. Where land clearing is required, the following management and mitigation measures will apply to minimise impacts:

- The extent of vegetation clearing must be clearly identified on construction plans and in the field. As soon as possible after cleared areas are no longer required, rehabilitation will commence using flora species of local provenance. Management of land disturbed as a result of construction works will occur in accordance with a Project Land Rehabilitation Plan.
- Vegetation clearing will be undertaken in a sequential manner to allow mobile fauna to disperse away from clearing areas. A fauna species relocation plan will be developed to facilitate relocation of fauna individuals according to species requirements (particularly if conservation significant fauna species are encountered during clearing activities).
- Waste management, speed limits, fire controls, dust suppression, pest and weed controls, management of sewage and other potentially harmful wastes and pollutants will be utilised onsite to minimise direct or indirect impacts to fauna or pollution of the environment.
- Landscape permeability will be retained where possible. Where fencing is required, it will be designed such that fauna can move through it excluding those instances where fenced areas seek to protect fauna from threats such as trenches.
- Design must incorporate stormwater management infrastructure and mechanisms to minimise the change in flow regime of watercourses where appropriate and mitigate potential pollution.
- Avoid and minimise human and vehicle access to river and creek bed and banks. Construction of river/watercourse crossings ahead of track construction (as far as is possible) will reduce the need for personnel, equipment, machinery and plant to traverse the river/watercourse and limit disturbance to bed and banks.
- A Project Erosion and Sediment Control Plan will be implemented to limit degradation of downstream aquatic habitat. Temporary stream or channel diversion may be required to facilitate activities in wet periods. Stream flow should be maintained to provide connectivity between aquatic habitats and facilitate aquatic fauna passage.

The mine construction impacts will be progressive with a timeframe that achieves peak production within 10 years. There is an initial intense construction phase (first three years) to realise first mine activity. Rehabilitation and progressive development will occur throughout the life of the Project.

11.5.1.5 Mine Operation

Impacts

Full details about the staged operations of the proposed mine are provided in the Description of the Project (refer to Volume 1, Section 2). Detailed information regarding impacts that may be realised from the intended operational works is provided in Volume 4 Appendix J matters of NES Report. Information is summarised here to support assessment of impacts to matters of NES that are likely to be associated with operational work activities, and to identify and nominate relevant management and mitigation measures.

The operation phase of the Project is proposed to involve the following activities:

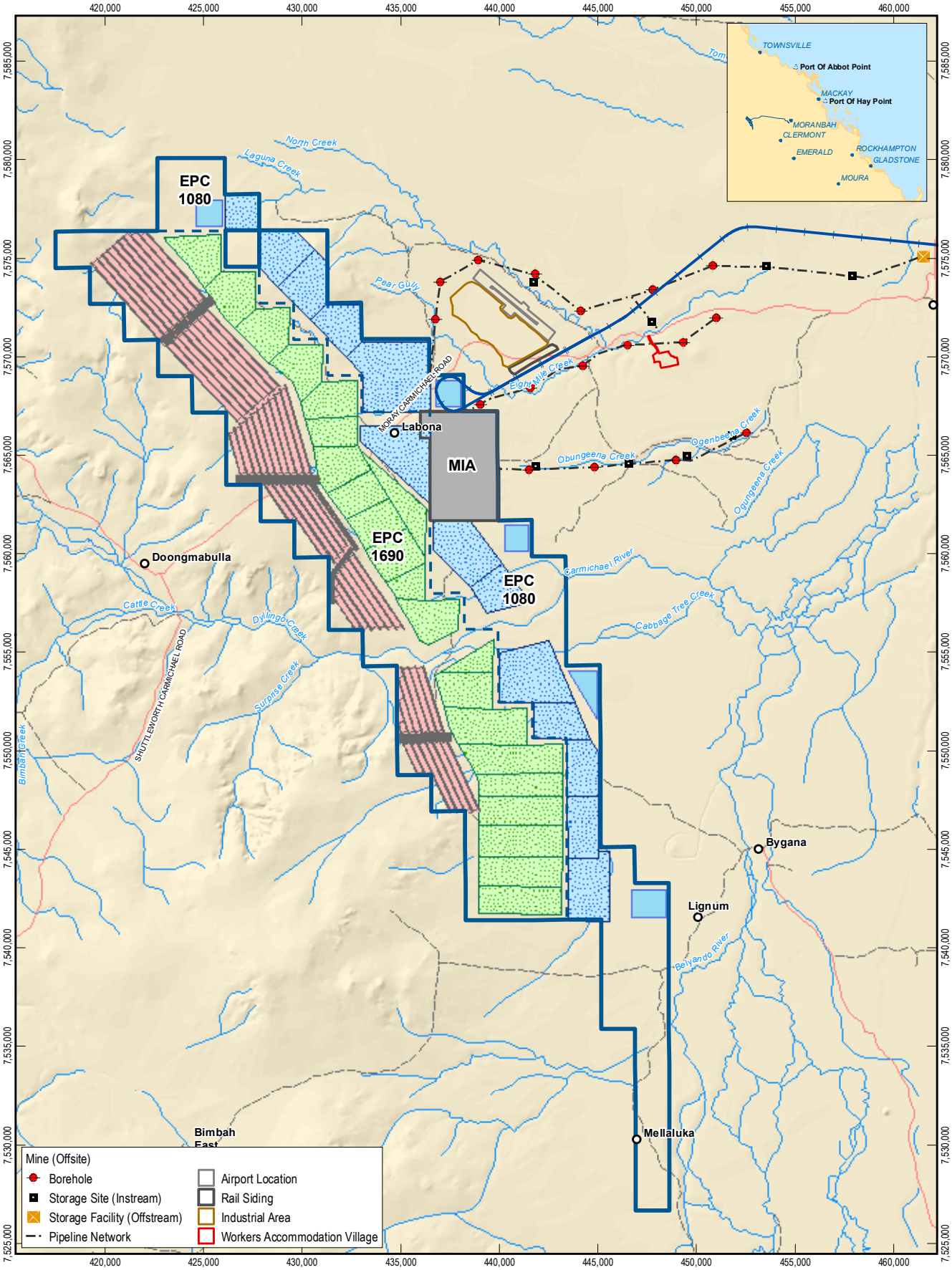
- Underground mining staged through development with subsidence of mined areas expected to occur
- Open cut mining staged through development and rehabilitation of pits over the duration of the mine life
- Management of overburden through disposal (out of pit waste dumping) and development and rehabilitation of waste areas over the duration of the mine life
- Development and maintenance of clean water diversion drains to be established along the boundary of the Study Area, and separating clean inflows from dirty water areas
- Establishment of sediment ponds to receive water from mining operations
- Development and maintenance of a 500 m buffer from each bank of the Carmichael River, with establishment of a flood levee bordering the 500 m buffer zone adjacent to the Carmichael River
- Diversion of Eight Mile Creek

The indicative locations of the underground mining area, open cut mining area (blocks), out of pit waste dumps, water management dams, areas potentially exposed to subsidence (i.e. those areas above the underground mine), and areas not to be subjected to operation phase activities, are presented in Figure 11-12. Detailed assessment of subsidence and waste effects of the Project are provided in Volume 2, Section 4 Land. Those assessments and their findings have informed this report.

It is understood that:

- Staged, non-sequential construction of the mine is proposed to occur over 90 years, incorporating
  - Underground mining at the west of the Study Area
  - Open cut mining at the middle of the Study Area
  - Overburden disposal (out of pit waste dumping) and water management dams at the east of the Study Area
- Discharge of water from sediment ponds to nearest drainage line will only occur under licence conditions
- Operation of the offsite water supply infrastructure including:
  - Pumping of water from North Creek and the Belyando River during peak flow periods
  - In-stream river extractions on North and Obungeena Creeks
  - Pumping of local groundwater reserves in the Moray Downs property, outside of the active mining leases
- Management of water through sediment basins/traps/treatment will be undertaken prior to any discharges into the Carmichael River
- Management of water from operations through capture in sediment ponds for reuse will occur
- Access to the southern part of the Study Area will be achieved via one access point, a spanned bridge across the Carmichael River
- No surface water will be extracted from the Carmichael River for operations

- All water leaving the mine footprint will be in keeping with the mine Water Quality Management Plan
- Sanitation for the operation crew will be treated in a packaged plant to an A standard
- All effluent will be recycled onsite for reuse or approved discharge



LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Construction Phase

Operation Phase

- Underground Mine Area
- Water Management Dams
- Underground Mine Plan
- Open Cut Blocks
- Out of Pit Waste Dumps

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Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Indicative Mine Plan - Areas of Impact

Job Number 41-25215
Revision B
Date 19-11-2012

Figure 11-12

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Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: DME: EPC 1690 (2010), EPC 1080 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); Adani Pty Ltd: Indicative Mine Plan/Infrastructure (2012). Created by: BW, CA

Summary of Impacts to Ecological Communities and Listed Threatened Species

One TEC, Brigalow (*Acacia harpophylla* dominant and co-dominant), was identified in the mine Study Area from field surveys. The presence of this TEC within the Study Area is described in Section 11.4.1.3. REs comprising this TEC are located within the proposed mining (operation) footprint and are proposed to be impacted by clearing for the operation of the mine. Table 11-4 lists the estimated area of direct impact for each TEC RE and the amount of RE within the mining lease that is proposed to not be impacted by vegetation clearing for mining operations.

An approximate area of 267 ha of Brigalow TEC is located within the Mine Study Area. Of that approximately 195 ha (73 per cent) of the TEC is proposed to be directly impacted from vegetation loss associated with clearing activities for mine operations. The remaining 72 ha (27 per cent) is proposed to be retained and not be directly impacted by clearing activities for mining operations but some areas may be subject to subsidence from underground mining activities.

Table 11-4 Approximate Areas of Impact for Threatened Ecological Community REs

RE	VM Act status	Short description[1]	Area of impact[2]	Area of RE remaining[3]
Brigalow (*Acacia harpophylla* dominant and codominant)				
11.3.1	E	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains	46 ha	5 ha
11.4.8	E	*Eucalyptus cambageana* open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains	< 1 ha	0 ha
11.4.9	E	*Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains	149 ha	61 ha
Total			195 ha	66 ha

[1] From REDD (Queensland Herbarium, 2011)

[2] Areas are approximations only as calculated based on ground-truthed RE mapping

[3] Approximate area of RE within the Project Area that will not be cleared for mining operation, however some parts of this area may be subject to subsidence

The footprint for mining operations may contain potentially suitable habitat for one EPBC Act listed flora species, *Acacia ramiflora* (vulnerable EPBC Act), assessment for which identified that it may occur at the Study Area (refer Section 11.4.1.1). This species was not confirmed present during field surveys of the Study Area. It is likely that potentially suitable habitat for this species will be removed through sequential vegetation clearing for the operation of the mine over the lifespan of the mine. In addition, the waxy cabbage palm was detected in field assessments in the Study Area, however, suitable habitat for the species was not predicted to occur in the Study Area and field assessments indicate it is restricted to the Carmichael River channel (Section 11.4.1.1).

The EPBC Act and *Nature Conservation Act 1992* (NC Act) list the endangered black-throated finch (southern), which was recorded at the Study Area (Section 11.4.1.2). Of the potential habitat for the black-throated finch (southern) identified at the Study Area, Figure 11-7 presents the 'important areas' for the black-throated finch (southern) at the Study Area, as defined in the Black-throated Finch (southern) Significant Impact Guidelines (DEWHA, 2009).

A total of 9,862 ha of the 21,222 ha of identified black-throated finch (southern) important areas is proposed to be impacted by vegetation clearing over the life of the mine. This comprises:

- 6,808 ha of important areas in areas to be cleared for open cut blocks
- 2,845 ha of important areas in areas to be cleared for out of pit waste dumps
- 209 ha of important areas in areas to be cleared for water management dams

Loss of habitat for the black-throated finch (southern) will be staged, in accordance with the staged development of the operational components of the mine. Previously mined areas will be rehabilitated in parallel with development of previously unmined areas within the Study Area. Nonetheless, an overall reduction in the local availability of habitat for the subspecies will occur as a result of the operation phase of the Project. It is possible that the subspecies may disperse away from the developed parts of the Study Area, either to suitable, unimpacted habitat within other parts of the Study Area, or to potentially suitable habitat in the landscape to the north, west and south of the Study Area.

The provision of surface water in the eastern part of the Study Area (water management dams) may provide additional localised access to drinking water for the subspecies (or at least compensate for the loss of surface water resources in nearby parts of the Study Area).

The EPBC Act (and NC Act) listed vulnerable squatter pigeon (southern) was recorded at the Study Area (Section 11.4.1.2). The proposed mining (operation) footprint that is proposed to require vegetation clearing over the life of mine operations incorporates 12,391 ha of the 29,716 ha of identified as potential habitat for the squatter pigeon (southern) (based on field verified REs, as identified in Volume 4 Appendix J). This comprises:

- 8,115 ha of potential habitat in areas to be cleared for open cut blocks
- 3,861 ha of potential habitat in areas to be cleared for out of pit waste dumps
- 414 ha of potential habitat in areas to be cleared for water management dams

Loss of habitat for the squatter pigeon (southern) is proposed to be staged, in accordance with the staged development of the operational components of the mine. Previously mined areas will be rehabilitated in parallel with development of previously unmined areas within the Study Area. Nonetheless, an overall reduction in the local availability of habitat for the subspecies will occur as a result of the operation phase of the Project. It is possible that the subspecies may disperse away from the developed parts of the Study Area, either to suitable habitat within other parts of the Study Area, or to potentially suitable habitat in the landscape to the north, west and south of the Study Area (as presented in Figure 11-3).

The provision of surface water in the eastern part of the Study Area (water management dams) may provide additional localised access to drinking water for the subspecies (or at least compensate for the loss of surface water resources in nearby parts of the Study Area).

The EPBC Act listed vulnerable koala was recorded at the Project Area (Section 11.4.1.2). The proposed mining (operation) footprint that is proposed to require vegetation clearing over the life of Mine operations incorporates 10,609 ha of the 21,801 ha of identified as potential habitat for the koala (based on field verified REs, as identified in Figure 3-9). This comprises:

- 7,199 ha of potential habitat in areas to be cleared for open cut blocks

- 3,060 ha of potential habitat in areas to be cleared for out of pit waste dumps
- 350 ha of potential habitat in areas to be cleared for water management dams

Habitat loss and fragmentation is a major threat to the koala (SEWPAC, 2012). The loss of habitat considered suitable for the koala is proposed to be staged, in accordance with the staged development of the operational components of the Mine. Previously mined areas will be rehabilitated in parallel with the development of previously unmined areas within the Project Area. Nonetheless, an overall reduction in the local availability of habitat for the species will occur as a result of the operation phase of the Project.

It is possible that the species may disperse away from the developed parts of the Project Area, either to suitable habitat within other parts of the Project Area, or to potentially suitable habitat in the landscape to the west and south, or riparian areas to the east of the Project Area (as presented in Figure 11-9). Preservation and enhancement of the habitat corridor along the Carmichael River may compensate for some of the habitat loss, and facilitate dispersal of the species in the local landscape.

The EPBC Act (and NC Act) listed vulnerable ornamental snake was not recorded at the Study Area, however is considered likely to occur based on the suitability of habitat, previous records from the region, and the species' known distribution (Section 11.4.1.2). The mining (operation) footprint that is proposed to require vegetation clearing over the life of mine operations incorporates 1,368 ha of the 2,540 ha of identified potential habitat for the ornamental snake (based on field verified REs, as identified in Volume 4 Appendix J). This comprises:

- 663 ha of potential habitat in areas to be cleared for open cut blocks
- 642 ha of potential habitat in areas to be cleared for out of pit waste dumps
- 64 ha of potential habitat in areas to be cleared for water management dams

While vegetation clearing and associated loss of potential ornamental snake habitat will be staged, an overall reduction in the localised extent of potential habitat for this species is proposed to occur as a result of the Project's operation phase.

