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Adani Mining Pty Ltd

NORTH GALILEE BASIN RAIL PROJECT

Environmental Impact Statement

Chapter 7 Matters of national environmental significance

November 2013

Executive Summary

Introduction

Adani Mining Pty Ltd (Adani) proposes to construct and operate the North Galilee Basin Rail Project (NGBR Project), a multiuser, standard gauge, greenfield rail line that will transport coal from mines in the northern Galilee Basin to the Port of Abbot Point in central Queensland. The NGBR Project is approximately 300 km in length and connects the proposed Carmichael Coal Mine and Rail Project's east-west rail corridor, approximately 70 km east of the proposed Carmichael Coal Mine in the vicinity of Mistake Creek, with supporting infrastructure at the Port of Abbot Point. The NGBR Project will have an operational capacity of up to 100 million tonnes per annum (mtpa) of coal product which is expected to be sourced from both Adani and third-party mines in the northern Galilee Basin.

A referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was prepared for the NGBR Project and submitted to the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC, now Department of the Environment (DotE)) in May 2013. Subsequently, SEWPaC issued a referral decision in June 2013 determining the NGBR Project to be a controlled action requiring assessment by way of an Environmental Impact Statement (EIS), with the following specific controlling provisions:

- World Heritage Properties (section 12 and 15A)
- Natural Heritage Places (sections 15B and 15C)
- Listed threatened species and communities (sections 18 and 18A)
- Listed migratory species (sections 20 and 20A)
- Commonwealth Marine Areas (sections 23 and 24A)
- Great Barrier Reef Marine Park (sections 23 and 24A).

This chapter has been prepared to address matters of national environmental significance (MNES), in accordance with the final Guidelines for an EIS for the North Galilee Basin Rail Project (EPBC 2013/6885). A copy of these guidelines is provided in Volume 2 Appendix G. A cross-reference to where each aspect of the guidelines has been considered is provided in Section 7.18.

The proponent

Adani Mining Pty Ltd (Adani) is the proponent for the NGBR Project. Adani is a subsidiary of Adani Enterprises Ltd, and forms part of the broader Adani Group of companies based in Ahmedabad, India.

Adani is a registered Australian company with corporate governance and reporting obligations under Australian Law, distinct from the management and obligations of other Adani Group subsidiaries in other jurisdictions. Adani has not been subject to any proceedings under an Australian Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources. Adani has a proven record of obtaining and complying with all necessary approvals for its projects including the Environmental Authority for the Carmichael Coal Mine ongoing exploration program.

Project rationale

The NGBR Project is a standard gauge rail project which is proposed to connect the Carmichael Project rail infrastructure to the Port of Abbot Point. The NGBR Project will service the Carmichael Project and third-parties, allowing coal to be transported to the Port of Abbot Point for international export.

The Galilee Basin spans over 247,000 km^2 of land which is considered to be one of the last undeveloped coal reserves within Queensland and is expected to become the largest coal producing region in the State. In June 2012, the Queensland government announced its support for the development of the coal industry in the Galilee Basin and recognised the need for infrastructure, particularly rail links from mine to port, to support such development.

The NGBR Project is proposed to provide a more direct and operationally more cost effective transport solution direct to the Port of Abbot Point in accordance with the Queensland Government's preference for a single north-south multi-user common access rail corridor servicing the Galilee Basin, as outlined in the Galilee Basin Coal Infrastructure Framework (DSDIP 2013). This will aid in the reduction of current rail congestion and cumulative impacts experienced on the Goonyella and Newlands systems via Moranbah.

The NGBR Project aligns with a number of key State government policies that guide and inform the development of Queensland's abundant coal resources including:

- Galilee Basin Coal Infrastructure Framework (DSDIP 2013)
- Galilee Basin Development Strategy (DSDIP 2013a)
- Coal Plan 2030 (DSDIP 2010)
- Queensland Infrastructure Plan (DLGP 2011a)
- Draft Moving Freight strategy (DTMR 2013)
- Queensland Regionalisation Strategy (DLGP 2011b).

Economic assessments estimate that at a regional level, the NGBR Project is expected to generate a significant and positive economic impact in the Mackay, Isaac and Whitsunday (MIW) region and Queensland. The NGBR Project will involve a capital investment of approximately $2.2 billion which includes capital expenditure on earthworks, drainage, bridges, road works, rail track and signalling, communications and construction management costs.

Economic modelling estimates that the NGBR Project will generate approximately 6,150 jobs (1,700 direct and 4,452 indirect) in the MIW region and just under 7,000 jobs (2,017 direct and 4,981 indirect) in total across Queensland during the peak construction year of 2015. In 2015, modelling estimates that the NGBR Project will contribute $791 million to Gross Regional Product in the MIW region and $909 million to Queensland's Gross State Product.

Once fully operational, modelling estimates that the NGBR Project will contribute $209 million to Gross Regional Product in the MIW region per annum and $369 million per annum to Queensland's Gross State Product. Operation of the NGBR Project is also estimated to generate 1,097 (277 direct and 820 indirect) full time equivalent positions each year in the MIW region and 1,940 (369 direct and 1,571 indirect) full time equivalent positions each year across Queensland over the life of the NGBR Project.

Relationship to other projects

Adani is committed to financing the environmental assessment and ongoing development of several projects in Queensland, including:

- Carmichael Coal Mine and Rail Project (refer EPBC 2010/5736)
- Abbot Point Coal Terminal 0 Project (refer EPBC 2011/6194)
- Dudgeon Point Coal Terminals Project (refer EPBC 2012/6240).

The NGBR Project will directly connect the Carmichael Coal Mine with the Port of Abbot Point; via a connection to the proposed east-west Carmichael Rail Line approximately 70 km east of the Carmichael Coal Mine. Adani also currently own the lease for Abbot Point Coal Terminal 1 and is proposing to develop Terminal 0 to facilitate increased coal export capacity in association with the proposed Carmichael Coal Mine and Rail Project and the NGBR Project.

Consultation

Adani commenced formal consultation with key stakeholders and the broader community for the NGBR Project in early 2013. Public consultation activities have also been implemented to align with requirements for the Social Impact Assessment and other components of the EIS.

A preliminary stakeholder list was developed through desk-based research and analysis of existing information materials. This list was subject to ongoing refinement throughout the consultation process, with input from Adani and other NGBR Project stakeholders.

Communication materials were developed to provide stakeholders with information about the NGBR Project, to help facilitate the two-way flow of information between the NGBR Project team and stakeholders, and to record all feedback. These materials included:

- NGBR Project factsheet and posters
- 1800 free call telephone information line
- NGBR Project email address
- Community feedback forms
- Project webpage
- Paid advertising
- PowerPoint presentations.

The stakeholder feedback identified potential environmental, social and economic impacts and benefits of the NGBR Project. Issues raised during consultation helped informed the EIS and were incorporated into technical studies as part of the EIS process.

Following acceptance of the EIS by the Coordinator-General and DotE, the document will be placed on public display for a minimum period of six weeks. Following completion of the public display period, all stakeholder and community feedback will be reviewed and addressed and a supplementary report will be provided if required.

Project description

- Key features of the NGBR Project include:
- Approximately 300 km of standard gauge, bi-directional rail track located within a nominal 100 m wide rail corridor (the final rail corridor)

- A rail maintenance access road running parallel to the rail track for approximately 300 km and wholly within the final rail corridor
- Seven passing loops, each 4.3 kilometres in length
- Signalling infrastructure
- Approximately 4.5 kilometres of fill greater than 15 m in depth (11 locations) and approximately 3.4 kilometres of cut greater than 15 m in depth (nine locations)
- At-grade and grade-separated road, rail, stock and occupational crossings
- Bridge and culvert structures at major waterways and drainage lines, and various other longitudinal and cross drainage structures
- A rolling stock maintenance facility near the Port of Abbot Point including provisioning line, train maintenance line, wagon and locomotive service sheds, wash bay and queuing line
- Five temporary accommodation camps for construction workers
- A temporary construction depot at the southern end of NGBR Project
- Temporary construction yards, concrete batching plants, bridge and track laydown areas and heavy vehicle turning circles.