The EPBC Act (and NC Act) listed vulnerable yakka skink was not recorded at the Study Area, however is considered likely to occur based on the suitability of habitat, previous records from the region, and the species' known distribution (Section 11.4.1.2). The mining (operation) footprint that is proposed to require vegetation clearing over the life of mine operations incorporates 12,282 ha of the 27,027 ha of identified potential habitat for the yakka skink (based on field verified REs, as identified in Volume 4 Appendix J). This comprises:

- 7,987 ha of potential habitat in areas to be cleared for open cut blocks
- 3,881 ha of potential habitat in areas to be cleared for out of pit waste dumps
- 414 ha of potential habitat in areas to be cleared for water management dams

While vegetation clearing and associated loss of potential yakka skink habitat is proposed to be staged, an overall reduction in the localised extent of potential habitat for this species will occur as a result of the Project's operation phase.

The regional extent of potentially suitable habitat for two EPBC Act listed vulnerable birds (red goshawk, Australian painted snipe), that may occur at the mine Study Area based on the presence of suitable habitat and known distribution, will be reduced. Potentially suitable habitat for these species

will still be present at the Study Area during the mine's operation phase, and occurs in the surrounding landscape.

The loss of vegetation, resulting in a loss of flora species and habitat, is a considerable impact of the Project which will be incurred regardless of management and mitigation measures. Commonwealth and State offset requirements will need to be addressed in relation to proposed vegetation clearing, amongst other impacts, for the Project. Offsetting requirements under the following policies will be addressed:

- DSEWPaC - EPBC Act Environmental Offsets Policy Consultation Draft (2011a)
- DERM - Queensland Biodiversity Offset Policy (DERM 2011e), a specific-issue offsets policy under the Queensland Government Environmental Offset Policy

Additional information regarding offset requirements for the Project is provided in Volume 1, Section 9.

The present groundwater characteristics of the Study Area are expected to be altered by the presence of the proposed pits and underground tunnels, as detailed in Mine Hydrogeology Report (Volume 4, Appendix R). Groundwater levels in the vicinity of the Carmichael River are currently ecologically accessible (i.e. within a few metres of the surface level), and the key structural species present in the community fringing the river are considered likely to have a facultative (i.e. partial or seasonal) dependency on groundwater. Therefore, this fringing vegetation community is considered to be a groundwater dependant ecosystem (GDE).

It is predicted that at full mine development groundwater levels in the Carmichael River vicinity may be lowered by up to 30 m, removing access to groundwater for the Carmichael River community. In addition, the cone of groundwater draw down expected to result from the Project development includes the Doongmabulla Springs, a regionally important Great Artesian Basin discharge spring ecosystem listed as a TEC under the EPBC Act. Doongmabulla Springs is located approximately ten km to the south-west of the Study Area. This is a permanent artesian spring provides baseflow to the adjacent Carmichael River. Predicted drawdowns at all springs in the Doongmabulla system are between 0.05 m and 0.12 m, less than 0.2 m throughout the operational period with the majority of predicted impacts lower than 0.05 m. In response to Coal Seam Gas (CSG) proposals, recent assessments of the potential for impacts of these operations on GAB springs have been carried out by DNRM and the Queensland Water Commission. These assessments have identified that drawdowns of over 0.2 m are considered to be potentially significant to the ecology and maintenance of the GAB springs. The predicted drawdown potential at the Doongmabulla springs is 60 per cent of the level considered to be potentially significant and will occur approximately 60 years into the life of the mine. A change in the groundwater supply to the springs has the potential to reduce the suitability of the ecosystems to support the ecological values for which it is listed.

Impacts (without management and mitigation) expected from the progressive drawdown of groundwater in the Carmichael River vicinity are:

- Reductions in channel flow as groundwater contributions diminish
- Reductions in environmental flows to the lower Carmichael River
- Increase the duration of zero flow and/or low flow periods in the Carmichael River, thereby reducing the temporal availability of aquatic habitat

- Progressive die-back of canopy trees and groundlayer vegetation in the area of groundwater drawdown, including in the riparian corridor of the Carmichael River, which may lead to loss of vegetative cover in these locations
- Loss of surface (channel) flows to the lower Carmichael River may also occur except during high rainfall events
- Loss of aquatic and vegetated habitat and resources for fauna currently utilising the Carmichael River and fringing open forest

Possible impacts expected to the Doongmabulla spring from groundwater drawdown may include:

- Loss of a small area of vegetation, including species of conservation significance, along the outer boundary of the wetland as the volume of flow from the spring declines
- Small declines in the output of the spring

Framework for the Management of Operation Phase Impacts

As is described in the following sections, it is recognised that substantial impacts associated with this Project to the ecological values of the Study Area will occur as a result of mine operations. In recognition of the nature and scale of impacts, and the impact previous land use has had on biodiversity in the region, the following framework is proposed to manage these impacts and assist with biodiversity recovery over the life of Project operations. It is critically important that implementation of the framework becomes a collaboration between the proponent, land managers, research organisations and government so that the package of mitigation measures are able to meet the framework's objective.

Prior to the commencement of Project operations, there will be a requirement to further develop the framework so that detailed plans and strategies contribute to its effective implementation. At this stage of the assessment process, the framework remains a concept, and substantial investment and collaborative efforts between key stakeholders will be required to further develop the framework (this is likely to require negotiation with regulating agencies). From a conceptual viewpoint, the framework will incorporate:

- Management of land and watercourses within the Project Area that will not be subject to direct impacts during parts of, or for the duration of the mine's operation phase (i.e. areas above the proposed underground mining footprint, the riparian corridor about the Carmichael River, areas to be mined in latter stages of the staged development etc.).
- Management (rehabilitation) of land and watercourse/drainage lines post-disturbance (i.e. areas where open cut pits and out of pit waste dumps were located).
- Enhancement of regional biodiversity values through land procurement (including ongoing management) and research as part of the Project's offset strategy.

It is proposed that as part of this framework, a detailed implementation schedule be prepared, outlining the timing and location of the applicable management actions, to reflect the staged development of the mine.

It is important to note that this framework will require frequent revision and updating, over the mine's 90 year operational life, so that it is reflective of the most current political, social and environmental circumstances. The Project (Offsite Infrastructure and Mine) Environmental Management Plan will allow for revision of management aspects and monitoring requirements at least every 10 years (if not

more frequently). This will enable assessment of the response of aquatic and terrestrial ecosystems to both the mining operation (and management actions) and other non-project related factors (for example climate and other impactive activities in the region). Regular review will identify whether additional or alternative management actions are required to be applied to the Project to conserve ecosystem values than are identified by the Project at its outset.

The framework's key attributes, including component management plans, objectives, actions, timeframes and stakeholders, are summarised in Table 11-5.

Table 11-5 Overview of Operation Phase Management Framework

Management Plan	Primary Objective	Key Actions	Timeframes	Stakeholders
Management of land within the Study Area that will not be subject to direct impacts during parts of, or for the duration of the mine's operation phase				
Project Land Management (Flora and Fauna) Plan	To manage unmined land within the Study Area such that adverse impacts to the terrestrial ecological values are minimised, while all opportunities for maintenance and enhancement of these values are identified and realised.	Identify priorities for further field studies and targeted research priorities at the Study Area Undertake mapping on and offsite to identify areas to be managed under this plan (and the sub-plans listed below). This should be done in consideration of staged Project operations Identify parts of the Study Area that should be targeted for ecological management, so as to enhance the value of these areas. This should be done in consideration of staged Project operations. Develop monitoring programs, research projects and natural resource management trials to inform flora and fauna management. Incorporate the findings of onsite research and monitoring into management activities (as detailed in sub-plans listed below).	This overarching management plan (and the component sub-plans) listed below will be prepared prior to the commencement of mine operations. The actions detailed in this overarching management plan (and its component sub-plans) will be implemented throughout the mine's operation phase. Five yearly revision and updating of this plan (and its component sub-plans) will be undertaken to reflect regulatory and environmental circumstances, and will incorporate the most up to date scientific information, including that collected from ongoing research and monitoring programs at and near the Study Area.	Adani Mining Pty Ltd Commonwealth, State and local government Research organisations (i.e. universities) Conservation groups (i.e. Black-throated Finch Recovery Team) Natural resource management groups (Burdekin Dry Tropics NRM group) Land holders in the region Local governments Local communities (Clermont, Alpha, Jericho)
Project Vegetation Management Plan	Management of ecological values associated with remnant vegetation located both within unmined areas and areas where vegetation is to remain but may be subject to subsidence.	Map areas of remnant vegetation to be managed, in for each of the staged Project operations. Develop and implement a monitoring protocol, involving demarcated sites in managed areas within the Study Area, and reference sites outside of the Study Area. Collaborate with research institutions to determine research program to identify remnant vegetation changes resulting from subsidence, with the objective of informing management of this process.	Management plan to be prepared prior to commencement of Project operations. Plan's actions to be implemented throughout life of mine operations. Five yearly revision and updating of this plan based on currency of information available. Commence research program at commencement of underground mining operations.	Adani Mining Pty Ltd Commonwealth, State and local government Research organisations (i.e. universities) Natural resource management groups Land holders in the region
Project Species Specific Management Plan(s)	Identification and management of key habitats within the Study Area (and in the vicinity of the Study Area) for priority species that occur, or are likely to occur, within the Study Area.	Develop and implement research programs to provide a greater level of detail on the ecology of threatened species at the Study Area – to be undertaken in collaboration with applicable research organisations, conservation groups and government agencies. With respect to the black-throated finch (southern), research initiatives (and habitat management) to be directed by the recovery actions presented in the National Recovery Plan for the Black-throated Finch Southern Subspecies (Black-throated Finch Recovery Team, 2007) Manage habitats at (and in the vicinity of) the Study Area, in accordance with the findings of ongoing research at the site. Implement a monitoring program to review the efficacy of management actions.	Management plan to be prepared prior to commencement of Project operations. Implement ecology and threatened species research at prior to and during mine operations Five yearly revision and updating of this plan based on currency of information available.	Adani Mining Pty Ltd Commonwealth, State and local government Research organisations (i.e. universities) Conservation groups (i.e. Black-throated Finch Recovery Team) Natural resource management groups Land holders in the region
Project Weed Management Plan	Monitoring and management/eradication of weeds (namely weeds on national significance and declared plants under the LP Act), where they have the potential to reduce the value of vegetation communities and habitats for native species, both in areas that will not be disturbed by mining activities and areas that will be rehabilitated.	Identification of weed infested areas at the Study Area (Year 1 of Project life) Development and implementation of protocols for eradicating weeds at the Study Area (Year 2 of Project life). Implementation of measures to minimise the introduction and spread of weeds at the Study Area (i.e. provision of weed wash down facilities, requirement for weed-free certification of vehicles entering Study Area) – throughout life of mine. Development and implementation of a weed monitoring program for the Study Area – throughout life of mine.	Management plan to be prepared prior to commencement of Project operations. Five yearly revision and updating of this plan based on currency of information available.	Adani Mining Pty Ltd Commonwealth, State and local government Research organisations (i.e. universities) Conservation groups (i.e. Greening Australia) Natural resource management groups Land holders in the region

Management Plan	Primary Objective	Key Actions	Timeframes	Stakeholders
Project Introduced Animals Management Plan	Monitoring and management/eradication of introduced animals, where they have the potential to reduce the value of vegetation communities and habitats for native species, particularly listed species. Focus species will include pigs, rabbits and cats.	Development and implementation of protocols for eradicating/controlling introduced animals at the Study Area (Year 1 and 2 of Project life) Development and implementation of an introduced animals monitoring program for the Study Area – throughout life of mine.	Management plan to be prepared prior to commencement of Project operations. Five yearly revision and updating of this plan based on currency of information available.	Adani Mining Pty Ltd Commonwealth, State and local government Research organisations (i.e. universities) Natural resource management groups Land holders in the region
Project Erosion Management Plan	Management of operation phase activities where they have the potential to degrade habitats as a result of erosion.	Identify and map erosive soils and potential erosion areas across Study Area – Year 1 of mine life. Implement standard erosion control measures wherever operations have the potential to facilitate erosion – throughout life of mine. Monitor the efficacy of erosion control measures, such that measures can be constantly improved – throughout life of mine.	Management plan to be prepared prior to commencement of Project operations. Plan's actions to be implemented throughout life of mine operations. Five yearly revision and updating of this plan based on currency of information available.	Adani Mining Pty Ltd Research organisations (i.e. universities)
Project Waste and Hazardous Materials Management Plan	Management of materials associated with the mine's operation phase, where these materials have the potential to degrade habitats.	Design storage and handling facilities of hazardous and waste materials, such that potential for accidental release (i.e. leaks, spills, explosions) is minimised to the greatest extent possible. Develop a protocol for the management of hazardous material/waste products in instances where spills, leaks or explosions occur.	Management plan to be prepared prior to commencement of Project operations. Plan's actions to be implemented throughout life of mine operations. Five yearly revision and updating of this plan based on currency of information available.	Adani Mining Pty Ltd Research organisations (i.e. universities)
Project Fire Management Plan	A documented approach to managing fire onsite, such that the potential for adverse ecological outcomes as a result of fire (frequency and intensity) are minimised.	Develop a protocol for fire management at the Study Area. Ecological considerations, informed by onsite studies and input from relevant stakeholders (i.e. university researchers, government agencies), should be incorporated into this protocol, to the extent that mine operations and safety are not compromised.	Management plan to be prepared prior to commencement of Project operations. Plan's actions to be implemented throughout life of mine operations. Five yearly revision and updating of this plan based on currency of information available.	Adani Mining Pty Ltd Commonwealth, State and local government Research organisations (i.e. universities) Natural resource management groups Land holders in the region
Management (rehabilitation) of land post-disturbance				
Project Land Rehabilitation Plan	Rehabilitation of any areas disturbed during the course of staged mining operations, to the extent that they provide the habitat features and values that were available prior to disturbance.	Review existing literature relating to mine rehabilitation, and consult with applicable organisations (universities, government agencies) to determine a detailed procedure for rehabilitation of land post-disturbance. Where required, undertake/contribute to onsite and offsite research (including trials) relating to post-mining rehabilitation, so as to increase the knowledgebase on this subject, and inform the design of the rehabilitation protocol to be implemented at the Study Area. Develop and implement a monitoring protocol to assess rehabilitated areas.	Rehabilitation plan to be prepared prior to conclusion of the first stage of mining operations at the Study Area. Research trials to commence prior to commencement of mining operations. Rehabilitation to commence immediately following conclusion of staged mining operations, and continue to such time that pre-determined rehabilitation targets / benchmarks have been achieved (as revealed through on-going monitoring of rehabilitated areas).	Adani Mining Pty Ltd Commonwealth, State and local government Research organisations (i.e. universities) Natural resource management groups
Enhancement of regional biodiversity values				
Project Offsets Package	Identification and implementation of measures to protect and enhance the region's biodiversity, through a combination of procurement and management of land within the Study Area and offsite, monitoring and research.	Prepare a framework for the identification of opportunities to enhance biodiversity values within the Study Area and in the region. Secure offsets as identified through the Project Offset Strategy, and undertake all management and research obligations committed to through the securement of these offsets.	Offset strategy to be prepared as part of Project EIS approvals phase. Identified offsets (in accordance with staging of mine operations) to be secured/committed to prior to commencement of staged mining operations, such that net loss of ecological values is prevented or minimised.	Adani Mining Pty Ltd Commonwealth, State and local government Research organisations (i.e. universities) Natural resource management groups

The individual impacts identified for the Project are described in detail in Volume 4 Appendix J matters of NES. It is proposed that the mitigation measures identified for each of these impacts will form part of the package of mitigation measures described herein. Potential operational phase impacts to ecological values have been considered and identified as:

1. Clearing of land (vegetation clearing) and changes to topography
   - Loss of vegetation and fauna habitat
   - Fauna mortality
   - Habitat fragmentation or changes as a result of change in topography
   - Habitat degradation (i.e. erosion of surface soils, degradation of water quality)
2. Disturbance of surface watercourses and removal of watercourses and waterbodies
   - Aquatic fauna mortality
   - Loss of habitat for species
   - Alteration/degradation of water quality
3. Alteration in groundwater regime
   - Changes to terrestrial habitat due to groundwater drawdown
   - Changes to surface water flows and aquatic habitat availability as a result of groundwater drawdown
4. Introduction of pest and weed species
   - Competition with native species, predation of native specie
   - Habitat degradation (presence and prevalence of pest and weed species) and reduction in resource availability
5. Alteration to air quality and noise environs from altered exposure to disturbance
   - Disturbance to roosting and foraging areas
   - Habitat degradation from dust settling

The mine operational impacts, as per construction impacts, will be progressive across the 90 year life of the Project. Rehabilitation and progressive development will occur throughout the life of the Project. Detailed consideration of all potential impacts has been provided in Volume 4 Appendix J Matters of NES and has supported the identification of the Project influences on threatened matters, which are summarised under Section 11.7.

Management and Mitigation

The operation phase of the mine is proposed to result in the disturbance of approximately 12,586 ha of remnant vegetation. In addition to the area of remnant vegetation required and additional 7,321 ha of non-remnant vegetation (approximate) is proposed to be utilised for the operation of the mine. Due to operational works occurring sequentially throughout the entire Study Area over the life of the mine, the loss of remnant vegetation cannot be greatly minimised, however due to the operational layout of the mine much of the western half of the Study Area is proposed to be retained. Areas to be retained contain both remnant (approximately 14,304 ha, 53 per cent of remnant vegetation within the Study Area) and non-remnant (approximately 4,674 ha) vegetation. However, some of these areas not impacted by clearing may be subject to subsidence as a result of underground mining. Less than

one per cent of the current (2006) subregional RE extent for all endangered and of concern REs impacted by the Project is proposed to be lost as a result of vegetation clearing.

Measures to mitigate and ameliorate potential impacts that may occur during the operation of the Mine are analogous to those identified under Sections 11.5.1.2 through 11.5.1.4 and include:

- Staged management of land disturbance, including clearing and revegetation. Land management strategies will be identified within the Project Land Management (Flora and Fauna) Plan and the Project Land Rehabilitation Plan. This plan will be implemented in conjunction with its component sub-plans relating to the maintenance/enhancement of ecological values of undeveloped parts of the Study Area (i.e. Project Introduced Animals Plan, Project Weed Management Plan, and Project Species Specific Management Plans).
- Use of a fauna species relocation plan and installation of fauna corridors/fish passages to avoid habitat fragmentation. Maintain fauna corridors where able.
- Fencing, waste management, speed limits, fire controls, dust suppression, lighting controls, pest and weed controls, vehicle maintenance and pollutant and waste/hazardous substance management plans will be utilised onsite to minimise direct or indirect impacts to flora or fauna or pollution of the environment.
- Landscape permeability will be retained where possible. Where fencing is required, it will be designed such that fauna can move through it excluding those instances where fenced areas seek to protect fauna from threats such as trenches.
- Progressive development of stormwater management infrastructure and mechanisms to minimise the change in flow regime of watercourses where appropriate and mitigate potential pollution as site works progress.
- Avoid and minimise human and vehicle access to river and creek bed and banks. Construction of river/watercourse crossings ahead of track construction (as far as is possible) will reduce the need for personnel, equipment, machinery and plant to traverse the river/watercourse and limit disturbance to bed and banks.
- A Project Erosion and Sediment Control Plan will be implemented to limit degradation of aquatic habitat across the site with progressive works. Temporary stream or channel diversion may be required to facilitate activities in wet periods. Stream flow should be maintained to provide connectivity between aquatic habitats and facilitate aquatic fauna passage.
- Sediment traps will be established at strategic locations to protect waterbodies from sediment and pollutants.
- Maintenance personnel and vehicle movements will be localised and confined to the operational footprint.
- Treated surface water flows from the mine site should be directed, wherever possible/feasible, to the Carmichael River to supplement channel flow.
- Groundwater ingress to open cut pits – this water should be treated to a suitable level and redirected to the Carmichael River.
- Prior to construction and mining operation, further research is to be undertaken into the groundwater interaction with Carmichael River and the interaction of groundwater with fringing ecosystems of the Carmichael River both within and outside of the Study Area. The location for

reintroduction of surface and ground water should be selected as a result of further research based on observations of channel 'porosity' or 'leakiness' i.e. the intention should be that this water be introduced to the channel at a location where it will remain in the channel (and thus contribute to environmental flows downstream, and not be immediately lost to groundwater).

- Further investigations into the Doongmabulla Springs are required to confirm modelled impacts associated with groundwater draw down. These investigations should include detailed flora surveys, geological studies and ongoing modelling and should inform management actions to be implemented and reviewed for mine operations.

The general management and mitigation measures outlined above seek to minimise habitat loss, fragmentation and other direct and indirect impact to the environs and biodiversity of the Study Area. Actions also seek to minimise the extent required for development of the various operational components of the mine, and maintain/enhance those parts of the Study Area that are proposed to not be subject to mining works during parts of, or throughout, the Project's operation phase.

Residual Impacts

Conservation Significant Fauna

It is recognised that, in spite of the recommended management and mitigation measures, and the active rehabilitation of disturbed areas that will occur through the mine's operational life, unavoidable loss of fauna habitat will occur. This will include loss of habitat for a number of listed threatened species known or expected to occur at the Study Area, including: black-throated finch (southern), squatter pigeon (southern), ornamental snake, yakka skink, red goshawk and Australian painted snipe.

Active, targeted management of habitats adjacent to the clearing footprint can improve their quality for migratory species. Establishing alternative habitats adjacent to the Project through active management prior to clearing migratory species habitats will encourage individuals to disperse from proposed clearing areas (or attract them to adjacent areas). This may include but not be limited to improving forage and nesting resources, increasing access to watering locations, and management of pest and weed species, to enhance the value of adjacent areas. This action will seek to minimise habitat loss (through replacement) and will also act to minimise potential for mortality by providing threatened species with habitat refugia within the operational mine landscape. The details for such management approaches and actions will consider the staged nature of operations, will be informed by onsite research, and will be detailed within Project Species Specific Management Plans (under the overarching Project Land Management (Flora and Fauna) Plan).

Notwithstanding the black-throated finch (southern) (discussed below), it is proposed that targeted additional field studies be undertaken to determine the presence of individuals, populations/colonies and/or important habitat areas for threatened species not detected during field surveys for the EIS, that are considered likely to occur at the Study Area (i.e. yakka skink, ornamental snake). The findings of such studies will be a component of Species Specific Management Plans for these animals, and the outcomes will be directly linked to the Project Offsets Strategy.

Excepting the black-throated finch (southern) (refer Section 11.4.1), the Study Area is not considered to support an 'important population' or 'habitat critical to the survival' (as defined in DEWHA, 2009) of any EPBC Act listed threatened fauna species (i.e. squatter pigeon (southern) (recorded at Study Area), ornamental snake (likely to occur at Study Area), yakka skink (likely to occur at Project Area,

red goshawk (may occur at Study Area), Australian Painted Snipe (may occur at Study Area – refer to Section 11.4.1.2). Thus, habitat loss resultant from vegetation clearing or fragmentation of habitat is not considered to constitute a 'significant impact' to these species. .

The Project Offset Strategy (refer Volume 1, Section 9 Offsets Strategy of this EIS) will address the unavoidable loss of habitat for conservation significant fauna resultant from mine operations. Further studies at the Project Area will assist in informing the offsets strategy with respect to threatened species. The strategy will provide a framework for the identification of measures designed to provide regional biodiversity benefits, where onsite impacts cannot be avoided. Such measures may include the identification and procurement of offsite land to be managed for conservation purposes, and investment in ecological research in the landscape in which the Study Area occurs.

11.5.1.6 Significance of Impacts on Listed Threatened Species or Ecological Communities

The potential to realise a significant impact upon the listed threatened species or ecological communities within the Study Area has been considered against criteria identified by DSEWPaC. As identified under Section 11.1.3.3, filtering of species has been undertaken for this assessment to consider only those species which are known, likely or which may occur at the Study Area. Criteria which define these likelihood of occurrence categories are identified in Section 11.1.3.3. The assessment, therefore, includes all taxa that have:

- Been detected within the Study Area by recent or historic studies
- A distribution which incorporates the Study Area and for which suitable habitat exists within the Study Area

This assessment does not consider those species:

- Which have not been recorded in the region
- Whose distribution does not encompass the Study Area and
- For which suitable habitat does not exist within the Study Area.

This approach is, therefore, considered to be a conservative one which captures all threatened species or communities that could potentially be affected by the Project. Those threatened species or ecological communities that could be affected by the Project, as determined by site assessments and desktop studies include:

- Threatened Flora
  - Waxy cabbage palm (*Livistona lanuginosa*) – threatened EPBC Act; not predicted to occur in Study Area, detected in field assessments
  - *Acacia ramiflora* – vulnerable EPBC Act; May occur across Study Area
  - King bluegrass (*Dichanthium queenslandicum*) – vulnerable EPBC Act; May occur across Rail Study Area, unlikely to occur across Mine Study Area
- Threatened Fauna
  - Black-throated finch (southern) (*Poephila cincta cincta*) – endangered EPBC Act; Known to occur at Mine and Likely to occur at Rail Study Area
  - Squatter pigeon (southern) (*Geophaps scripta scripta*) – vulnerable EPBC Act; Known to occur across both Mine and Rail Study Areas

- Koala (*Phascolarctos cinereus*) (combined populations of Queensland, New South Wales and the Australian Capital Territory) – vulnerable EPBC Act; Known to occur at Mine Study Area and likely to occur at Rail Study Area
- Ornamental snake (*Denisonia maculata*) – vulnerable EPBC Act; Likely to occur across both Mine and Rail Study Areas
- Northern quoll (*Dasyurus hallucatus*) – endangered EPBC Act; Likely to occur across Rail Study Area
- Yakka skink (*Egernia rugosa*) - vulnerable EPBC Act; Likely to occur across Mine Study Area

◗ Threatened Ecological Communities

- Brigalow (*Acacia harpophylla* dominant and co-dominant) – endangered under EPBC Act; Known to occur in Study Area
- The community of native species dependant on natural discharge of groundwater from the Great Artesian Basin (GAB) – endangered under EPBC Act; Known to occur west of Mine Study Area, may be subject to indirect impacts

To identify whether a significant impact will occur to any of the above identified matters of NES an assessment was also made in relation to whether an important population (as defined in Volume 4 Appendix J matters of NES Report) of these listed threatened species occurs at the Study Area or whether the Project would affect threatened ecological communities or habitat critical to the survival of listed threatened species at the Study Area.

Threatened Flora

Neither of the threatened flora species predicted to occur in the Study Area from the EPBC search (*Acacia ramiflora* and *Dichanthium queenslandicum*) were detected during field investigations. These floristic species may occur within the Study Area, however, field investigations clarify that if present neither species is prevalent. Field investigations did, however, detect the waxy cabbage palm which desktop assessment did not predict to occur in the Study Area. Assessment against EPBC Act criteria, as discussed in Section 11.1.3.5, (refer to Volume 2, Section 5 Mine Nature Conservation and Volume 3, Section 5 Rail Nature Conservation of this EIS) indicate that there is not an important population of these species across the Study Area. Given no representatives of *Acacia ramiflora* and *Dichanthium queenslandicum* were found on site and the waxy cabbage palm is restricted to Carmichael River channel, the Project is not expected to lead to a long term decrease in the size of any of these vulnerable species populations. As no representatives of *Acacia ramiflora* and *Dichanthium queenslandicum* were detected, it is not considered that the Project could fragment any populations, adversely affect habitat critical to the survival of these species, including for reproduction, or reduce their area of occupancy. Since the waxy cabbage palm is restricted to the Carmichael River channel, it will not be directly disturbed, nor will it be undermined, and a buffer is to be established. Therefore, there will be no clearing or loss of habitat for this species.

Management actions will be implemented to avoid losses of habitat and vegetation as far as possible and to avoid introduction or spread of any weeds, pests or diseases that could affect these species detrimentally. Although there is potential for these species to occur within the Study Area, it is not considered likely that the Project will significantly affect either of these species either within the immediate Study Area or the regional landscape.

On this basis, this Project is not expected to significantly affect either the *Acacia ramiflora* or King bluegrass (*Dichanthium queenslandicum*) threatened flora species.

Threatened Fauna

Detailed assessment of potential to significantly impact upon any threatened fauna species noted above has occurred giving consideration to the DSEWPaC Significant Impact Guidelines. That assessment is provided in Volume 2, Section 5 Mine Nature Conservation and Volume 3, Section 5 Rail Nature Conservation of this EIS. In summary, assessment identifies that the Project is not expected to have a significant impact upon any of the identified threatened flora or fauna except the black-throated finch (southern).

For species which are not considered to be significantly impacted, this finding is on the basis that:

- Measures identified in Sections 11.5.1.2 to 11.5.1.5 are expected to manage the potential to directly or indirectly impact these fauna
- The Study Area does not support an important population of any of these species
- The species are well represented in landscapes that surround the Study Area, where suitable alternative habitat is prevalent and will persist
- The species are not considered to be dependent upon any habitat within the Study Area for survival.

As such, while large tracts of habitat suitable for these protected matters will be affected, alternative habitat suitable for these species exists adjacent to the Study Area and within the region. Accordingly the Project is not predicted to adversely affect

- The survival of the species as it will not
  - Lead to a long term decrease in the size of the population of any of these species
  - Fragment existing populations of these protected species
  - Affect the breeding success of any of these species
  - Introduce disease of invasive species harmful to the protected species
- The persistence of the species in the regional landscape as it will not
  - Remove or degrade habitat critical to the survival of the species
  - Reduce the occupancy of the species in the regional landscape
  - Interfere with the recovery of the species

With regard to the black-throated finch (southern), a significant impact to this protected matter is predicted to occur as a consequence of the Project. Based on the (currently available) information (acquired from desktop and field studies) and in consideration of the Significant Impact Guidelines, (DEWHA, 2009), it is considered that the Study Area, in particular the Mine Study Area, does support a 'population' of the black-throated finch (southern), noting that a 'population' of an (EPBC Act) endangered species is defined in the Significant Impact Guidelines as:

- *A geographically distinct regional population, or collection of local populations, or*
- *A population, or collection of local populations, that occurs within a particular bioregion* (DEWHA, 2009c).

Given the presence and prevalence of the black-throated finch (southern) in the Mine Study Area, and given mining activity is expected to remove large tracts of habitat for this endangered species, the Project has potential to significantly impact upon this subspecies. In particular, works may:

- Lead to a long-term decrease in the size of the local population of black-throated finch (southern)
- Reduce the area of occupancy of the black-throated finch (southern) in a local and a regional landscape
- Fragment, into two or more populations, an existing population (or series of populations) of the black-throated finch
- Adversely affect habitat critical to the survival of the black-throated finch locally
- Disrupt the breeding cycle of the species

The impacts to this species are expected as a consequence of loss of habitat to mining. Habitat losses will be staged. Research will be undertaken prior to mining works to improve knowledge of the habitat dependencies of this subspecies and to identify appropriate areas that can be rehabilitated/engineered to offer alternative habitats into which the species could naturally relocate ahead of mining works. This preliminary research will also seek to inform the distribution and abundance of the subspecies in the landscape surrounding the Study Area, and provide information on the ecology of the black-throated finch (southern) in the region.

Habitat management, informed by ongoing research and monitoring, will occur during the life of the Project to minimise potential to realise a significant impact upon this species. Research works will contribute to the maintenance of this subspecies within this bioregion and therefore, in general, to the recovery of the subspecies, as per the objectives of the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007). The onsite and offsite habitat management and research program to be implemented will be informed by the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007), and developed in consultation with the Black-throated Finch Recovery Team, and other relevant stakeholders (i.e. Commonwealth and State governments, natural resource management groups, landholders etc.). Examples of recovery actions, documented in the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007), to be incorporated into the Project Species Specific Management Plan (on and offsite) for the subspecies, will include:

- Investigate breeding requirements and threats to key breeding areas (Action 1.1)
- Investigate feeding and other habitat requirements (Action 1.2)
- Undertake targeted surveys (to identify habitat) (Action 2.4)
- Secure selected sites for conservation (Action 3.1) – under the Project Offsets
- Address threats on grazing lands (Action 3.2)
- Monitor management effectiveness (Action 3.3)
- Determine suitability of birds in captivity for a reintroduction project (Action 4.1)

Information obtained from such studies will be incorporated into the Project Species Specific Management Plan for the subspecies (under the overarching Project Land Management (Flora and Fauna) Plan).