During construction, quarries and borrow pits within acceptable haulage distances will be required to provide a cost effective source of fill, gravel, aggregate and ballast. The number and location of borrow pits and quarries will be investigated further during detailed design and each may require screening and crushing plants to process material.

Cost and timing

Capital expenditure for construction of the NGBR Project including all ancillary infrastructure is expected to be in the order of $2.2 billion. Construction is scheduled to start in late 2014 and be completed within approximately two years.

Operational expenditure for the operation and maintenance of the NGBR Project is expected to be in the order of $2.50 per tonne. Operation of the NGBR Project will coincide with completion of construction and commencement of Carmichael Project (Mine) output, currently expected in 2016. The NGBR Project will service the Carmichael Project (Mine) and third-party users throughout its proposed 90 year lifespan.

Pre-construction and construction

Construction of the NGBR Project will occur over four phases as summarised in Table 7-1. The estimate peak construction workforce of 1,700 (full-time equivalent) will occur in 2015.

Table 7-1 Construction schedule

Phase	Timeframe (estimated)
Phase 1, site preparation	Late 2014 – 2nd quarter 2015
Phase 2, drainage structure, earthworks and bridges	4th quarter 2014 – 1st quarter 2016
Phase 3, track laying	4th quarter 2015 – 3rd quarter 2016
Phase 4, signalling and communications	3rd quarter 2016 – 4th quarter 2016

Construction of watercourse crossings

The final rail corridor will intersect a number of regional surface water features and smaller ephemeral streams.The major waterway and bridge structure crossings along the preliminary investigation corridor are listed in Table 7-10. A total of 196 watercourses along the final rail corridor have been identified as requiring cross drainage structures.

Table 7-2 Major waterways and crossing structures

Chainage (km)	Waterway	Crossing structure
20.23	Splitters Creek	Bridge (3 span) Box culverts (4 cell)
35.08	Elliot River	Bridge (4 span)
61.22	Bogie River	Bridge (9 span)
64.78	Sandy Creek	Bridge (3 span)
98.78	Strathmore Creek	Bridge (2 span)
106.05	Pelican Creek	Bridge (8 span)
132.20	Bowen River	Bridge (20 span) Box culverts (15 cell)
172.06	Suttor River (Upper)	Bridge (2 span)
176.58	Lily Creek	Box culverts (15 cell) Pipe culverts (4 cell)
187.00	Rockingham Creek	Bridge (2 span)
206.51	Murray Creek	Bridge (3 span)
220.86	Upper Gunn Creek	Box culverts (6 cell)
231.20	Gunn Creek	Pipe culverts (25 cell) Box culverts (13 cell)
242.53	Verbena Creek	Bridge (3 span)
244.49	Serpentine Creek	Box culverts (12 cell)
271.06 - 273.37	Suttor River (Lower)	Bridge (55 span) Box culverts (18 cell)

Operation

The operation of the NGBR Project is expected to commence in 2016 and reach peak capacity of 100 mtpa by 2026. The utilisation of the capacity of the NGBR Project will reflect the production of coal from the Carmichael Coal Mine and utilisation by third-party users. At full capacity (100 mtpa) the following train movements will occur daily:

- Nine loaded train movements (day)
- Nine unloaded trains movements (day)

- Five loaded train movements (night)
- Five unloaded train movements (night).

Unloaded trains will travel at up to 100 km per hour and loaded trains will travel at up to 80 km per hour. Within passing loops and maintenance sidings, trains will slow to 50 km per hour and 25 km per hour respective to each location.

An estimate of the yearly peak workforce numbers (full-time equivalent) for each year of operation is provided in Table 7-3.

Table 7-3 Operational workforce requirements

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Total	66	103	141	173	209	254	315	327	350	361	369

Decommissioning and rehabilitation

Temporary construction infrastructure will be decommissioned as soon as they cease to serve their intended purpose. The sites of the decommissioned infrastructure will then be rehabilitated to a state consistent with the natural environment. The general approach will be to regrade the site, followed by reapplication of topsoil and seeding with native species. The infrastructure that this will apply to includes:

- Construction camps
- Borrow areas
- Stockpiles
- Haul roads and access roads
- Turkey nest dams
- Laydown areas
- Turning circles
- Temporary work platforms

Most decommissioning activities will occur at the end of the 90 year life of the NGBR Project. Rehabilitation will be planned and refined throughout the life of the NGBR Project and incorporated into the decommissioning and rehabilitation plan. This will enable compliance with any legislated requirements closer to the time of intended end-of-life decommissioning.

Assessment of alternatives

While the development of the proposed NGBR Project is considered the preferred option for standard gauge rail infrastructure to transport coal product out of the northern Galilee Basin, alternatives to the NGBR Project have also been investigated, as well as exploring a ‘do nothing’ option.

Adani has separately considered developing and / or utilising a consolidated corridor with Waratah Coal’s proposed China First Project, or Hancock Coal Infrastructure’s proposed Alpha Coal Project, both of which provide for standard gauge rail infrastructure. However, uncertain development timeframes and the identification of a more direct rail route has left Adani with limited potential for co-use of these railways. Transportation to the Port of Abbot Point, via the proposed Carmichael Coal Mine and Rail Project requires access and utilisation of the existing Aurizon narrow gauge network which, presents a number of constraints. The current Goonyella and Newlands systems are narrow gauge, having a much lower axle load with limited capacity for upgrade, all of which combined will act to increase coal prices and reduce the cost-competitiveness of Galilee Basin coal in the global market.

Aurizon is proposing to develop a Central Queensland Integrated Rail Project to service proposed coal mines in the Galilee Basin. This rail project alignment proposed to connect to already congested rail systems, while being a longer and operationally less efficient narrow gauge system compared to the heavy haul standard gauge proposed for the NGBR Project. Opportunities to consolidate the Aurizon and Adani alignments have been explored however, due to uncertainty with regard to Aurizon's development timelines in addition to the above technical aspects, Adani has decided to propose the much shorter, standard gauge, NGBR Project.

The 'do nothing' option will result in increased traffic on Aurizon's Goonyella and Newlands rail systems and thus increase the bottleneck situation currently being experienced on the existing rail system near Moranbah. Subsequent upgrades to sections of rail are envisaged to be larger in scale and lead to further social and environmental disturbances. Longer rail routes will also increase the cost of producing the coal, which will in turn impact the competitive pricing of coal from the Galilee Basin in the global market.

Methodology

Desktop assessment and field surveys were conducted to assess the existing MNES values of the preliminary investigation corridor and wider study area. Steps in the methodology included:

- Review existing studies and available data relevant to MNES within the study area
- Undertake a field survey and inspection of a number of representative sites
- Describe the potential MNES values of the NGBR Project preliminary investigation corridor and, where their presence is uncertain, assign a likelihood of their occurrence
- Describe the potential MNES values within a wider study area and, where their presence is uncertain, assign a likelihood of their occurrence
- Define the potential direct (nominal 100 m final rail corridor) and indirect (wider study area) impacts associated with the NGBR Project
- Identify appropriate avoidance, mitigation and management measures to minimise potential impacts
- Assess the significance of residual impacts on MNES in accordance with the EPBC Act Matters of National Environmental Significance Significant Impact Guidelines 1.1 (DEWHA 2009, hereafter referred to as the Significant Impact Guidelines).