The measures summarised here and detailed throughout this section seek to address the Project's impact to the black-throated finch (southern) to reduce these to the greatest extent possible. Given current knowledge, determining the efficacy of the proposed measures in reducing impacts and protecting the subspecies is difficult to quantify. Preliminary research is required such that a clearer understanding of the subspecies' prevalence and behavioural ecology in the region can be ascertained, thereby allowing for the assessment of Project impacts to the subspecies to be undertaken in the context of a detailed understanding of the subspecies' regional population, abundance and behavioural ecology.

Threatened Ecological Communities

The Brigalow TEC within the Rail Study Area occurs in contiguous patches associated primarily with creek lines. As for the grasslands TEC, the Brigalow TEC patches are fragmented by non-remnant and cleared habitat, but offer corridors along the waterways for fauna movements. It is expected that 37.4 ha of this TEC will be cleared to facilitate the rail corridor infrastructure development.

Within the Mine Study Area an extant patch of Brigalow TEC occurs south of the Carmichael River at the eastern boundary of EPC 1690 and into the western edge of EPC 1080. In total, across the Mine Study Area, 195 ha of this TEC will be affected by vegetation clearing to facilitate mining and stockpiling works (refer Section 11.4.1.3). Clearing of the Brigalow TEC will occur late in the operational schedule sequence, several decades from first operational activity commencement.

All of the TECs to be affected will be as a direct result of vegetation clearing. Vegetation clearing is an unavoidable consequence of the Project. Where possible, the Project footprint has been located in existing cleared areas. However, where the clearing of remnant vegetation, including that protected under the EPBC Act, is unavoidable and cannot be satisfactorily avoided, managed and mitigated, offsets are likely to be provided in accordance with the relevant Commonwealth and State offset policies (refer Volume 1 Section 9 Draft Offsets Strategy). Likely offset requirements for the Project are discussed further in 11.9.

The protected brigalow TEC and the natural grasslands TEC REs recorded for the Project are known to occur within the landscape immediately surrounding the Study Area and across the region. Residual impacts from clearing across the Study Area are less than 1 per cent of the subregional extent of each TEC. Within Queensland approximately 65 per cent of extant Brigalow TEC and approximately 20 per cent of extant Natural Grasslands TEC occur within protected area estates. Therefore, in general terms of the permanent removal of area, it is considered that this Project will have a minor impact on prevalence of these TECs across Queensland as a result of clearing from the Project footprint. Notwithstanding, clearing of vegetation for the Project will result in reductions in extent, diversity and abundance of these communities and the species that utilise them.

In relation to the Brigalow TEC, there is the potential for significant impacts to occur on the local presence of this TEC given:

- Clearing of 37.4 ha of this TEC at the rail and 195 ha of this TEC at the mine sites will reduce the extent of this ecological community within the local and regional landscape
- This clearing will remove the majority of identified areas of this TEC at the mine site and has potential to fragment this TEC within the rail site
- The alteration of the landscape to mining activities will adversely affect the habitat critical to the persistence of this TEC

- Draw down of groundwater levels may modify factors necessary for this TECs persistence in the surrounding landscape.

Table 11-6 Threatened Ecological Communities and Expected Clearing Impacts

TEC	Proposed clearing area	TEC extent in Queensland[1] (% impact)	Bioregion current extent[2] (% impact)	Subregions current extent[3] (% impact)	Protected area estate (% of Queensland current extent)[4]
Brigalow	232.4 ha	75,187,246 ha (0.0004%)	15,050,991 ha (0.002%)	1,373,593 ha (0.02%)	49,428,835 ha (65.74%)

[1] Extent of TEC located within Queensland only, excludes areas located within other states. Figures calculated from DERM 2010a, b, c, 2011a: regional ecosystem 'current extent' as of 2006 based on the regional ecosystems comprising each TEC.

[2] TEC current extent within the Brigalow Belt bioregion as impacted by the Project.

[3] Subregions include the Belyando Downs and Northern Bowen Basin of the Brigalow Belt bioregion which are intersected by the project.

[4] Protected area estate = land tenured as national park, state forest and timber reserves within Queensland (DERM 2010a, b, c, 2011a).

It is not expected that the Project will significantly affect the prevalence of the brigalow TEC regionally as management measures will be implemented to minimise habitat losses within the Study Area and to ensure that no losses of this TEC will be realised outside the Study Area; no invasive species that could detriment the TEC will be introduced or spread as a consequence of the Project and chemicals that would detriment the TEC will not be spread into the regional remaining patches of this TEC. Offsets are likely to be provided to address losses in accordance with the relevant Commonwealth and State offset policies (refer Volume 1 Section 9 Draft Offsets Strategy).

Native flora, fauna (including fish) and invertebrate species form a community dependant on natural discharge of groundwater from the Great Artesian Basin (abbreviated to 'GAB discharge spring wetlands') TEC (Fensham *et al.,* 2010). This dependency restricts distribution of the TEC to the GAB. Surveys confirmed that this TEC is not present within the Study Area. However, impacts to regional aquifers as a result of groundwater draw down have the potential to impact this TEC.

The impacts on the spring (and the vegetation community that is dependent on it) of this identified drawdown of are not yet fully understood and ongoing work in this area will be completed to inform the potential to impact these assemblages. This work will include comprehensive flora surveys and further geological investigations. Further test work was undertaken in 2012 and ongoing work will significantly reduce uncertainty in model predictions.

Possible impacts expected to the Doongmabulla spring from groundwater drawdown may include:

- Loss of a small area of vegetation, including species of conservation significance, along the outer boundary of the wetland as the volume of flow from the spring declines
- Small declines in the output of the spring

The potential for significant impact to this TEC will only be understood following the additional works described above. However, management measures will be required to be identified and implemented if groundwater draw down indicates a significant impact is likely to occur. These measures may

include adjustment of groundwater draw down and re-injection to the groundwater aquifer to avoid drawdown extent at the springs which would realise impacts.

11.5.2 Summary

Operation of the mine will be staged across the 90 year life of the site. First mine activity will occur approximately three years into the construction of the mine. This will involve both underground and open cut mining works. Impacts will include land clearing, removal of water resources, alteration of topography and potential for introduction of pests, weeds or release of wastes and pollutants. Construction works for the Project will be progressive and will overlap with operational works from year three onwards.

Based on current knowledge assessment indicates the Project will likely realise significant impacts to the following EPBC Act protected threatened species or ecological communities:

- Brigalow TEC
- Black-throated finch (southern)

Impacts to the TECs result from unavoidable vegetation clearing and will be restricted to the Study Area only with management measures ensuring no offsite affects are realised. Large areas of this TEC are protected in the surrounding landscape and losses equate to less than 1 per cent of the subregional extent of each TEC. Losses are not expected to affect the ongoing prevalence or genetic diversity of this TEC within the subregion. Offsets are likely to be provided to address these losses in accordance with the relevant Commonwealth and State offset policies (refer Volume 1, Section 9 Offsets Strategy). Likely offset requirements for the Project are discussed further in Section 11.9.

As a consequence of habitat losses to mining, and direct impacts, significant impacts to the black-throated finch (southern) are expected to occur. Further, works may interfere with the species recovery by decreasing the availability or quality of habitat to the extent that the species is likely to decline.

Habitat losses will be staged. Research will be undertaken prior to mining works to improve knowledge of the habitat dependencies of this species and to identify appropriate areas that can be rehabilitated/engineered to offer alternative habitats into which the species could naturally relocate ahead of mining works. Habitat management, informed by ongoing research and monitoring, will also occur during the Project to minimise potential to realise a significant impact upon this species. Research works will contribute to the maintenance of this subspecies within this bioregion and therefore, in general, to the recovery of the subspecies, as per the objectives of the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007).

The measures summarised here and detailed throughout this section seek to address the Project's impact to the black-throated finch (southern) to reduce these to the greatest extent possible. Given current knowledge, determining the efficacy of the proposed measures in reducing impacts and protecting the subspecies is difficult to quantify. Preliminary research is required such that a clearer understanding of the subspecies' prevalence and behavioural ecology in the region can be ascertained, thereby allowing for the assessment of Project impacts to the subspecies to be undertaken in the context of a detailed understanding of the subspecies' regional population, abundance and behavioural ecology.

Operational works may realise groundwater draw down impacts to the Doongmabulla Springs, a regionally important Great Artesian Basin discharge spring ecosystem listed as a TEC under the EPBC Act. Predicted drawdowns at all springs in the Doongmabulla system are between 0.05 m and 0.12 m, throughout the operational period with the majority of predicted impacts lower than 0.05 m. The predicted drawdown potential at the Doongmabulla springs is 60 per cent of the level considered to be potentially significant and will occur approximately 60 years into the life of the mine.

11.6 Impact on a Listed Migratory Species

11.6.1 Description of Environmental Values

Desktop assessment indicated that a number of EPBC Act listed migratory species have been previously recorded or are predicted to occur within the desktop search extent encompassing the Mine and Rail Study Areas (as defined in Section 11.1.3). Of these, three were confirmed present during field surveys:

- Eastern great egret (*Ardea modesta*)
- Rainbow bee-eater (*Merops ornatus*)
- Satin flycatcher (*Myiagra cyanoleuca*)

A likelihood of occurrence assessment for EPBC Act migratory species was undertaken and details are provided in Volume 2, Section 5 Mine Nature Conservation and Volume 3, Section 5 Rail Nature Conservation and Volume 4 Appendix J matters of NES. Those species considered known, likely or which may occur at the site are discussed in detail in Volume 4 Appendix J matters of NES Report with information summarised herein.

11.6.1.1 Listed Migratory Fauna – Confirmed Present

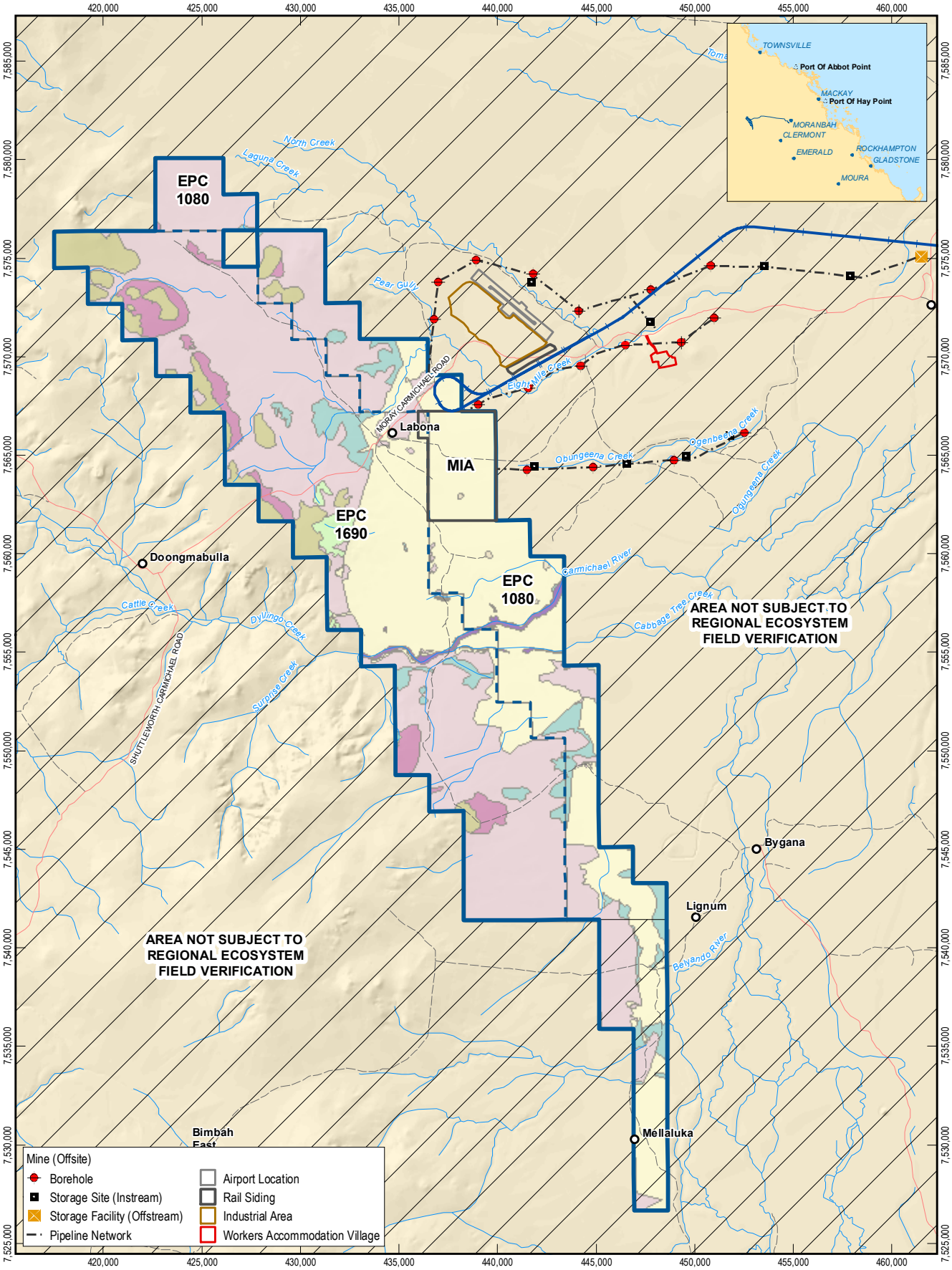
Eastern Great Egret (Migratory, Marine EPBC Act)

The eastern great egret is a moderately large wading bird, listed as migratory (CAMBA; JAMBA, ROKAMBA) and marine under the EPBC Act. This species is widespread throughout southern and eastern Asia and Australasia (DSEPWaC, 2011e). The eastern great egret was recorded on one occasion during the September survey of the Rail Study Area and on four occasions across the three survey events of the Mine Study Area. The species was typically observed at farm dams. Group size ranged from a single bird to >10 birds. Field and desktop analysis provides an indication of habitat that may be utilised by the eastern great egret within the Rail and Mine Study Areas. These habitats have been mapped as fringing open forest / woodland habitat and natural and artificial water bodies. The distribution of these habitat types within the Study Areas and broader region is presented in Figure 11-13 and Figure 11-14.

Habitat at the Study Area is likely to be used on a temporary to permanent basis by this species. As the eastern great egret is common and widespread, and suitable habitat is likely to occur over much of the surrounding landscape, habitat at the Study Area is not considered to constitute 'important habitat' as defined in the Significant Impact Guidelines (DEWHA, 2009b), that is:

- *Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion* (as defined in DEWHA, 2009b) *of the population of a species, and/or*

- *Habitat that is of critical importance to the species at particular life-cycle stages, and/or*
- *Habitat utilised by a migratory species which is at the limit of the species' range, and/or*
- *Habitat within an area where the species is declining* (DEWHA, 2009b)



LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area

Broad Vegetation Communities and Fauna Habitat Type

- Gidgee and brigalow woodland on clay plains
- Ironbark-box grassy woodland on grey sand plains
- Low open woodland on ferricrete/laterised sandstone
- Open forest and woodland fringing streams and on flood plains
- Tall mixed shrubland on red sand plains and over ferricrete
- Yellowjacket-rough leaved bloodwood open woodland on red sand plains
- Open cleared land

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0 1 2 3 4 5
Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Vegetation Communities and Fauna Habitat Types: Project (Mine)

Job Number 41-25215
Revision C
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Figure 11-13

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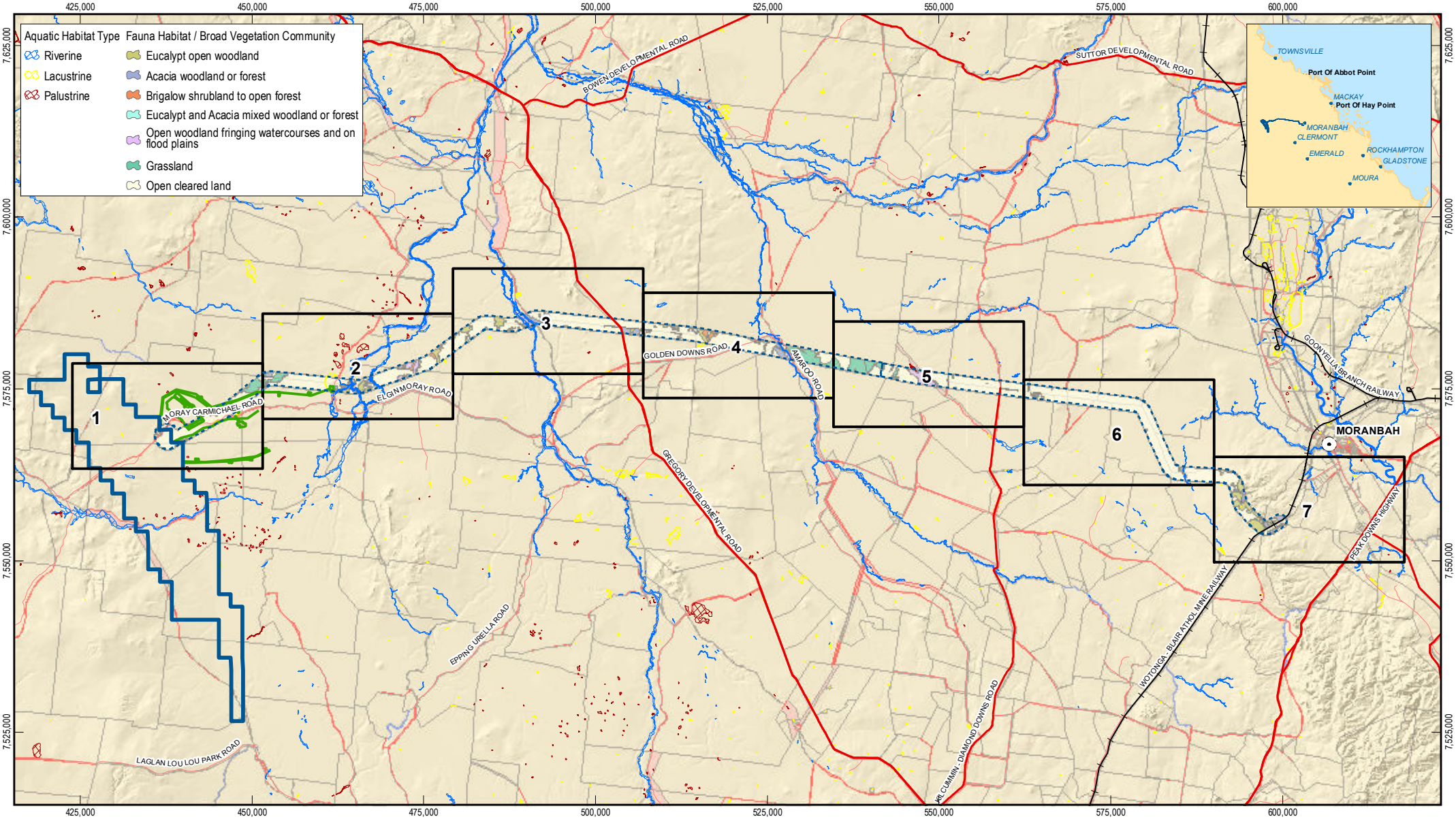
Data Source: DME: EPC 1690 (2010), EPC 1080 (2011); DERM: Broad Vegetation Communities, Fauna Habitat Types (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: BW, CA



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Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Town
- State Road
- Local Road
- Other Railway
- Cadastral Parcel
- Road Reserve
- Watercourse Reserve
- Mine (Onsite)
- Mine (Offsite)
- Study Area

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Carmichael Coal Mine and Rail Project

Vegetation Communities and Fauna Habitat Types: Project Rail

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Figure 11-14
Series Index

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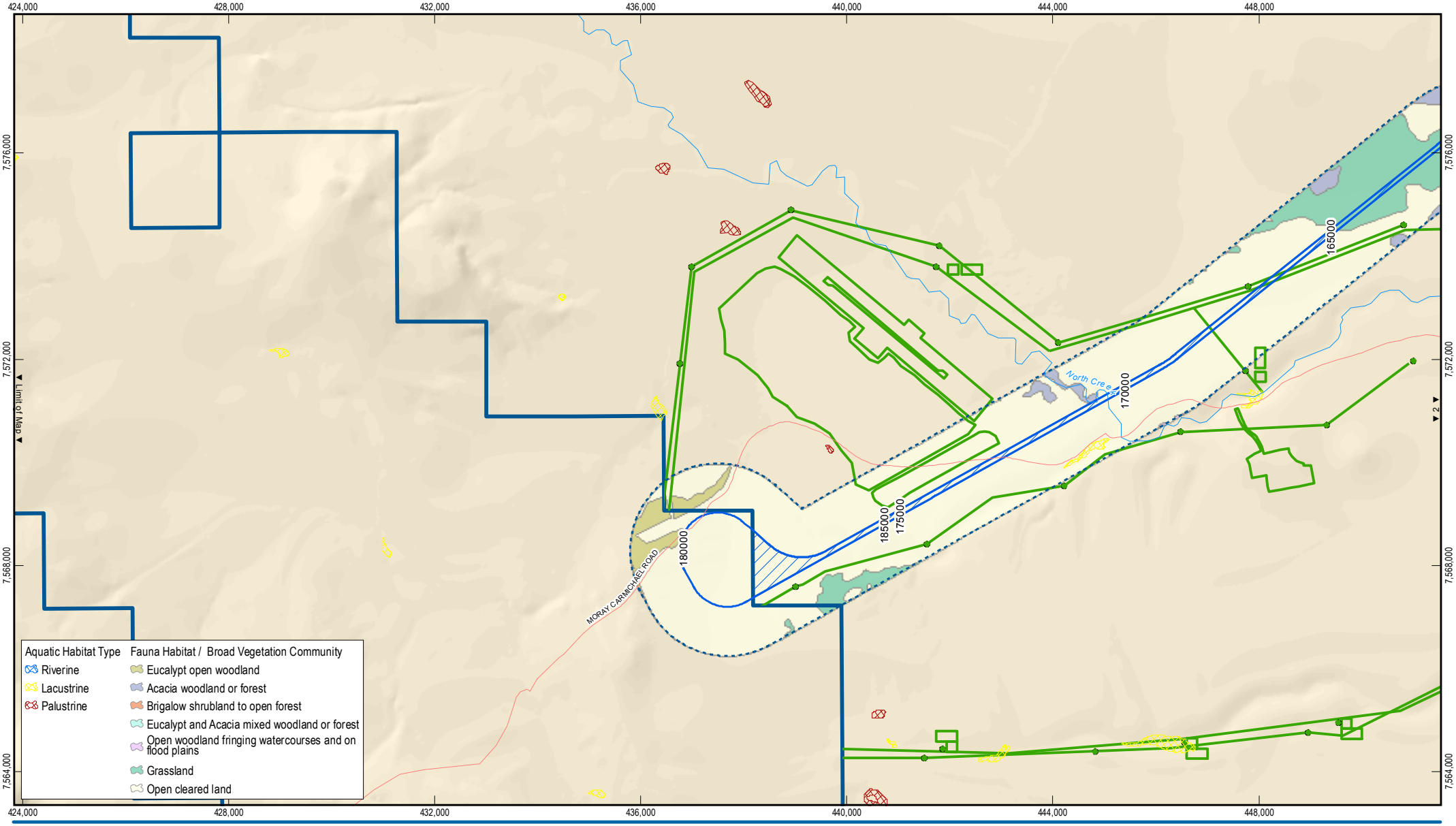
Data source: DERM: DEM (2008), Aquatic Habitat Type / Fauna Habitat / Broad Vegetation Community (2009), DCDB (2010); DME: EPC1690 (2010)/EPC1080 (2011); © Commonwealth of Australia (Geoscience Australia):Localities, Railways, Roads (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: BW, MS, CA



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Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- State Road
- Local Road
- Watercourse
- Other Railway
- Study Area
- Mine (Onsite)
- Mine (Offsite)
- Mine (Offsite)
- Rail (West)
- Rail (East)

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Vegetation Communities and Fauna Habitat Types: Project Rail

Job Number 41-25215
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Date 19-11-2012

Figure 11-14
Sheet 1 of 7

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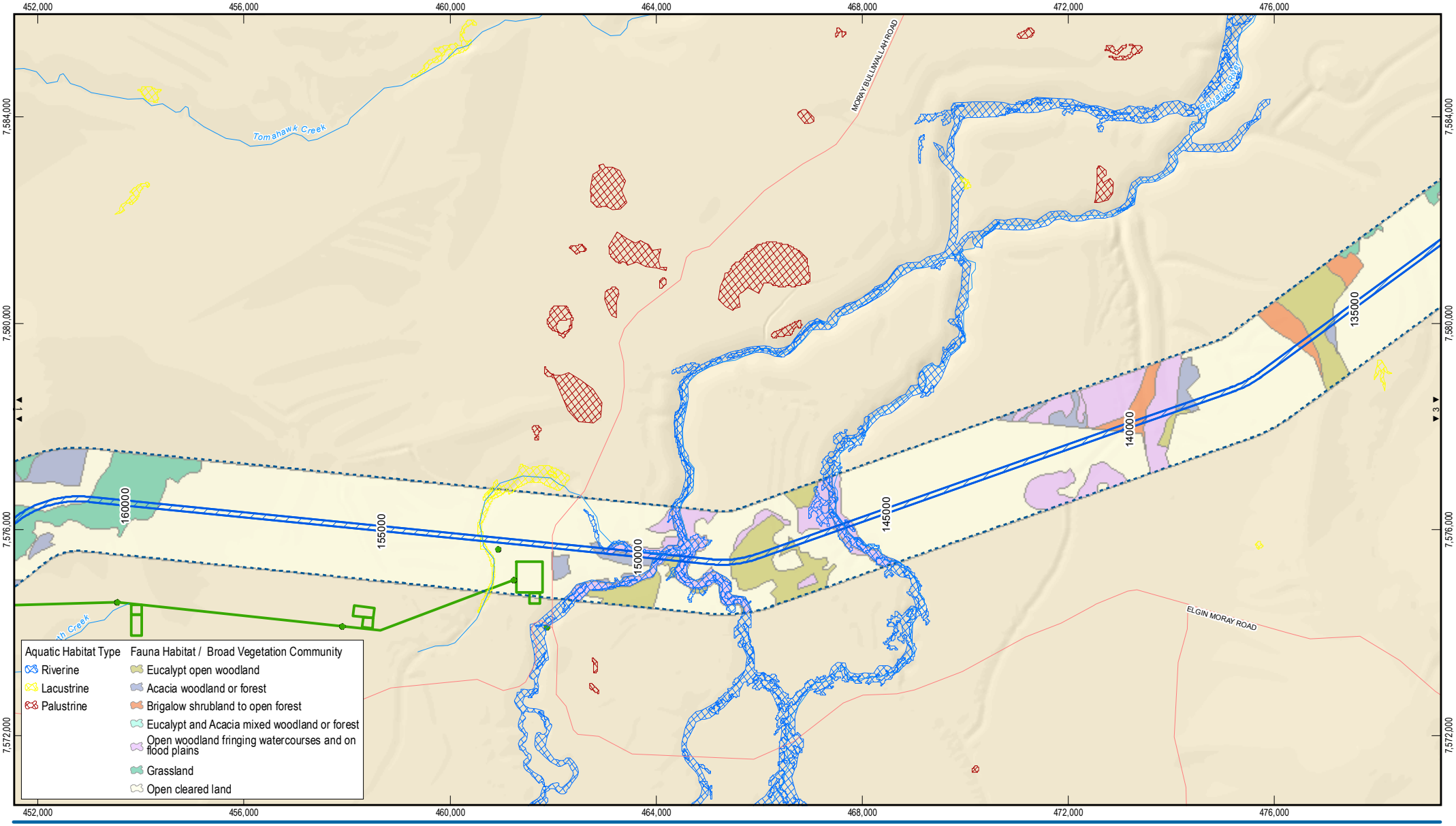

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Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

State Road
Local Road
Watercourse
Other Railway
Study Area
Mine (Onsite)
Mine (Offsite)
Mine (Offsite)
Rail (West)
Rail (East)

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Vegetation Communities and Fauna Habitat Types: Project Rail

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Figure 11-14
Sheet 2 of 7

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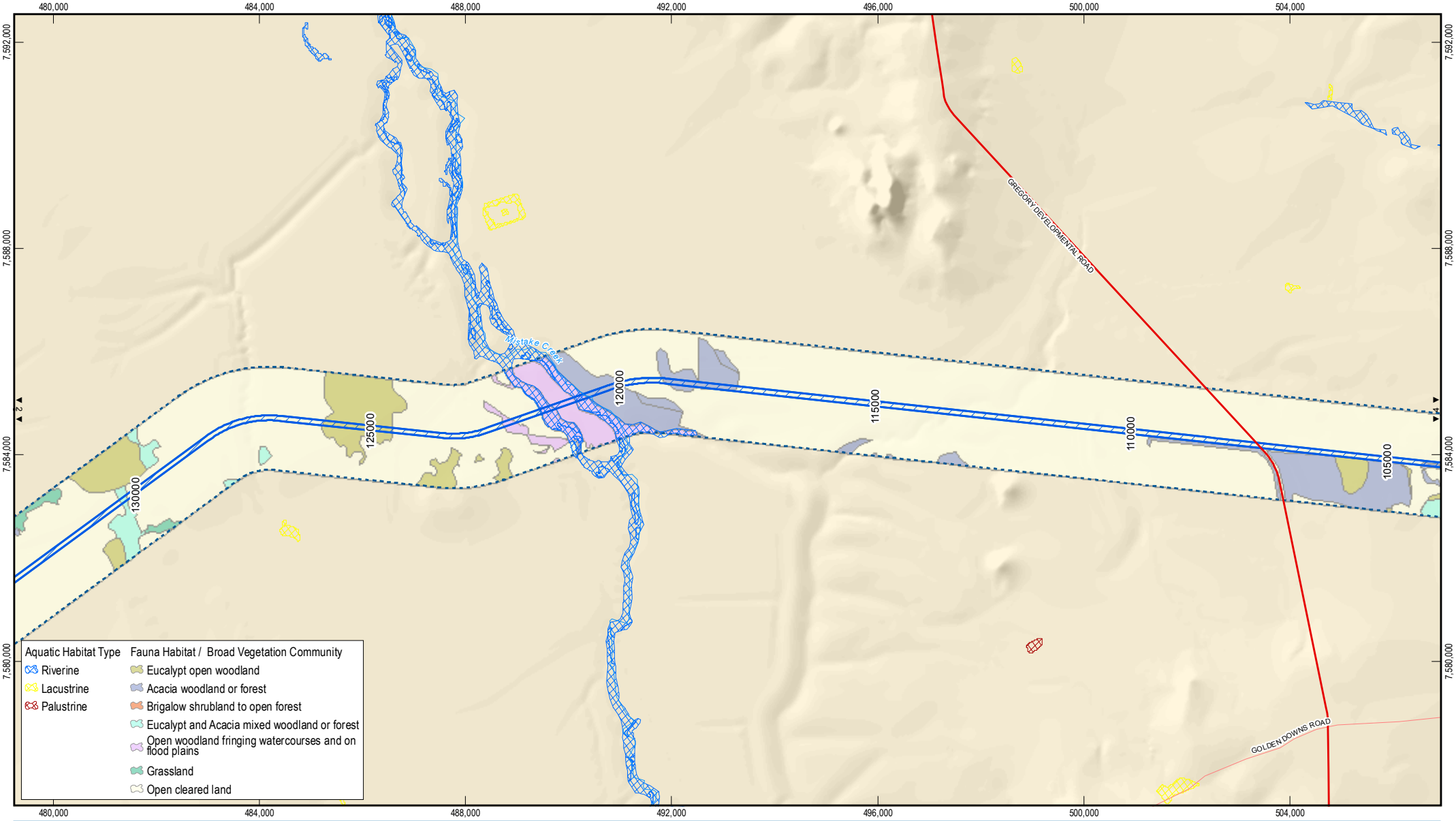

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Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- State Road
- Local Road
- Watercourse
- Other Railway
- Study Area
- Mine (Onsite)
- Mine (Offsite)
- Mine (Offsite)
- Rail (West)
- Rail (East)

Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project

Vegetation Communities and Fauna Habitat Types: Project Rail

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Figure 11-14
Sheet 3 of 7

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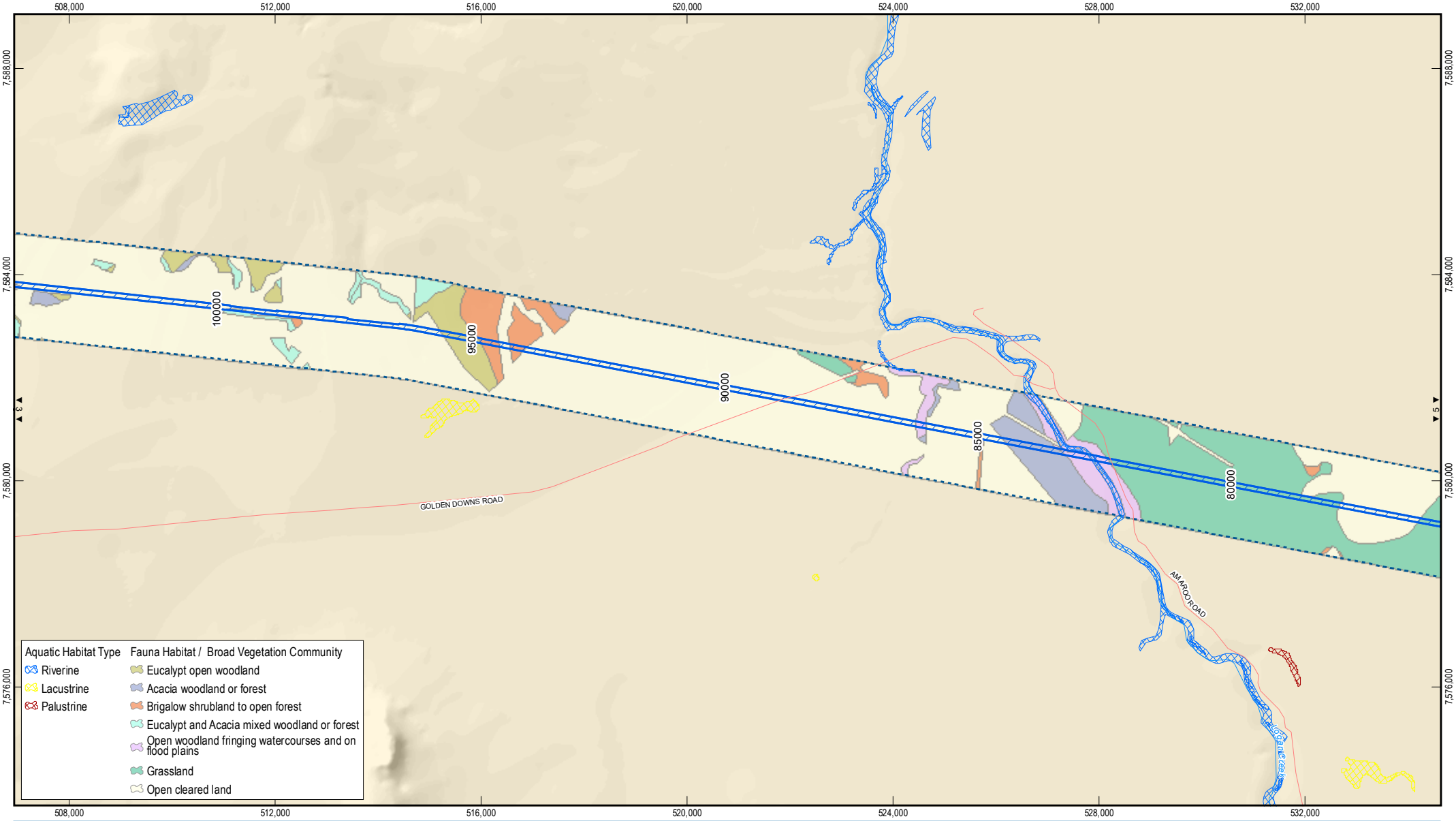

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N

LEGEND

- State Road
- Local Road
- Watercourse
- Other Railway
- Study Area
- Mine (Onsite)
- Mine (Offsite)
- Mine (Offsite)
- Rail (West)
- Rail (East)

Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project

Vegetation Communities and Fauna Habitat Types: Project Rail

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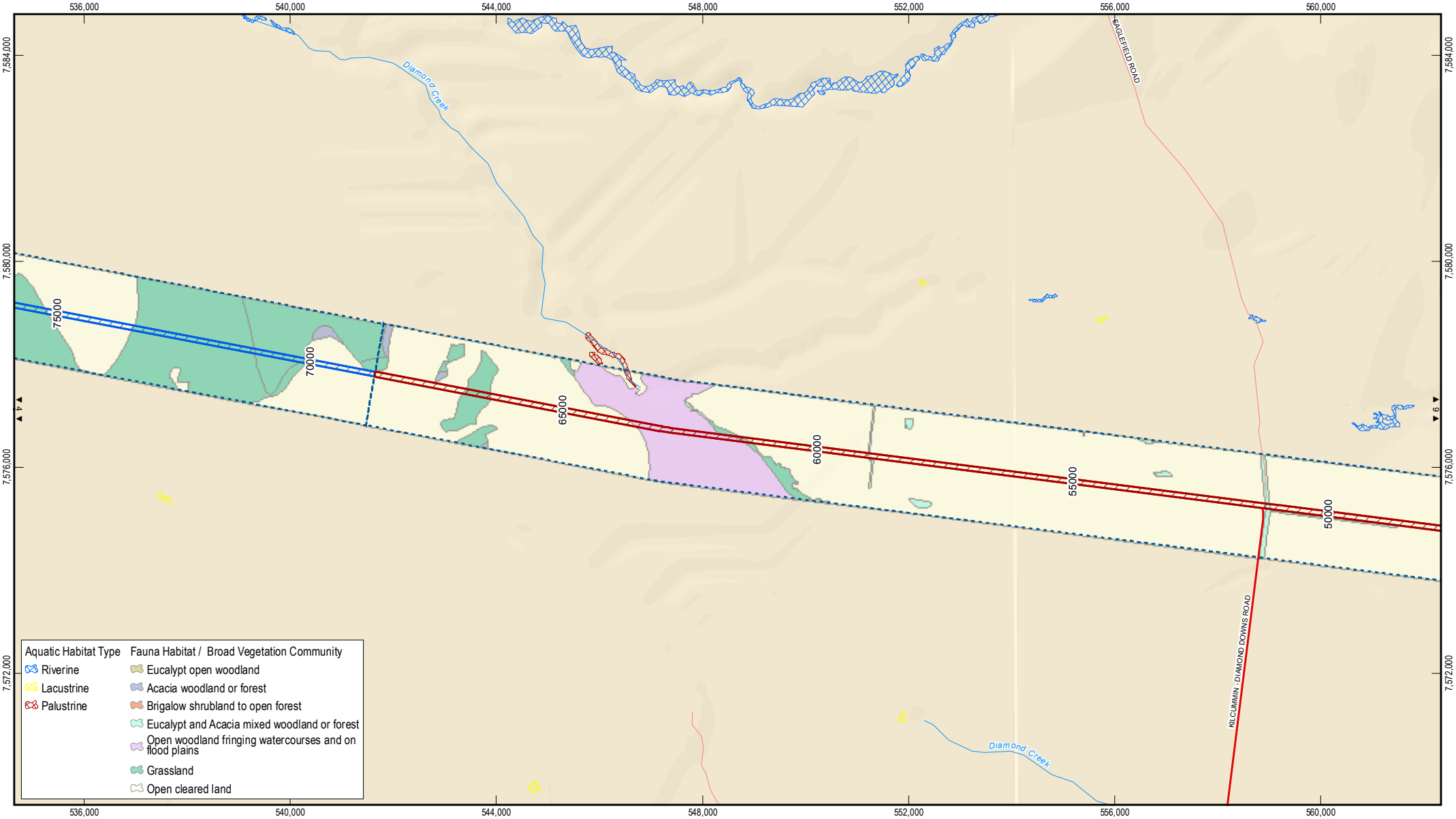

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Kilometres

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N

LEGEND

State Road
Local Road
Watercourse
Other Railway
Study Area
Mine (Onsite)
Mine (Offsite)
Mine (Offsite)
Rail (West)
Rail (East)

Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project

Vegetation Communities and Fauna Habitat Types: Project Rail

Job Number 41-25215
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Figure 11-14
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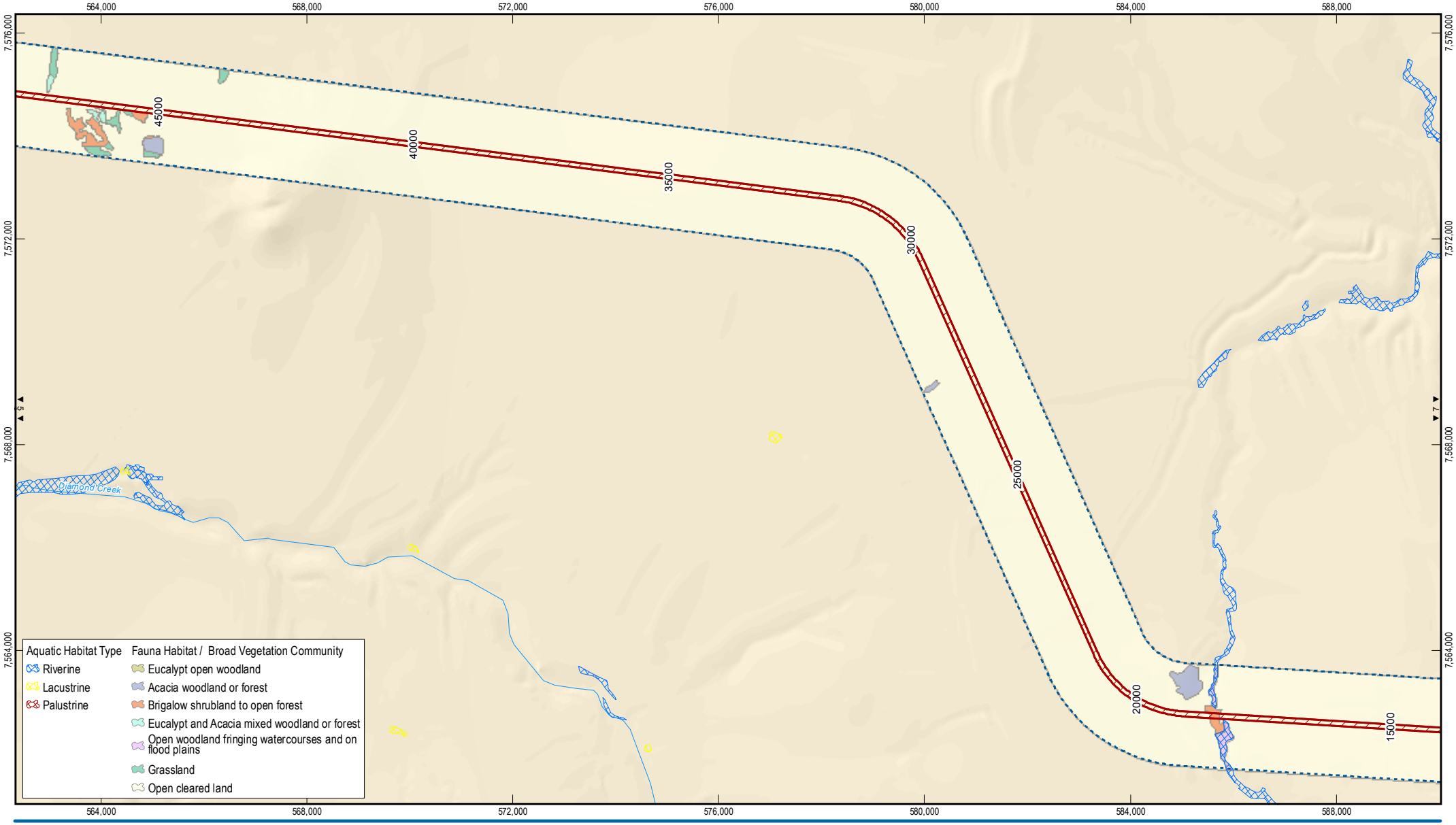

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Kilometres

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N

LEGEND

- State Road
- Local Road
- Watercourse
- Other Railway
- Study Area
- Mine (Onsite)
- Mine (Offsite)
- Mine (Offsite)
- Rail (West)
- Rail (East)

Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project

Vegetation Communities and Fauna Habitat Types: Project Rail

Job Number	41-25215
Revision	C
Date	19-11-2012

Figure 11-14
Sheet 6 of 7

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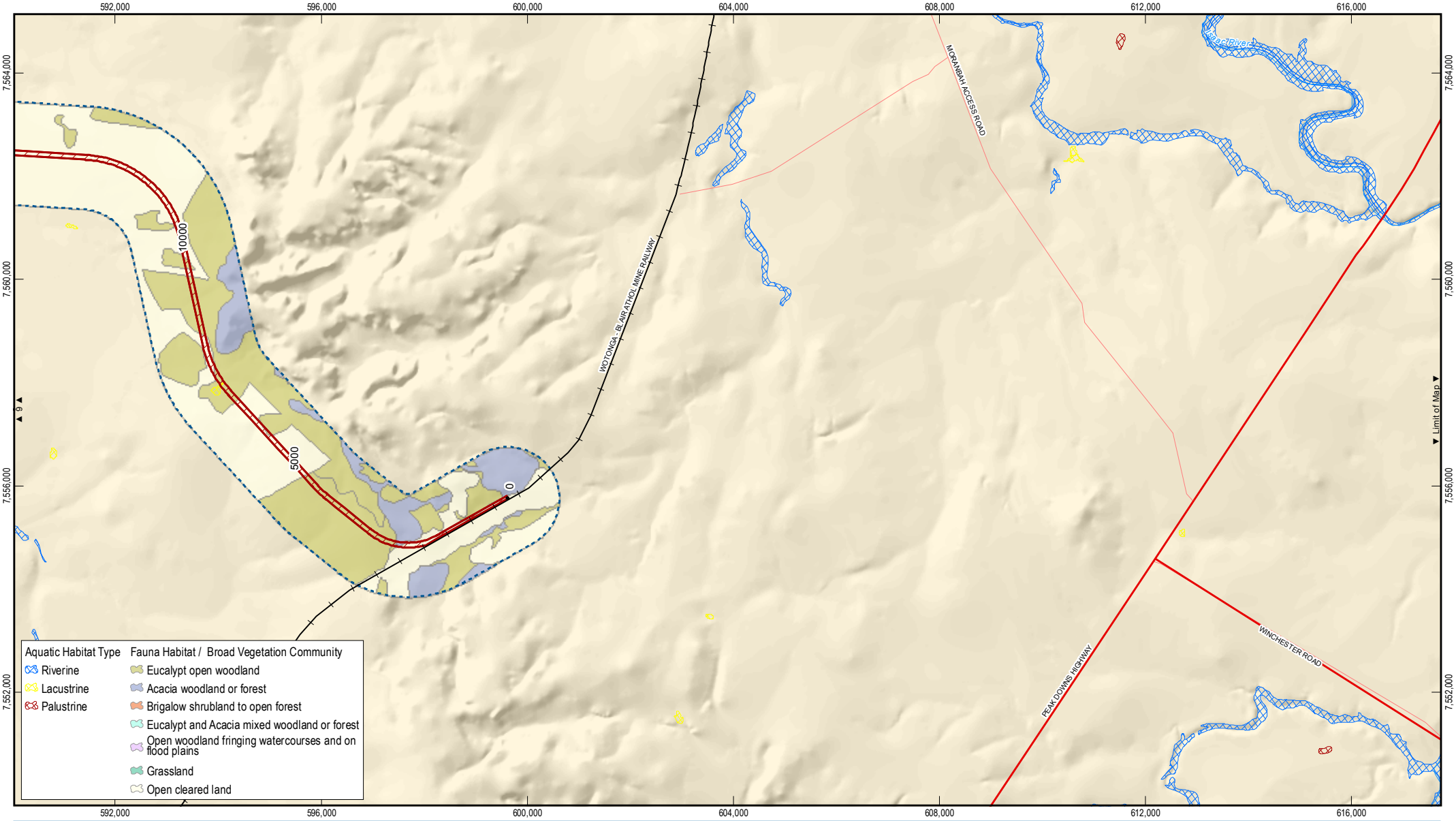
Data source: DERM: DEM (2008), Aquatic Habitat Type, Fauna Habitat / Broad Vegetation Type (2009); © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Roads, Watercourse (2007); GHD: Fauna Habitat Type (2011); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); DME: EPC1690 (2010)/EPC 1080(2011). Created by: BW, MS, CA