Great Barrier Reef World Heritage Properties and National Heritage Places

There are no World Heritage Properties (WHPs) or National Heritage Places (NHPs) directly intersected by the final rail corridor. Despite this, there is the potential that the NGBR Project may indirectly impact on WHPs or NHPs due to hydraulic connectivity with watercourses intersected by the final rail corridor. Two WHPs / one NHP have been identified as of potential relevance to the NGBR Project, these include:

- The Wet Tropics World Heritage Area (WTWHA)

- The Great Barrier Reef World Heritage Area (GBRWHA) and National Heritage Place (GBRNHP).

The existing environmental values of each are discussed further below.

Wet Tropics World Heritage Area

The WTWHA is located over 300 km north of the final rail corridor and is outside the Burdekin River Basin and the Brigalow Belt Bioregion, with no direct or indirect terrestrial, aquatic or biodiversity links to the final rail corridor. The WTWHA is, therefore, not hydrologically or regionally connected to the final rail corridor and, as such, there is no ecological connection between the final rail corridor and the WTWHA. No influences from the NGBR Project are predicted to occur on the WTWHA and this site has not been considered further within this assessment.

Great Barrier Reef World Heritage Area and National Heritage place

The GBRWHA has been identified as being of relevance to the study area. The GBRWHA is not directly intersected by the final rail corridor, however may be subject to indirect impacts due to the hydrological connection of the watercourses crossed by the NGBR final rail corridor.

The GBRWHA lies within 500 m of the northern-most part of the final rail corridor near the Port of Abbot Point. The final rail corridor crosses watercourses which discharge indirectly into the GBRWHA via the Lower Burdekin River; the watercourses crossed include the Bowen River, Bogie River and Suttor River. The majority of the final rail corridor is within the Burdekin River Basin, which discharges directly to the GBRWHA near the town of Ayr, into Upstart Bay.

The final rail corridor also intersects a number of perennial and ephemeral streams (Elliot River, Saltwater Creek and Splitters Creek, among others) within the Don River Basin, which flow directly into Abbot Bay or into the Caley Valley Wetland, which subsequently discharges into Abbot Bay and the GBRWHA.

The existing environmental values associated with the GBRWHA with the potential to be impacted by the NGBR Project can be characterised into the following components:

- The outstanding universal values of the GBRWHA
- The existing World Heritage values at Abbot Point
- The National Heritage criteria of the GBRNHP
- The existing marine environment at Abbot Point.

Construction phase - potential impacts

Construction activities associated within the final rail corridor (i.e. vegetation clearing, cut and fill activities etc.) will not directly affect the GBRWHA or GBRNHP, however indirect impacts such as increased sediment load of runoff into watercourses or accidental spillages of contaminants have the potential to degrade downstream water quality and subsequently affect the relevant World Heritage / National Heritage values.

Construction works have the potential to directly affect watercourses that are hydrologically connected to coastal habitats. The NGBR Project traverses 567 waterways and overland flow paths, as well as their catchments and flood plains. Activities during the construction phase that have relevance to the GBRWHA and GBRNHP are those that have potential to influence the quality of water entering the downstream catchment system as a result of:

- Changes in water quality

- Changes to freshwater inflows.
- Introduction of weeds and pests.

To limit the degradation of downstream water quality and the introduction of weeds during construction activities, mitigation and management will focus on reducing the potential mobilisation of sediments or pollutants, and limiting sediment transport from exposed areas.

This will be achieved through the implementation of the following management plans:

- Erosion and Sediment Control Plan
- Acid Sulfate Soils Management Plan
- Water Quality Management Plan
- Weed and Pest Management Plan.

Operation phase - potential impacts

The potential impacts during the operations phase of the NGBR Project on the GBRWHA and GBRNHP are expected to be similar in nature to those experienced during the construction phase. In this regard, the operations of the final rail corridor are not expected to directly impact the values of the GBRWHA and GBRNHP however there is the potential for contamination of the watercourses crossed by the final rail corridor. The contamination of these watercourses may subsequently affect the water quality of the GBRWHA and GBRNHP and could hence detract from the World Heritage and National Heritage values.

During the operations phase of the NGBR Project, no further changes to the existing topography or surface cover are expected and it is not anticipated that any further hardstand areas will be developed. It is therefore unlikely that there will be any change to the inflow of freshwater (i.e. stormwater) into waterways and subsequently, the GBRWHA and GBRNHP.

Activities during the operations phase which have relevance to the GBRWHA and GBRNHP are those that have potential to influence quality of water entering the downstream catchment system.

Water quality management during the operations phase of the NGBR Project primarily comprise of an operational water quality monitoring program which will be developed prior to commencement of operations of the NGBR Project.

Significance of residual impacts

The NGBR Project is not anticipated to have a significant residual impact on either the GBRWHA or the GBRNHP and therefore offsets are not required for these values.

GBRMP

The Great Barrier Reef Marine Park (GBRMP) is not directly intersected by the final rail corridor however it may be subject to indirect impacts due to the hydrological connection of the watercourses intersected by the final rail corridor.

The GBRMP lies adjacent to the coastline between Upstart Bay and Abbot Bay; the port area at Abbot Point is excluded from the marine park and the northern-most part of the final rail corridor is adjacent to the GBRMP. In 1975, the Great Barrier Reef Marine Park was designated and the Great Barrier Reef Marine Park Authority was established as a management agency chartered with the responsibility of management of activities within the park boundaries. The marine park covers more than 344,400 km^2 of the GBRWHA and extends 2,300 km along the Queensland coast.

The existing environmental values associated with the GBRMP include:

- The existing marine environment at Abbot Point and Upstart Bay
- The GBRMP zoning in the vicinity of Abbot Point and Upstart Bay.

Construction phase - potential impacts

The final rail corridor does not directly traverse the GBRMP and therefore construction activities associated with the NGBR Project (i.e. vegetation clearing, cut and fill activities etc.) will not directly affect the existing environmental values of the GBRMP. However, there is the potential for indirect impacts such as increased sediment load in runoff or accidental spillages of contaminants at watercourse crossings in upstream catchments, to have the potential to degrade downstream water quality and subsequently affect the quality of the marine environment within the GBRMP.

The NGBR Project traverses 567 waterways and overland flow paths, as well as their catchments and flood plains. Activities during the construction phase that have relevance to the GBRMP are those that have the potential to influence the quality of water entering the downstream catchment system as a result of:

- Changes in water quality
- Changes to freshwater inflows.

The construction of the NGBR Project has the potential to increase sediment and nutrient loads if stormwater, waste and other pollutant sources are not appropriately managed. Environmental control measures proposed for the NGBR Project, including stormwater management measures will aim to appropriately manage this risk.

To limit the degradation of downstream water quality during construction activities, mitigation and management will focus on reducing the potential mobilisation of sediments or pollutants, as well as limiting sediment transport from exposed areas.

This will be achieved through the implementation of the following management plans:

- Erosion and Sediment Control Plan (ESC Plan)
- Acid Sulfate Soils Management Plan (ASS Plan)
- Water Quality Management Plan.

The monitoring programs will be incorporated into each management plan as required and conditioned under the approval for the NGBR Project

Operation phase - potential impacts

The potential impacts during the operations phase of the NGBR Project on the GBRMP are expected to be similar in nature to those experienced during the construction phase (i.e. potential changes to water quality or watercourses which discharge into the GBRMP). The operations of the final rail corridor are not expected to significantly impact the environmental values of the GBRMP however there is the potential for contamination of the watercourses crossed by the final rail corridor due to accidental spillages or leakage of hazardous substances. The contamination of these watercourses may subsequently affect the water quality within the GBRMP and the ecological integrity of the marine ecosystem.

Significance of residual impacts

The NGBR Project is not anticipated to have a significant residual impact on the GBRMP and therefore offsets are not required for this value.

Threatened species

Forty-one threatened species listed under the EPBC Act were predicted to occur within the preliminary investigation corridor. Two threatened species, black ironbox (*Eucalyptus raveretiana*) and squatter pigeon (southern) (*Geophaps scripta scripta*) were confirmed present during field surveys of the preliminary investigation corridor. A further four fauna species are assessed as being likely to occur and 12 species as may occur within the preliminary investigation corridor.

A summary of the potential direct and indirect impacts of the NGBR Project as well as an assessment of residual impacts is provided in Table 7-4.

Table 7-4 Summary of potential impacts and residual impacts

Threatened species	Potential direct impacts	Potential indirect impacts	Residual impact assessment against the Guidelines
Black ironbox (*Eucalyptus raveretiana*)	**Construction** Direct loss of 64.6 ha of potential habitat. Potential direct loss of individuals. Alteration of stream and floodplain hydrology.	**Operation** Proliferation of exotic weeds (particularly rubber vine)	The final rail corridor of the NGBR Project is unlikely to contain an important population of black ironbox or habitat critical to the survival of the species. No significant impacts are predicted.
Squatter pigeon (southern) (*Geophaps scripta scripta*)	**Construction** Direct loss of 1,788 ha of potential habitat. Individual mortality through vehicle collisions. **Operation** Individual mortality through train/maintenance vehicle collisions.	**Construction** Degradation of surrounding habitat through edge effects (e.g. weed spread and predation, noise, light, dust and vibration). **Operation** Habitat degradation due to weed spread and predation, noise, light, dust and vibration.	While an important population of squatter pigeon is unlikely to occur within the final rail corridor, potential habitat will be impacted that may be habitat critical to the survival of the species. The NGBR Project may therefore result in a significant impact to the species.
Australian painted snipe (*Rostratula australis*)	**Construction** Direct loss of 45.6 ha of potential habitat. Habitat fragmentation **Operation**	**Construction** Degradation of surrounding habitat through edge effects (e.g. weed spread and sedimentation). Noise,	The final rail corridor of the NGBR Project is unlikely to contain an important population of Australian painted snipe or habitat critical to the survival of the species. No significant

Threatened species	Potential direct impacts	Potential indirect impacts	Residual impact assessment against the Guidelines
	Individual mortality through train/maintenance vehicle collisions.	light, dust and vibration. Potential for reduced water quality. **Operation** Habitat degradation due to weed spread and predation, noise, light, dust and vibration.	impacts are predicted.
Black-throated finch (southern) (*Poephila cincta cincta*)	**Construction** Direct loss of 2,143 ha of potential habitat **Operation** Individual mortality through train/maintenance vehicle collisions.	**Construction** Degradation of surrounding habitat through edge effects (e.g. weed spread and sedimentation). Noise, light, dust and vibration **Operation** Habitat degradation due to weed spread and predation, noise, light, dust and vibration.	While an important population of black-throated finch is unlikely to occur within the final rail corridor, potential habitat will be impacted that may be habitat critical to the survival of the species and the Project may reduce the area of occupancy of the species. The NGBR Project may therefore result in a significant impact to the species.
Koala (*Phascolarctos cinereus*)	**Construction** Direct loss of 2,390 ha of potential habitat. **Operation** Individual mortality through train/maintenance vehicle collisions.	**Construction** Degradation of surrounding habitat through edge effects (e.g. weed spread and sedimentation). Noise, light, dust and vibration **Operation** Habitat degradation due to noise, light, dust and vibration.	While an important population of koala is unlikely to occur within the final rail corridor, potential habitat critical to the survival of the species will be impacted. The NGBR Project may therefore result in a significant impact to the species.
Ornamental snake (*Denisonia maculata*)	**Construction** Direct loss of 246 ha of potential habitat **Operation** Individual mortality through train/maintenance	**Construction** Degradation of surrounding habitat through edge effects (e.g. weed spread and sedimentation). Noise, light, dust and vibration.	The final rail corridor of the NGBR Project is unlikely to contain an important population of ornamental snake or habitat critical to the survival of the species. No significant impacts are predicted.

Threatened species	Potential direct impacts	Potential indirect impacts	Residual impact assessment against the Guidelines
	vehicle collisions.	**Operation** Habitat degradation due to weed spread, noise, light, dust and vibration.	

Threatened Ecological Communities

The Protected Matters Search Tool (refer Appendix G of Volume 2 Appendix F Nature conservation (page 292) identified three TECs predicted to occur within the final rail corridor:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) - endangered
- Semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar Bioregions - endangered
- Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin – endangered.

The occurrence of TECs was predicted based on the presence of TEC constituent regional ecosystems (REs) occurring within the preliminary investigation corridor.

The NGBR Project is expected to have both direct and indirect impacts on TECs, throughout both the construction and operational phases. Key impacts to TECs that are likely to result from construction of the NGBR Project are:

- Reduction in TEC extents as a result of vegetation clearing
- Fragmentation of previously intact areas of TECs.

A summary of potential direct impact to each of the TECs anticipated to be impacted by the NGBR Project is provided below in Table 7-5. Note these are considered to be conservative estimates; additional survey work is likely to refine these calculations to more accurately represent expected impacts on TECs.

Table 7-5 Potential impacts to TECs

Threatened ecological community	Potential impact area (ha)	Potential impact area as percentage of extent remaining in bioregion
Brigalow (*Acacia harpophylla*) dominant and co-dominant	100	0.0002
Semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar regions	35.8	0.0003
Natural grasslands of the Queensland central highlands and the northern Fitzroy Basin	0	n/a

Potential impacts to TECs that are likely to result from the operation of the NGBR Project are:

- Degradation of retained areas of TEC around NGBR Project infrastructure
- Increased spread and prevalence of introduced weeds and/or pest species

- Degradation of TECs through increased fire severity (as a result of altered fuel characteristics).
- Dust deposition impacting the photosynthetic ability of vegetation.

Significance of residual impacts

A summary of potential direct and indirect impacts, proposed mitigation measures and residual impact assessment is provided below in Table 7-6.

Table 7-6 Summary of potential impacts and residual impacts

TEC	Potential direct impacts	Potential indirect impacts	Residual impact assessment against the Guidelines
Brigalow (*Acacia harpophylla* dominant and co-dominant)	**Construction:** Direct loss of 100 ha of brigalow TEC Fragmentation of previously intact areas of TEC	**Operation:** Degradation of retained areas of TEC Increased spread and prevalence of introduced weeds and/or pest species	The NGBR Project is likely to have a significant impact on this TEC as it will reduce the extent, increase fragmentation and interfere with the recovery of this TEC.
Semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar regions	**Construction:** Direct loss of 35.8 ha of SEVT TEC Fragmentation of previously intact areas of TEC	**Operation:** Degradation of retained areas of TEC Increased spread and prevalence of introduced weeds and/or pest species	The NGBR Project is likely to have a significant impact on this TEC as it will reduce the extent, increase fragmentation (at a highly localised scale) and interfere with the recovery of this TEC.
Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin	**Construction:** No direct impacts predicted	**Operation:** No indirect impacts predicted	The NGBR Project is unlikely to have a significant impact on this TEC, as it has not been confirmed within or adjacent to the final rail corridor. During detailed design, additional targeted survey in areas where access was previously unavailable will confirm this.

Migratory species

Three listed migratory (bird) species were confirmed present within the preliminary investigation corridor during field surveys, with a further 25 bird species and one reptile species being likely to occur within that corridor. In addition, three migratory marine mammal species are considered likely to occur within the area adjacent to the preliminary investigation corridor.

A summary of potential direct and indirect impacts, proposed mitigation measures and residual impact assessment is provided below in Table 7-7.