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0 1 2 3 4

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- State Road
- Local Road
- Watercourse
- Other Railway
- Study Area
- Mine (Onsite)
- Mine (Offsite)
- Mine (Offsite)
- Rail (West)
- Rail (East)

Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project

Vegetation Communities and Fauna Habitat Types: Project Rail

Job Number	41-25215
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Figure 11-14
Sheet 7 of 7

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Data source: DERM: DEM (2008), Aquatic Habitat Type, Fauna Habitat / Broad Vegetation Type (2009); © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Roads, Watercourse (2007); GHD: Fauna Habitat Type (2011); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); DME: EPC1690 (2010)/EPC 1080(2011). Created by: BW, MS, CA

Rainbow Bee-eater (Migratory, Marine EPBC Act)

The rainbow bee-eater is a medium-sized insectivore, listed as migratory (JAMBA) and marine under the EBPC Act. This species is widespread throughout Australia, eastern Indonesia, eastern Papa New Guinea and the Bismarck Archipelago (DSEWPaC, 2011f). The rainbow bee-eater was recorded on one occasion during the September survey of the Rail Study Area and on seven occasions across the three survey events of the Mine Study Area. The species was typically observed within open woodland and riparian habitats. Group size ranged from a single bird to around 60 birds. All habitats at the Study Area were considered to provide potentially suitable habitat for this species. Habitat at the Study Area is likely to be used on a temporary to permanent basis by this species. As the rainbow bee-eater is common and widespread, and suitable habitat is likely to occur over much of the surrounding landscape, habitat at the Study Area is not considered to constitute 'important habitat' as defined in the Significant Impact Guidelines (DEWHA, 2009b), that is:

- *Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion* (as defined in DEWHA, 2009b) *of the population of a species, and/or*
- *Habitat that is of critical importance to the species at particular life-cycle stages, and/or*
- *Habitat utilised by a migratory species which is at the limit of the species' range, and/or*
- *Habitat within an area where the species is declining* (DEWHA, 2009b)

Satin Flycatcher (Migratory, Marine EPBC Act)

The satin flycatcher is an insectivorous woodland bird, listed as migratory (Bonn) and marine under the EPBC Act. This species is widespread in eastern Australia and vagrant to New Zealand (DSEWPaC, 2011g). Satin flycatchers were opportunistically recorded on two occasions during the spring surveys (2010 and 2011) of the Mine Study Area. The species was observed within the open woodland and farm dam habitats and two individuals were observed on each occasion. Habitat at the Study Area is likely to be used on a temporary to permanent basis by this species. As the satin flycatcher is common and widespread, and suitable habitat is likely to occur over much of the surrounding landscape, habitat at the Study Area is not considered to constitute 'important habitat' as defined in the Significant Impact Guidelines (DEWHA, 2009b), that is:

- *Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion* (as defined in DEWHA, 2009b) *of the population of a species, and/or*
- *Habitat that is of critical importance to the species at particular life-cycle stages, and/or*
- *Habitat utilised by a migratory species which is at the limit of the species' range, and/or*
- *Habitat within an area where the species is declining* (DEWHA, 2009b)

11.6.1.2 Listed Migratory Species – Likely to Occur

The following EPBC Act listed migratory species are likely to occur at the Study Area, based on distribution, presence of potentially suitable habitat and previous records from the region:

- Common sandpiper (*Actitis hypoleucos*) – migratory (Bonn; CAMBA; JAMBA; ROKAMBA) and marine EPBC Act – inhabits shallow, pebbly, muddy or sandy edges of rivers or streams from coastal to far inland areas including dams and lakes.

- Fort-tailed swift (*Apus pacificus*) – migratory (CAMBA; JAMBA; ROKAMBA) and marine EPBC Act – habitat preferences include open country from semi-deserts to coasts.
- Curlew sandpiper (*Calidris ferruginea*) – migratory (Bonn; CAMBA; JAMBA; ROKAMBA) and marine EPBC Act – inhabits tidal mudflats, saltmarsh and saline and freshwater wetlands.
- Latham's snipe (*Gallinago hardwickii*) – migratory (Bonn; CAMBA; JAMBA; ROKAMBA) and marine EPBC Act – habitat preferences include soft wet ground or shallow water with tussocks and other green or dead growth, wet parts of paddocks or near dams, scrub or open woodland.
- White-bellied sea eagle (*Haliaeetus leucogaster*) – migratory (CAMBA) and marine EPBC Act – inhabits coasts, estuaries, large rivers and inland lakes.
- White-throated needletail (*Hirundapus caudacutus*) – migratory (CAMBA; JAMBA; ROKAMBA) and marine EPBC Act – occupies airspace over forests, woodlands, farmlands, plains, lakes and favoured timbered ranges.
- Caspian tern (*Hydroprogne caspia*) – migratory (CAMBA; JAMBA) and marine EPBC Act – inhabits coastal and offshore waters, beaches, estuaries, larger rivers and lakes some inland.
- Black-tailed godwit (*Limosa limosa*) – migratory (Bonn; CAMBA; JAMBA; ROKAMBA) and marine EPBC Act – widespread summer migrant to eastern Australia (Sept-April), mostly on the coasts but makes use of some inland lakes.
- Glossy ibis (*Plegadis falcinellus*) – migratory (Bonn; CAMBA) and marine EPBC Act – inhabits well vegetated wetlands, wet pastures, ricefields, floodwaters, floodplains, brackish or occasionally saline wetlands and occasionally dry grasslands.
- Common greenshank (*Tringa nebularia*) – migratory (Bonn; CAMBA; JAMBA; ROKAMBA) and marine EPBC Act – inhabits mudflats, estuaries, saltmarshes, lake margins, wetlands and claypans.
- Marsh sandpiper (*Tringa stagnatilis*) – migratory (Bonn; CAMBA; JAMBA; ROKAMBA) and marine EPBC Act – inhabits wetlands, bore drains mangroves, tidal mudflats and estuaries.

A number of habitat and vegetation types across the Study Area may provide habitat for these listed migratory species. Habitats likely to support the highest diversity of migratory species include:

- Fringing open forest / woodland
- Natural and artificial water bodies
- Eucalypt open woodland

As with the three bird species detected at the Study Area, these 11 migratory species are common and widespread, and thus the Study Area is not considered to support 'important habitat' as defined in the Significant Impact Guidelines (DEWHA, 2009b) for any of these birds.

11.6.1.3 Listed Migratory Species – May Occur

The likelihood of occurrence assessment identified a further four EPBC Act listed migratory species, including two nominated in the Project Terms of Reference (spectacled monarch (*Monarcha trivirgatus*); black-faced monarch (*Monarcha melanopsis*)) may occur at the Study Area, based on distribution and presence of potentially suitable habitat:

- Cattle egret (*Ardea ibis*) – migratory (CAMBA; JAMBA) and marine EPBC Act – occurs in stock paddocks, croplands, wetlands, tidal mudflats and drains. Not previously recorded in the region.
- Sharp-tailed sandpiper (*Calidris acuminata*) – migratory (Bonn; CAMBA; JAMBA; ROKAMBA) and marine EPBC Act - inhabits tidal mudflats, saltmarshes, mangroves, shallow fresh, brackish and saline inland wetlands, floodwaters and irrigated lands. Not previously recorded in the region.
- Spectacled monarch (*Monarcha trivirgatus*) – migratory (Bonn) and marine EPBC Act - typically inhabits understorey of densely vegetated areas (rainforests, gullies, riparian areas). Predominantly coastal but range extends inland. Not previously recorded in the region.
- Black-faced monarch (*Monarcha melanopsis*) – migratory (Bonn) and marine EPBC Act - rainforest and open forest, gullies and open woodlands (when migrating). Predominantly coastal but range extends inland. Not previously recorded in the region.

With respect to the Significant Impact Guidelines (DEWHA, 2009b), it is not considered that the Study Area supports an 'important population' of any of these migratory species.

11.6.2 Potential Impacts and Mitigation Measures

11.6.2.1 Summary of Matters of NES for Impact Assessment

Desktop and field survey findings indicate the following protected matters of NES are confirmed present, likely to occur or may occur within the Study Area (Mine and Rail):

- Confirmed present
  - Eastern great egret (*Ardea modesta*)
  - Rainbow bee-eater (*Merops ornatus*)
  - Satin flycatcher (*Myiagra cyanoleuca*)
- Likely to occur
  - Common sandpiper (*Actitis hypoleucos*)
  - Fort-tailed swift (*Apus pacificus*)
  - Curlew sandpiper (*Calidris ferruginea*)
  - Latham's snipe (*Gallinago hardwickii*)
  - White-bellied sea eagle (*Haliaeetus leucogaster*)
  - White-throated needletail (*Hirundapus caudacutus*)
  - Caspian tern (*Hydroprogne caspia*)
  - Black-tailed godwit (*Limosa limosa*)
  - Glossy ibis (*Plegadis falcinellus*)
  - Common greenshank (*Tringa nebularia*)
  - Marsh sandpiper (*Tringa stagnatilis*)
- May occur
  - Cattle egret (*Ardea ibis*)
  - Sharp-tailed sandpiper (*Calidris acuminata*)
  - Spectacled monarch (*Monarcha trivirgatus*)

– Black-faced monarch (*Monarcha melanopsis*)

11.6.2.2 Potential Impacts and Mitigation Measures - Rail

Potential impacts to terrestrial and aquatic ecology values have been discussed in detail in Volume 3, Section 5 Rail Nature Conservation of this EIS.

Table 11-7 Impact to EPBC Act Listed Migratory Species - Rail

EPBC Act listed migratory species	Total clearing extent*
Confirmed present	
Eastern great egret (*Ardea modesta*)	156 ha
Rainbow bee-eater (*Merops ornatus*)	3,934 ha, Two dams
Satin flycatcher (*Myiagra cyanoleuca*)	311 ha
Likely to occur	
Common sandpiper (*Actitis hypoleucos*)	-
Fort-tailed swift (*Apus pacificus*)	3,934 ha, Two dams
Curlew sandpiper (*Calidris ferruginea*)	-
Latham's snipe (*Gallinago hardwickii*)	302 ha, Two dams
White-bellied sea eagle (*Haliaeetus leucogaster*)	156 ha, Two dams
White-throated needletail (*Hirundapus caudacutus*)	3,934 ha, Two dams
Caspian tern (*Hydroprogne caspia*)	-
Black-tailed godwit (*Limosa limosa*)	-
Glossy ibis (*Plegadis falcinellus*)	-
Common greenshank (*Tringa nebularia*)	-
Marsh sandpiper (*Tringa stagnatilis*)	-
May occur	
Cattle egret (*Ardea ibis*)	3,286 ha, Two dams
Sharp-tailed sandpiper (*Calidris acuminata*)	-
Spectacled monarch (*Monarcha trivirgatus*)	156 ha
Black-faced monarch (*Monarcha melanopsis*)	362 ha

Rail Construction

- Loss of habitat (roosting, shelter, foraging, breeding) for native fauna including conservation significant fauna
- Degradation of terrestrial and aquatic habitat adjacent to and downstream of cleared areas
- Disturbance as a result of increased exposure to light, noise, dust, vehicles and people
- Spread of introduced weeds
- Fauna mortality

Rail Operation

- Disturbance as a result of increased exposure to light, noise, dust, vehicles and people
- Spread of introduced weeds
- Degradation of aquatic habitats as a result of runoff or an altered catchment landscape
- Mortality as a result of train and maintenance vehicle strikes.

11.6.2.3 Potential Impacts and Mitigation Measures - Mine

Potential impacts to terrestrial and aquatic ecology values have been discussed in detail in Volume 2, Section 5 Mine Nature Conservation.

Table 11-8 Impact to EPBC Act Listed Migratory Species - Mine

EPBC Act listed migratory species	Total clearing extent*
Confirmed present	
Eastern great egret (*Ardea modesta*)	67 ha Permanent dams (at least twelve)
Rainbow bee-eater (*Merops ornatus*)	20,430 ha
Satin flycatcher (*Myiagra cyanoleuca*)	67 ha
Likely to occur	
Common sandpiper (*Actitis hypoleucos*)	Permanent dams (at least twelve)
Fort-tailed swift (*Apus pacificus*)	20,430 ha
Curlew sandpiper (*Calidris ferruginea*)	Permanent dams (at least twelve)
Latham's snipe (*Gallinago hardwickii*)	67 ha Permanent dams (at least twelve)
White-bellied sea eagle (*Haliaeetus leucogaster*)	67 ha Permanent dams (at least twelve)
White-throated needletail (*Hirundapus caudacutus*)	20,430 ha
Caspian tern (*Hydroprogne caspia*)	Permanent dams (at least twelve)
Black-tailed godwit (*Limosa limosa*)	Permanent dams (at least twelve)

EPBC Act listed migratory species	Total clearing extent*
Glossy ibis (*Plegadis falcinellus*)	Permanent dams (at least twelve)
Common greenshank (*Tringa nebularia*)	Permanent dams (at least twelve)
Marsh sandpiper (*Tringa stagnatilis*)	Permanent dams (at least twelve)
May occur	
Cattle egret (*Ardea ibis*)	18 660 ha Permanent dams (at least twelve)
Sharp-tailed sandpiper (*Calidris acuminata*)	Permanent dams (at least twelve)
Spectacled monarch (*Monarcha trivirgatus*)	67 ha
Black-faced monarch (*Monarcha melanopsis*)	67 ha

Mine Construction

- Loss of fauna habitat (including roosting, foraging and breeding areas) - clearing of land during the construction phase of the Project is proposed to result in a loss of approximately 24 ha of remnant vegetation and approximately 2,599 ha of non-remnant vegetation. One permanent dam (Brigalow Dam) will also be lost as a result of Project construction.
- Degradation of terrestrial and aquatic habitat adjacent to and downstream of cleared areas
- Introduction of pest and weed species
- Alteration to air quality and noise environs from altered exposure to disturbance
- Fauna mortality

Mine Operation

- Clearing of land (vegetation clearing) and changes to topography
  - Loss of fauna habitat
  - Fauna mortality
  - Habitat degradation (i.e. erosion of surface soils, degradation of water quality)
- Disturbance of surface watercourses and removal of watercourses and water bodies
  - Loss of habitat for species
  - Alteration/degradation of water quality
- Alteration in groundwater regime
  - Changes to terrestrial habitat due to groundwater drawdown
  - Changes to surface water flows and aquatic habitat availability as a result of groundwater drawdown
- Introduction of pest and weed species
  - Competition with native species, predation of native species
  - Habitat degradation (presence and prevalence of pest and weed species) and reduction in resource availability

- Alteration to air quality and noise environs from altered exposure to disturbance
  - Disturbance to roosting and foraging areas
  - Habitat degradation from dust settling

Summary

It is recognised that, in spite of the recommended management and mitigation measures, and the active rehabilitation of disturbed areas that will occur through the Project's operational life, unavoidable loss of habitat for migratory species will occur.

Active, targeted management of habitats adjacent to the clearing footprint can improve their quality for migratory species. Establishing alternative habitats adjacent to the Project through active management prior to clearing migratory species habitats will encourage individuals to disperse from proposed clearing areas (or attract them to adjacent areas). This may include but not be limited to improving forage and nesting resources, increasing access to watering locations, and management of pest and weed species, to enhance the value of adjacent areas. This action will seek to minimise habitat loss (through replacement) and will also act to minimise potential for mortality by providing migratory species with habitat refugia within the operational landscape. The details for such management approaches and actions will consider the staged nature of operations, will be informed by onsite research, and will be detailed within Project Species Specific Management Plans (under the overarching Project Land Management (Flora and Fauna) Plan).