Table 7-7 Summary of potential impacts and residual impacts

MNES	Potential direct impacts	Potential indirect impacts	Residual impact assessment against the Guidelines
Migratory aerial bird species	**Construction**: Very low potential for collision with infrastructure.	**Construction:** Localised depletion of invertebrate prey food availability as a result of vegetation clearing.	No significant impacts are predicted
Migratory woodland bird species	**Construction:** Loss and fragmentation of woodland habitats. **Operation:** Very low potential for collision with vehicles or permanent infrastructure.	**Construction:** Disturbance through noise, light, dust and vibration. Increased localised abundance of pest species as a result of poor waste management. **Operation**: Noise and dust disturbance from coal trains, loading facilities and maintenance vehicles.	No significant impacts are predicted
Migratory bird of prey species	**Construction:** Loss of nesting sites and foraging habitat. **Operation:** Very low potential for collision with vehicles or permanent infrastructure.	**Construction:** Potential for disturbance through noise, light, dust and vibration to impact nesting activities. **Operation:** Potential for disturbance through noise, light, dust and vibration to impact nesting activities.	No significant impacts are predicted
Migratory wetland bird species	**Construction:** Loss of foraging and nesting habitat for migratory wetland bird species. Destruction of active nests could lead to loss of eggs or mortality of young. **Operation:** Very low potential for collision with vehicles or permanent	**Construction**: Disturbance through noise, light, dust and vibration. Increased localised abundance of pest species as a result of poor waste management. **Operation**: Disturbance through noise, light, dust and vibration. Increased localised abundance of pest species as a result of poor waste management.	No significant impacts are predicted

MNES	Potential direct impacts	Potential indirect impacts	Residual impact assessment against the Guidelines
	infrastructure.		
Migratory shorebird species	**Construction:** Loss of foraging and roosting habitat for migratory shorebird species. **Operation:** Risk of degradation in water quality. Very low potential for collision with vehicles or permanent infrastructure.	**Construction:** Disturbance through noise, light, dust and vibration in a localised area. **Operation**: Low level disturbance through noise and light in a localised area.	No significant impacts are predicted
Dugong	No potential direct impact	Degradation of habitat due to water quality impacts from sedimentation or pollution.	No significant impacts are predicted
Estuarine crocodile	No potential direct impact	Degradation of habitat due to water quality impacts from sedimentation or pollution.	No significant impacts are predicted
Inshore dolphins	No potential direct impact	Degradation of habitat due to water quality impacts from sedimentation or pollution.	No significant impacts are predicted

As no significant impacts are anticipated to listed migratory species, no specific offsets for these species have been proposed. However, some of the terrestrial migratory species in particular may benefit from offsets that will be implemented for a number of listed threatened species, where these species share similar habitat requirements.

Where populations of listed migratory species are found during the evolution of the NGBR project, an adaptive management and mitigation approach may be required, involving the collection of monitoring data to inform and improve appropriate levels of management and corrective actions over time. Monitoring of weed and pest species presence and abundance will also be undertaken during the construction and operation of the NGBR Project.

Commonwealth Marine Areas

The NGBR Project is wholly terrestrial in nature, and therefore is not located within the boundaries of the Commonwealth Marine Areas (CMA); however, there is an indirect hydrological connection between the CMA and watercourses crossed by the NGBR Project final rail corridor. Impacts on the hydrology and water quality of these waterways may indirectly impact the existing condition of the CMA.

The CMA encompasses the GBRMP which is considered to be of high conservation value under the EPBC Act. A detailed description of the existing environmental values of the GBRMP is provided in Section 7.7.2. The values of the CMA in proximity to the NGBR Project are generally identical to those of the GBRMP; the primary difference is that all habitats within three nautical miles of the coastline is excluded from the CMA.

Additionally, the Coral Sea Commonwealth marine reserve is considered likely to be indirectly impacted by the construction and operations of the NGBR Project.

Construction and operations phase – potential impacts

The CMA boundary lies three nautical miles off the coast and the final rail corridor therefore does not directly traverse the CMA. It is subsequently expected that the construction and operations activities associated with the NGBR Project (i.e. vegetation clearing, cut and fill activities, train movements and maintenance etc.) will not directly affect the existing environmental values of the CMA.

However, there is the potential for indirect impacts such as minor increases in sediment load in runoff or accidental spillages of contaminants at watercourse crossings in upstream catchments, to have the potential to degrade downstream water quality and subsequently affect the quality of the marine environment within the CMA.

Potential indirect impacts of the NGBR Project on the conservation values of the reserve and the CMA are confined to the impacts of increased shipping activity. The capacity of the existing port, coupled with the proposed expansion at Abbot Point, will inherently result in an increase in shipping numbers and the contribution of the NGBR Project to shipping activity in the port will not affect the significance of the impacts already associated with the port development.

The following events have the potential to occur as a result of increased shipping activity in the port (ELA and Open Lines 2012):

- Groundings and collisions
- Oil spills
- Introduction of marine pests
- Underwater radiated noise
- Increased lighting from ships
- Increased number of marine fauna strike incidents.

The implementation of operational guidelines of NQBP (including the use of accredited marine pilots) will minimise the likelihood of occurrence of any direct impacts to the marine ecosystem as a result of groundings / collisions / oil spills facilitated by increased shipping at the Port of Abbot Point. It is expected that the implementation of industry standard pest management measures will minimise the likelihood of the introduction of pest species associated with an increase in vessel numbers.

The implementation of the proposed mitigation and management measures is expected to minimise the potential impacts of the NGBR Project on the CMA. The management plans developed will also incorporate a monitoring program during both the construction and operations phase to ensure that any changes in water quality directly associated with NGBR Project activities is identified and remedied in a timely manner.

Significance of residual impacts

The NGBR Project is not anticipated to have a significant residual impact on the Commonwealth marine area and therefore offsets are not required for this value.

Cumulative and consequential impacts

Cumulative impacts

The assessment of potential cumulative impacts of the NGBR Project was undertaken and included the following tasks:

- Identification of proposed projects within the public domain
- Review of project descriptions of proposed projects
- Review of residual impacts of NGBR Project on MNES
- Screening of residual impacts for their potential to interact with other impacts
- Review of environmental assessments of proposed projects
- Prediction of the scale and magnitude of cumulative impacts on MNES.

Based on the assessment of the residual impacts associated with the NGBR Project, the following were considered to be of relevance cumulatively with other projects:

- Loss of habitat for TECs as well as threatened and migratory species
- Increased levels of noise on migratory birds in the Caley Valley wetland.

The assessment of cumulative impacts concluded that the NGBR Project is not anticipated to result in any significant cumulative impacts on MNES.

Consequential impacts

Consequential impacts were considered to be those arising from third party activities that will occur as a result of commissioning and operation of the NGBR Project. The consequential impacts considered relevant to the MNES values associated with the NGBR Project include:

- Lighting impacts on fauna behaviour
- Increased coal dust from trains and stockpiles at Abbot Point
- Increase in shipping activity through the GBR and CMA.

The development of the NGBR Project will result in an increase in light spillage at Abbot Point during the construction phase. These impacts however, are likely to be minor and temporary and are not expected to result in a significant impact to any MNES. During operations, the contribution of increased light spillage of the NGBR Project into the marine environment will be relatively minor compared to that resulting from the proposed port expansion projects.

The direct impacts of the NGBR Project due to coal dust and subsequent impacts on MNES along the final rail corridor is considered negligible; the indirect impacts however, of the unloading of the coal trains at the rail loops and subsequent movement of the coal product within the Port of Abbot Point, has the potential to result in an increase in coal dust and deposition into the marine environment. These impacts are not considered to be significant given the scale of the existing and proposed development at the Port of Abbot Point and in a relative context, the contribution of the NGBR Project to the cumulative deposition of coal dust in the marine environment is considered negligible.

The relevant MNES values likely to be impacted by an increase in shipping activity at the Port of Abbot Point include:

- The listed threatened and/or migratory marine fauna species (refer Section 7-161 Section 7-254 respectively)
- Outstanding universal values of the GBRWHA (refer Section 7.6)
- The marine environment of the GBRMP and the CMA (refer Section 7.6 and 7.10.34).

It is anticipated that these events will be appropriately managed under the operational guidelines of NQBP (including the use of accredited marine pilots) and the likelihood of occurrence of these impacts will therefore be greatly reduced. Industry standards mandate regular monitoring of shipping movements and appropriate maintenance of vessels entering the GBR. The projected increase in shipping numbers is expected to stimulate further development and regulation of these standards across the industry (ELA and Open Lines 2012). The implementation of appropriate standards and management plans at the Port of Abbot Point will significantly reduce the risk of shipping incidents related to port activities and the likelihood of occurrence of adverse impacts to MNES will therefore be minimised.

Approvals and conditions

Following the lodgement of an initial advice statement, the Queensland Coordinator General on 14 June 2013 declared the NGBR Project to be a coordinated project requiring assessment by EIS under the *State Development and Public Works Organisation Act 1971* (SDPWO Act). The NGBR Project also requires assessment by EIS under the EPBC Act. The Queensland and Commonwealth Governments are working closely together and with Adani to ensure a coordinated assessment approach for the NGBR Project, including consistent timeframes and public notification periods. Therefore, this draft EIS is submitted to both the Coordinator-General and DotE for assessment under the SDPWO Act and EPBC Act respectively.

A range of other legislation is applicable to the NGBR Project at the Commonwealth, State and local government level. As a result, a wide range of approvals will need to be obtained for the NGBR Project and compliance with statutory requirements demonstrated throughout various stages of construction and operation. A summary of the approvals required for the various components of the NGBR Project and when these approvals will be sought is provided Section 7.15. This includes assessable development triggers coordinated under, or outside of, Queensland’s principal planning statute, the *Sustainable Planning Act 2009*; and State, regional and local government planning polices and schemes applicable to the NGBR Project. It also includes all approvals required in accordance with the SDPWO Act.

The majority of the properties immediately affected by the NGBR Project are zoned as rural, and are located within the jurisdictions of the following local planning schemes:

- Properties within the Abbot Point State Development Area regulated by the *Abbot Point State Development Area Development Scheme 2012* and the *Port of Abbot Point Land Use Plan 2010*
- Properties within the Whitsunday Regional Council area regulated by the *Bowen Shire Planning Scheme 2006*
- Properties within the Isaac Regional Council area regulated by the *Belyando Shire Planning Scheme 2008.*

In general, all proposals for material change of use developments within the Abbot Point State Development Area must comply with the objectives of the *Abbot Point State Development Area*

Development Scheme 2012 and the intents of the relevant land use precincts. The NGBR Project constitutes an 'infrastructure facility' under the *Abbot Point State Development Area Development Scheme 2012* and is considered to be a use that 'may meet the purpose of the land use designation'. The NGBR Project is considered consistent with intent of the relevant land use precincts.

The NGBR Project is primarily located within the Rural Zones of the *Bowen Shire Planning Scheme 2006* and *Belyando Shire Planning Scheme 2008*. The NGBR Project will require a material change of use application to be lodged with Isaac Regional Council and Whitsunday Regional Council for assessment against the relevant codes set out in the respective planning schemes. The NGBR Project has been located and designed to minimise impacts to the natural environment and will be managed in accordance with a detailed Environmental Management Plan (EMP) which will aim to mitigate any residual impacts. The NGBR Project is considered to be generally consistent with the intent of these local planning schemes.

It should be noted that the Coordinator-General (CG) may establish a State Development area and associated development scheme incorporating for the NGBR Project in accordance with the Galilee Basin Development Strategy released in November 2013 (DSDIP 2013). Should this occur Adani will seek a development approval for a material change of use in accordance with the associated development scheme. This will remove the need for a material change of use approval under the *Bowen Shire Planning Scheme 2006* and *Belyando Shire Planning Scheme 2008* once this new scheme becomes available.

Offsets

Where a 'no net loss' of ecological values cannot be delivered through avoidance, incorporation of sensitive design strategies and implementation of species and habitat management measures, resulting in a predicted significant impact to matters during the construction and operation of the NGBR Project, environmental offsets have been proposed. Availability of potential environmental offsets has been identified and an approach proposed for offset delivery for the NGBR Project to meet identified obligations in line with the requirements of the EPBC Act Environmental Offsets Policy (EOP).

The NGBR Project will involve the removal of vegetation and the loss of species' habitat, which will be partially mitigated through the sensitive design, construction and operation of the NGBR Project. Nevertheless, there will be unavoidable residual impacts that cannot be fully mitigated in this way. Where this residual impact loss is predicted to result in a significant impact to the matter environmental offsets have been proposed to achive a 'no net loss' of ecological values. Where residual impacts resulting from the NGBR Project are not anticipated to result in a significant impact to known or likely to occur TECs and listed species, environmental offsets may also be proposed in accordance with State based offset triggers.

For the purposes of the offset assessment, the area for the offset availability analysis was limited to the identified conservation priority areas within the Galilee Basin Offsets Strategy and properties adjoining the NGBR Project. The Galilee Basin Offset Strategy was developed to provide spatial resources that guide proponents to locate offset sites in strategic conservation hubs and corridors and assist decision makers in the assessment of development activities in the Galilee Basin.

The Galilee Basin Offset Strategy identifies a strategic footprint within the Brigalow Belt and Desert Uplands bioregions that determines where to locate land based offsets for the best biodiversity conservation outcomes. The strategic footprint identifies two types of priority areas, these being:

- Priority 1 areas: identification of conservations hubs that are areas of high conservation value and where there are limited mining interests
- Priority 2 areas: key north-south and east-west corridors that link to adjacent bioregions.

The offset availability analysis considered both priority 1 and priority 2 areas of the Galilee Basin Offset Strategy.

Large quantities of potential offset areas were identified within priority 1 and 2 areas of the Galilee Basin Offset Strategy for all TECs and listed species requiring offsetting in association with the NGBR Project.

Proposed approach to offset delivery

It is anticipated that a combination of both direct and indirect methods of offset delivery will be selected for the NGBR Project.

While the NGBR Project's preference is to offset impacts using direct offsets, it is possible that indirect offsets may be included. As part of the final offsets package, landholder engagement and ecological surveys to confirm the suitability of the preferred package option will be conducted. Following this, the offsets package will be refined and confirmed. This may include the use of indirect offsets, which are likely to be in the form of contributions to species-specific management plans and targeted recovery actions.

The final offsets package will be developed to finalise the proposed approach to offset delivery and to address the requirements of the EOP. The final Offsets Package will include:

- Updated offset requirements based on offset requirements at the time of preparation (if applicable)
- Refined impact data (if applicable)
- The results of ecological equivalence assessments to determine 'quality' or BioCondition scores at impact and potential offset sites
- Final details regarding the delivery approach of direct and indirect offsets or offset payments and transfers within the Offsets Package
- Detail regarding the compliance of the Offsets Package with the relevant offset policies
- Proposed legally binding mechanisms to secure direct offsets
- A schedule of future tasks and timeframes to secure offsets
- A framework for the management of offset areas.

An indicative use of the EPBC Act offsets assessments guide was undertaken to estimate future offset requirements under the EOP using this guide, noting that limited field verified data was available for input. The indicative calculations using the EPBC Act offsets assessments guide showed that potential offset availability greatly exceeded the direct offset requirements that are anticipated for TECs, as well as threatened species.

Outstanding and ongoing actions

A number of remaining tasks are required to be undertaken to advance the offsets process for the NGBR Project. In summary, such tasks include:

- Identification of large-scale strategic offset sites to focus further investigations and offset site selection

- Field assessment of potential impact sites to gain ‘quality’ or BioCondition scores for impacted values
- Field assessment of potential offset sites to verify that the values identified through desktop assessments are present and that they are ecologically equivalent to the impact sites.