11.6.2.4 Significance of Impacts on Migratory Species

Detailed assessment of potential to significantly impact upon any migratory species noted above has occurred giving consideration to the DSEWPaC Significant Impact Guidelines (refer Volume 4 Appendix J matters of NES). In summary, assessment identifies that the Project is not expected to have a significant impact upon any migratory species. This finding is on the basis that:

- The Study Area does not support an important population of any of these species
- The Study Area does not support an ecologically significant proportion of the population of a migratory species
- Measures identified in Sections 11.5.1.2 to 11.5.1.5 are expected to manage the potential to directly or indirectly impact these species
- The species are well represented in landscapes that surround the Study Area, where suitable alternative habitat is prevalent and will persist
- The species are not considered to be dependent upon any habitat within the Study Area for any particular lifecycle stages.

As such, while large tracts of habitat suitable for these protected matters will be affected, alternative habitat suitable for these species exists adjacent to the Study Area and within the region. Accordingly the Project is not predicted to adversely impact migratory species by:

- Substantially modifying (including fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroying or isolating an area of important habitat for a migratory species.
- Resulting in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.

- Seriously disrupting the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

11.7 Summary

A desktop and field assessment was undertaken to identify EPBC Act listed migratory species that have the potential to occur within the Mine and Rail Study Areas. Three species, eastern great egret (*Ardea modesta*), rainbow bee-eater (*Merops ornatus*) and stain flycatcher (*Myiagra cyanoleuca*) were confirmed present within the Study Area. An additional 11 species are considered likely to occur while four species may occur.

Potential impacts arising from construction and operational works may include:

- Vegetation clearing and changes to topography
- Loss of habitat including roosting, shelter, foraging and breeding areas
- Degradation and disturbance of habitat as a result of sedimentation, erosion, alteration of water quality and increased exposure to noise, light and dust
- Disturbance of surface watercourses and removal of watercourses and water bodies
- Fauna mortality
- Introduction of pest and weed species
- Alteration in groundwater regime

It is recognised that, in spite of the recommended management and mitigation measures, and the active rehabilitation of disturbed areas that will occur through the Project's operational life, unavoidable loss of habitat for migratory species will occur.

Active, targeted management of habitats adjacent to the clearing footprint can improve their quality for migratory species. Establishing alternative habitats adjacent to the Project through active management prior to clearing migratory species habitats will encourage individuals to disperse from proposed clearing areas (or attract them to adjacent areas). This may include, but not be limited to, improving forage and nesting resources, increasing access to watering locations, and management of pest and weed species, to enhance the value of adjacent areas. This action will seek to minimise habitat loss (through replacement) and will also act to minimise potential for mortality by providing migratory species with habitat refugia within the operational landscape. The details for such management approaches and actions will consider the staged nature of operations, will be informed by onsite research, and will be detailed within Project Species Specific Management Plans (under the overarching Project Land Management (Flora and Fauna) Plan).

The potential to realise a significant impact upon migratory species within the Study Area has been considered against criteria identified by DSEWPaC. Based on current knowledge the assessment identifies that the Project is not expected to have a significant impact upon any migratory species. This finding is on the basis that:

- The Study Area does not support an important population of any of these species
- The Study Area does not support an ecologically significant proportion of the population of a migratory species

- Measures identified in Sections 11.5.1.2 to 11.5.1.5 are expected to manage the potential to directly or indirectly impact these species
- The species are well represented in landscapes that surround the Study Area, where suitable alternative habitat is prevalent and will persist
- The species are not considered to be dependent upon any habitat within the Study Area for any particular lifecycle stages.

As such, while large tracts of habitat suitable for these protected matters will be affected, alternative habitat suitable for these species exists adjacent to the Study Area and within the region. Accordingly the Project is not predicted to adversely impact migratory species.

11.8 Cumulative and Consequential Impacts

An evaluation of the potential cumulative impacts resulting from the Project including an estimation of the overall size, significance and likelihood of these impacts has been undertaken. That assessment is reported in detail in Volume 1, Section 8 Cumulative Impacts.

Assessment has identified that the cumulative impacts having a low risk, include:

- Aquatic ecology
- Surface water
- Groundwater

The cumulative impact which has a high risk is:

- Terrestrial ecology

Implementation of the proposed Project offsets (as described in Volume 1 Section 9) it is considered that the overall impact of the Project can be managed.

Consideration of cumulative impacts relevant to matters of NES is provided in detail in Volume 4 Appendix J.

11.9 Proposed Offsets

An Offset Strategy has been drafted for the Project and is provided in Volume 1, Section 9 Offsets Strategy and Volume 4 Appendix AH Environmental Offsets Strategy. That Strategy provides a proposed approach to compiling an offset package that meets the Project's Commonwealth and State offset obligations.

A number of potential direct and indirect impacts have been identified within the Project footprint under both Commonwealth and State offset policies and include the direct loss of protected vegetation communities, habitat for threatened species and resources as a result of vegetation clearing. The delivery of offsets must meet the specific offset requirements outlined in all relevant environmental offset policies. In general there are two primary options for delivering offsets, these being either land-based offsets (direct or indirect) and/or offset payments.

There is scope for most of the offset obligations associated with impacts to Commonwealth and State environmental values to be met through the delivery of a combined offset approach that address impacts to environmental values protected under both areas of legislative jurisdiction. Offset options

that nominate a complementary approach will need to be agreed with DSEWPaC and DEHP so that these options satisfy the requirements of both Commonwealth and State offset policies.

The Draft Offset Strategy presents a staged approach to meeting offset requirements. The Offset Strategy, including components of relevance to matters of NES, will be further developed and finalised following liaison and meetings between the key stakeholders including the client, relevant government agencies (i.e. DSEWPaC and DEHP) and an environmental offset broker to discuss final offset requirements and proposed offset options for the Project.

11.10 Conclusions and Recommendations

Assessment of the potential to affect matters of NES has been achieved by integrating knowledge from desktop and field surveys. This has enabled a description of the existing environment of the project Study Are to be developed and confirm the presence and prevalence of any matters of NES within the Project Study Area. Where limited data exists potential habitat mapping has informed likelihood of species occurrence within the mine and rail Study Areas.

In consideration of construction and operational activities of the mine and rail components of the Project, potential impacts have been identified and described with respect to flora and fauna species, their confirmed and potential habitat and vegetation communities that occur within (confirmed) or are considered likely to occur within, the Study Area (as per the criteria nominated under Section 11.1.3.3).

Potential impacts arising from construction and operational works may include:

- Loss of remnant vegetation in the form of REs, flora habitat and vegetation community extents
- Loss of habitat (roosting, shelter, foraging, breeding) for native fauna including conservation significant fauna
- Degradation of terrestrial and aquatic habitat adjacent to and downstream of cleared areas
- Landscape fragmentation, reduction in connectivity and reduced capacity for fauna dispersal
- Fauna mortality

How these may affect matters of NES of relevance to the Project has been assessed in detail. Potential impacts have been considered with regard to whether an important population of protected species occurs at the site and whether impacts may be significant or not.

The significance of residual impacts, post-mitigation, was evaluated with consideration to the DSEWPaC significance criteria, which are provided in the Significant Impact Guidelines (DEWHA, 2009).

In considering impact to listed taxa and communities, assessment was also made to identify relevant matters for impact assessment in relation to the following:

- An important population – for listed vulnerable threatened species
- Habitat critical to survival – for listed threatened species
- Important habitat – for migratory species

Mitigation measures to avoid/minimise/offset impacts to identified matters of NES resulting from the construction and operational activities associated with the Project have been proposed and offset

commitments have been identified. Findings of the assessment are summarised against the controlling provisions for the Project.

World Heritage Properties, National Heritage Places and the Great Barrier Reef Marine Park

The DSEWPaC Projected Matters Search Tool did not identify any world heritage properties or National Heritage Places of relevance to the Project.

The WTWHA is located over 300 km north of the Study Area with no direct terrestrial, aquatic or biodiversity links to the Study Area. No influences from the Project are predicted to occur on the WTWHA and this area has not been considered further within this assessment.

The Tree of Knowledge and curtilage at Barcaldine is the closest National Heritage Place to the Study Area. It is located approximately 200 km south-west of the western extent of the Study Area. No direct or indirect influences on this Place will occur as a consequence of the Project and this Place has, therefore, not been considered further.

The GBRWHA and the Marine Park are located over 300 km downstream of the Study Area and although connected aquatically via watercourses, substantial watercourse and overland barriers exist between the ocean and the Study Area, including the Burdekin River dam. Significant controls will be established to manage onsite and offsite water and sediment quality impacts. These measures will mitigate potential for offsite impacts to aquatic values that could affect the downstream reefal environment. The distance from the GBR and the extant barriers would impede site conditions from having an influence on the values for which the reef is protected. No impacts associated with the Project will result in a substantial and measurable change in the hydrological regime of the GBRWHA waters and, therefore, no effects on the Marine Park are predicted either. Accordingly no impacts to the ecological, cultural or social values which the Great Barrier Reef is recognised will occur as a result of the Project.

The Project will not impact upon any World Heritage Areas, National Heritage Places or the Great Barrier Reef Marine Park.

Wetlands – Ramsar

No areas of Ramsar wetland are predicted to be impacted by this Project. The closest Ramsar wetland is 380 km from the site, disconnected from the Study Area by substantial barriers. No areas of internationally important wetland will be lost, destroyed or substantially modified as a result of the Project nor will the hydrological regime of those distant wetlands be interfered with. None of the biodiversity for which distant wetlands are recognised will be impacted by Project activities as the Project will not affect the geography of any Ramsar protected wetlands nor will it act to introduce invasive species to any wetland sites. Accordingly, no impacts to Ramsar wetlands are predicted to occur as a result of this Project.

Listed Threatened Species and Communities

Based on current knowledge assessment indicates the Project will likely realise significant impacts to the Black-throated finch (southern).

Significant impacts to Brigalow TEC will also result from unavoidable vegetation clearing, however, impacts will be restricted to the Project Area only with management measures ensuring no offsite affects are realised. Large areas of these TEC are protected in the surrounding landscape and losses equate to less than 1 per cent of the subregional extent of each TEC. Losses are not

expected to affect the ongoing prevalence or genetic diversity of these TEC within the subregion. Offsets will be proposed to address these losses in accordance with the relevant Commonwealth and State offset policies (refer Volume 1 Section 10 Draft Offsets Strategy).

As a consequence of habitat losses resulting from mining and other Project activities, significant impacts to the black-throated finch (southern) are expected to occur. Further, works may interfere with the species recovery by decreasing the availability or quality of habitat across the footprint of the Project area to the extent that the species is likely to decline. Consideration has been given to measures to ameliorate potential for impact to reduce potential to significantly affect the population of this subspecies.

Habitat losses will be staged. Research will be undertaken prior to mining works to improve knowledge of the habitat dependencies of this species and to identify appropriate areas that can be rehabilitated/engineered to offer alternative habitats into which the species could naturally relocate ahead of mining works. Habitat management, informed by ongoing research and monitoring, will also occur during the Project to minimise potential to realise a significant impact upon this species. Research works will contribute to the maintenance of this subspecies within this bioregion and therefore, in general, to the recovery of the subspecies, as per the objectives of the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007). The onsite and offsite habitat management and research program to be implemented will be informed by the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007), and developed in consultation with the Black-throated Finch Recovery Team, and other relevant stakeholders (i.e. Commonwealth and State governments, natural resource management groups, landholders etc.). Examples of recovery actions, documented in the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007), to be incorporated into the Project Species Specific Management Plan (on and offsite) for the subspecies, will include:

- Investigate breeding requirements and threats to key breeding areas (Action 1.1)
- Investigate feeding and other habitat requirements (Action 1.2)
- Undertake targeted surveys (to identify habitat) (Action 2.4)
- Secure selected sites for conservation (Action 3.1) – under Project Offsets
- Address threats on grazing lands (Action 3.2)
- Monitor management effectiveness (Action 3.3)
- Determine suitability of birds in captivity for a reintroduction project (Action 4.1)

Information obtained from such studies will be incorporated into the Project Species Specific Management Plan for the subspecies (under the overarching Project Land Management (Flora and Fauna) Plan). The measures summarised here and detailed throughout this section seek to address the Project's impact to the black-throated finch (southern) to reduce these to the greatest extent possible. Given current knowledge, determining the efficacy of the proposed measures in reducing impacts and protecting the subspecies is difficult to quantify. Preliminary research is required such that a clearer understanding of the subspecies' prevalence and behavioural ecology in the region can be ascertained, thereby allowing for the assessment of Project impacts to the subspecies to be undertaken in the context of a detailed understanding of the subspecies' regional population, abundance and behavioural ecology.

Operational works may realise groundwater draw down impacts to the Doongmabulla Springs, a regionally important Great Artesian Basin discharge spring ecosystem listed as a TEC under the EPBC Act. Predicted drawdowns at all springs in the Doongmabulla system are between 0.05 m and 0.12 m, throughout the operational period with the majority of predicted impacts lower than 0.05 m. The predicted drawdown potential at the Doongmabulla springs is 60 per cent of the level considered to be potentially significant and will occur approximately 60 years into the life of the mine.

Listed Migratory Species

A desktop and field assessment was undertaken to identify EPBC Act listed migratory species that have the potential to occur within the Mine and Rail Study Areas. Three species, eastern great egret (*Ardea modesta*), rainbow bee-eater (*Merops ornatus*) and stain flycatcher (*Myiagra cyanoleuca*) were confirmed present within the Study Area. An additional 11 species are considered likely to occur while four species may occur.

It is recognised that, in spite of the recommended management and mitigation measures, and the active rehabilitation of disturbed areas that will occur through the Project's operational life, unavoidable loss of habitat for migratory species will occur.

Active, targeted management of habitats adjacent to the clearing footprint can improve their quality for migratory species. Establishing alternative habitats adjacent to the Project through active management prior to clearing migratory species habitats will encourage individuals to disperse from proposed clearing areas (or attract them to adjacent areas). This may include, but not be limited to, improving forage and nesting resources, increasing access to watering locations, and management of pest and weed species, to enhance the value of adjacent areas. This action will seek to minimise habitat loss (through replacement) and will also act to minimise potential for mortality by providing migratory species with habitat refugia within the operational landscape. The details for such management approaches and actions will consider the staged nature of operations, will be informed by onsite research, and will be detailed within Project Species Specific Management Plans (under the overarching Project Land Management (Flora and Fauna) Plan).

The potential to realise a significant impact upon migratory species within the Study Area has been considered against criteria identified by DSEWPaC. Based on current knowledge the assessment identifies that the Project is not expected to have a significant impact upon any migratory species. This finding is on the basis that:

- The Study Area does not support an important population of any of these species
- The Study Area does not support an ecologically significant proportion of the population of a migratory species
- Measures identified in Sections 11.5.1.2 to 11.5.1.5 are expected to manage the potential to directly or indirectly impact these species
- The species are well represented in landscapes that surround the Study Area, where suitable alternative habitat is prevalent and will persist
- The species are not considered to be dependent upon any habitat within the Study Area for any particular lifecycle stages.

As such, while large tracts of habitat suitable for these protected matters will be affected, alternative habitat suitable for these species exists adjacent to the Study Area and within the region. Accordingly the Project is not predicted to adversely impact migratory species.

Recommendations

Project activities have been identified as having a significant effect on matters of NES. A number of Project commitments have been identified to provide additional baseline data pre-construction to:

- Inform and refine potential for impact upon specific environmental features such as the black throated finch
- Inform offset requirements for specific environmental features
- Establish site specific thresholds for application of effective monitoring of environmental receptors
- Enable applicable management and mitigation measures to be developed and incorporated into Project Environmental Management Plans
- Confirm relevancy of findings from EIS studies immediately prior to construction work commencement to show currency of data at that time
- Confirm agency expectations are met with regard to environmental protection during Project delivery

It is recommended that all pre-construction monitoring and research studies identified are completed to achieve the above and to provide additional information to regulatory agencies. Further, it is also recommended that consideration be given to establishing technical advisory panels for specific environmental features of concern. Panels could guide additional study requirements, independently verify objectives are achieved by studies and include regulators, proponents and technical specialists to provide a common forum for discussion to enable targeted activity requirements to be identified, agreed and delivered.

While this report address matters of NES of relevance to the Project, it is aligned with and has utilised information from all studies completed for the EIS. Readers should be familiar with all works available under Volumes 1, 2 and 3 of this EIS.