Further refinement of threatened species habitat mapping is recommended to produce a more accurate indication of potential impacts to threatened species habitat. The mapping process used to determine the potential impact to MNES does not take into account localised features, previous disturbance (other than remnant vegetation current extent), relationships with introduced species, local habitat condition or current land use. It takes key habitat features at a regional scale that can be spatially represented to describe potential habitat. For this reason, the mapping outputs of potential habitat do not reflect current distribution or predict occurrence of a species and indeed provides an overestimate of where species actually occur, and therefore an overestimate of unavoidable impact to MNES. Further field investigations and threatened species habitat modelling could produce more accurate threatened species habitat mapping and therefore minimise overestimation of these values.

In conclusion, the results of this assessment indicate that it will be possible for the NGBR Project to achieve ‘no net loss’ of ecological values through a combination of direct and indirect offsets, in accordance with the ambitions of the various offset policies and the NGBR Project’s EIS Guidelines. Delivery of direct offsets will be broadly achievable within the priority 1 and priority 2 areas of the Galilee Basin Offset Strategy.

Conclusion

The NGBR Project has been and will continue to be developed to ensure the most environmentally sustainable outcome. This will be achieved in accordance with the following steps:

- Avoidance of sensitive environmental areas via a comprehensive route selection study
- Assessment of all potential environmental impacts of the chosen route
- Mitigation of the potential impacts through design criteria and industry standard management measures
- Management of any residual impacts through the development of comprehensive management plans
- Where required, residual impacts will be offset to achieve an overall gain in biodiversity value
- Monitoring of ongoing impacts during the life of the NGBR Project through the development of adaptive management and monitoring protocol.

The outcomes of the assessment and management measures outlined above have been discussed throughout this chapter. It is anticipated that any residual impacts associated with the development of the NGBR Project will be appropriately managed and the impacts to MNES values will be negligible. In this regard, Adani considers the development of the NGBR Project to be environmentally acceptable.

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7. Matters of national environmental significance

7.1 Introduction

7.1.1 Proposed action

Adani Mining Pty Ltd (Adani) proposes to construct and operate the North Galilee Basin Rail Project (NGBR Project), a multiuser, standard gauge, greenfield rail line that will transport coal from mines in the northern Galilee Basin to the Port of Abbot Point in central Queensland. The NGBR Project is approximately 300 km in length and connects the proposed Carmichael Coal Mine and Rail Project's east-west rail corridor, approximately 70 km east of the proposed Carmichael Coal Mine in the vicinity of Mistake Creek, with supporting infrastructure at the Port of Abbot Point (refer Figure 7-1). The NGBR Project will have an operational capacity of up to 100 million tonnes per annum (mtpa) of coal product which is expected to be sourced from both Adani and third-party mines in the northern Galilee Basin. Key features of the NGBR Project are discussed further in Section 7.2.

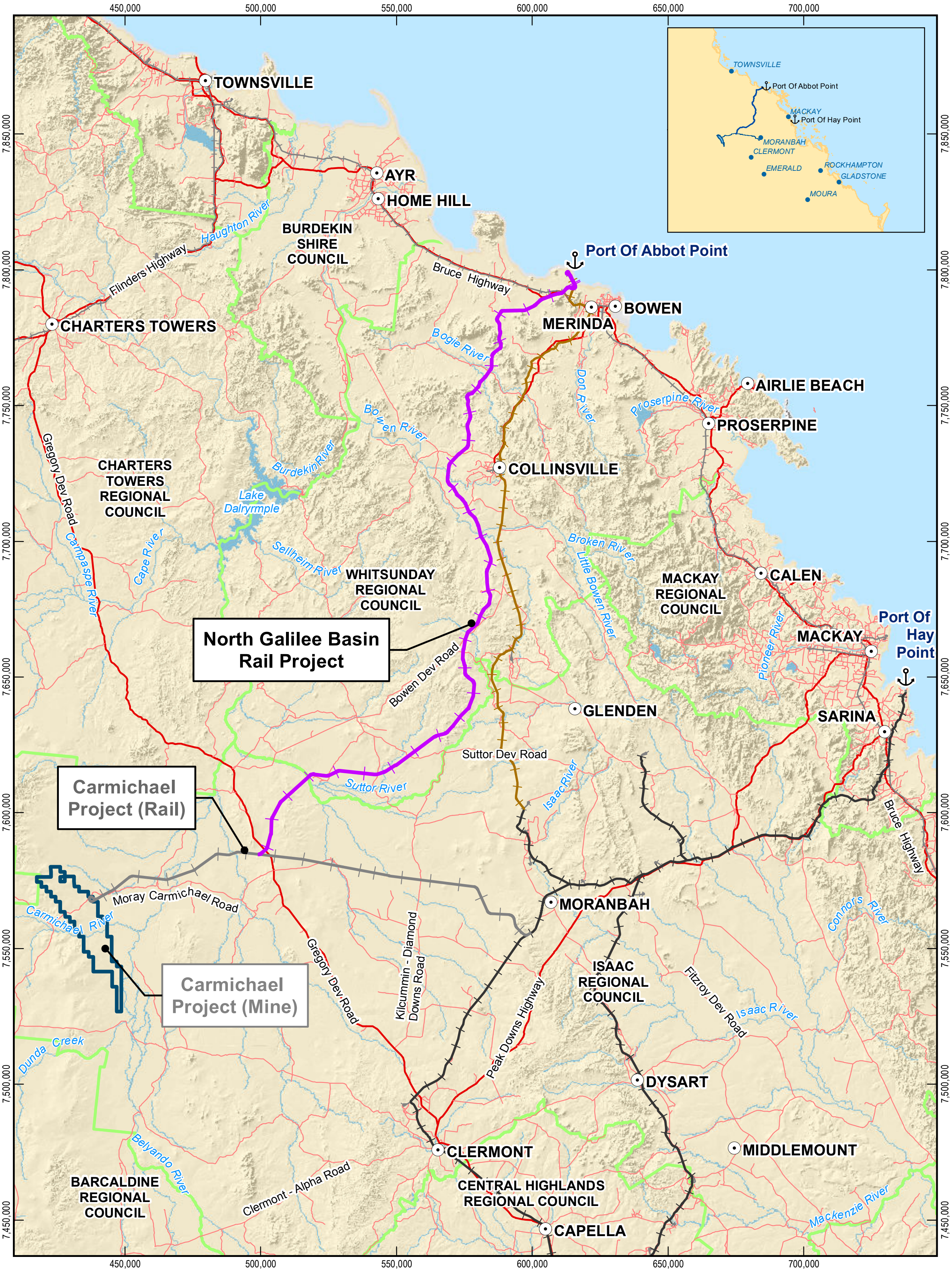
A referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was prepared for the NGBR Project and submitted to the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC, now Department of the Environment (DotE)) in May 2013. Subsequently, SEWPaC issued a referral decision in June 2013 determining the NGBR Project to be a controlled action requiring assessment by way of an Environmental Impact Statement (EIS), with the following specific controlling provisions:

- World Heritage Properties (section 12 and 15A)
- Natural Heritage Places (sections 15B and 15C)
- Listed threatened species and communities (sections 18 and 18A)
- Listed migratory species (sections 20 and 20A)
- Commonwealth Marine Areas (sections 23 and 24A)
- Great Barrier Reef Marine Park (sections 23 and 24A).

This chapter has been prepared to address matters of national environmental significance (MNES), in accordance with the final Guidelines for an EIS for the North Galilee Basin Rail Project (EPBC 2013/6885). A copy of these guidelines is provided in Volume 2 Appendix G. A cross-reference to where each aspect of the guidelines has been considered is provided in Section7.18.

A list of references and information sources used within the chapter is provided in Volume 1 Chapter 23 References. A glossary defining technical terms and abbreviations used in this chapter is provided in Volume 1 Terms and abbreviations.

Detailed technical information supporting this chapter is provided in Volume 2 (Appendices).



LEGEND

- Town
- Major Port
- Other Rail Network
- Goonyella System
- Newlands System
- Major Road
- Local Road
- Watercourse
- Local Government Area
- Carmichael Project (Rail)
- North Galilee Basin Rail
- Carmichael Project (Mine)

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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
North Galilee Basin Rail Project

Job Number 41-26457
Revision B
Date 20 Sep 2013

Project location

Figure 7-1

G:\41\26457\06 GIS\Maps\MXD\0001_Overview\41_26457_0005_rev_b.mxd

Level 9, 145 Ann St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: © Commonwealth of Australia (Geoscience Australia): Town, Railways, Watercourses (2007); DNRM: LGA, (2011), Hillshade (2009); DMR: State Roads (2008); DME: EPC1690 (2010), EPC1080 (2011); Adani: Alignment Opt9 Rev3 (2012), NGBR: Alignment Opt6 Rev 2 (2013).

7.1.2 The proponent

Adani Mining Pty Ltd (Adani) is the proponent for the NGBR Project. Adani is a subsidiary of Adani Enterprises Ltd, and forms part of the broader Adani Group of companies based in Ahmedabad, India. The postal address for Adani's corporate office in Brisbane is GPO Box 2569, Brisbane, QLD 4001, Australia.

Adani is a registered Australian company with corporate governance and reporting obligations under Australian Law, distinct from the management and obligations of other Adani Group subsidiaries in other jurisdictions.

Adani Abbot Point Terminal Pty Ltd, also an Australian subsidiary of Adani Enterprises Limited, has purchased the lease of Abbot Point Coal Terminal 1 and is proposing to develop Abbot Point Coal Terminal 0 as part of their overall programme for exportation of coal.

Adani has not been subject to any proceedings under an Australian Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources. Under both State and Commonwealth laws, Adani is required to obtain all relevant approvals, including all necessary environmental approvals, prior to the commencement of a project.

Internationally, any representations to statutory authorities or proceedings initiated and /or currently before the courts are under judicial consideration.

Adani has a proven record of obtaining and complying with all necessary approvals for its projects including the Environmental Authority for the Carmichael Coal Mine ongoing exploration program.

Adani is committed to complying with all required approvals for the NGBR Project and to attain an overall conservation objective with no significant residual impacts to any MNES values.

7.1.3 Project rationale

The NGBR Project is a standard gauge rail project which is proposed to connect the Carmichael Project rail infrastructure to the Port of Abbot Point. The NGBR Project will service the Carmichael Project and third-parties, allowing coal to be transported to the Port of Abbot Point for international export.

The Galilee Basin spans over 247,000 km^2 of land which is considered to be one of the last undeveloped coal reserves within Queensland and is expected to become the largest coal producing region in the State. In June 2012, the Queensland government announced its support for the development of the coal industry in the Galilee Basin and recognised the need for infrastructure, particularly rail links from mine to port, to support such development.

The NGBR Project is proposed to provide a more direct and operationally more cost effective transport solution direct to the Port of Abbot Point in accordance with the Queensland Government's preference for a single north-south multi-user common access rail corridor servicing the Galilee Basin, as outlined in the Galilee Basin Coal Infrastructure Framework (DSDIP 2013). This will aid in the reduction of current rail congestion and cumulative impacts experienced on the Goonyella and Newlands systems via Moranbah.

The NGBR Project aligns with a number of key State government policies that guide and inform the development of Queensland's abundant coal resources including:

- Galilee Basin Coal Infrastructure Framework (DSDIP 2013)

- Galilee Basin Development Strategy (DSDIP 2013a)
- Coal Plan 2030 (DSDIP 2010)
- Queensland Infrastructure Plan (DLGP 2011a)
- Draft Moving Freight strategy (DTMR 2013)
- Queensland Regionalisation Strategy (DLGP 2011b).

Economic assessments estimate that at a regional level, the NGBR Project is expected to generate a significant and positive economic impact in the Mackay, Isaac and Whitsunday (MIW) region and Queensland. The NGBR Project will involve a capital investment of approximately $2.2 billion which includes capital expenditure on earthworks, drainage, bridges, road works, rail track and signalling, communications and construction management costs.

Economic modelling estimates that the NGBR Project will generate approximately 6,150 jobs (1,700 direct and 4,452 indirect) in the MIW region and just under 7,000 jobs (2,017 direct and 4,981 indirect) in total across Queensland during the peak construction year of 2015. In 2015, modelling estimates that the NGBR Project will contribute $791 million to Gross Regional Product in the MIW region and $909 million to Queensland's Gross State Product.

Once fully operational, modelling estimates that the NGBR Project will contribute $209 million to Gross Regional Product in the MIW region per annum and $369 million per annum to Queensland's Gross State Product. Operation of the NGBR Project is also estimated to generate 1,097 (277 direct and 820 indirect) full time equivalent positions each year in the MIW region and 1,940 (369 direct and 1,571 indirect) full time equivalent positions each year across Queensland over the life of the NGBR Project.

7.1.4 Relationship to other projects

Adani is committed to financing the environmental assessment and ongoing development of several projects in Queensland, including:

- Carmichael Coal Mine and Rail Project (refer EPBC 2010/5736)
- Abbot Point Coal Terminal 0 Project (refer EPBC 2011/6194)
- Dudgeon Point Coal Terminals Project (refer EPBC 2012/6240).

The Carmichael Coal Mine and Rail Project includes the construction and operation of the Carmichael Coal Mine, which is predicted to be the largest coal mine in Queensland with maximum operational capacity of up to 60 mtpa, and the east-west Carmichael Rail line which will run between the coal mine and a junction with Aurizon's Goonyella system, south of Moranbah on the Blair Athol line. The NGBR Project will directly connect the Carmichael Coal Mine with the Port of Abbot Point; via a connection to the proposed east-west Carmichael Rail line approximately 70 km east of the Carmichael Coal Mine.

Adani also currently own the lease for Abbot Point Coal Terminal 1 and is proposing to develop Terminal 0 to facilitate increased coal export capacity in association with the proposed Carmichael Coal Mine and Rail Project and the NGBR Project.

The NGBR Project's primary function is to link proposed coal mines in the northern Galilee Basin to the Port of Abbot Point where product coal can be exported internationally. This includes the China Stone Coal Project.

7.1.5 Legislative basis

Following the lodgement of an initial advice statement, the Queensland Coordinator General on 14 June 2013 declared the NGBR Project to be a coordinated project requiring assessment by EIS under the *State Development and Public Works Organisation Act 1971* (SDPWO Act). The NGBR Project also requires assessment by EIS under the EPBC Act. The Queensland and Commonwealth Governments are working closely together and with Adani to ensure a coordinated assessment approach for the NGBR Project, including consistent timeframes and public notification periods. Therefore, this draft EIS is submitted to both the Coordinator-General and DotE for assessment under the SDPWO Act and EPBC Act respectively.

A range of other legislation is applicable to the NGBR Project at the Commonwealth, State and local government level. As a result, a wide range of approvals will need to be obtained for the NGBR Project and compliance with statutory requirements demonstrated throughout various stages of construction and operation. A summary of the approvals required for the various components of the NGBR Project and when these approvals will be sought is provided Section7.16. This includes assessable development triggers coordinated under, or outside of, Queensland's principal planning statute, the *Sustainable Planning Act 2009*; and State, regional and local government planning polices and schemes applicable to the NGBR Project. It also includes all approvals required in accordance with the SDPWO Act

The majority of the properties immediately affected by the NGBR Project are zoned as rural, and are located within the jurisdictions of the following local planning schemes:

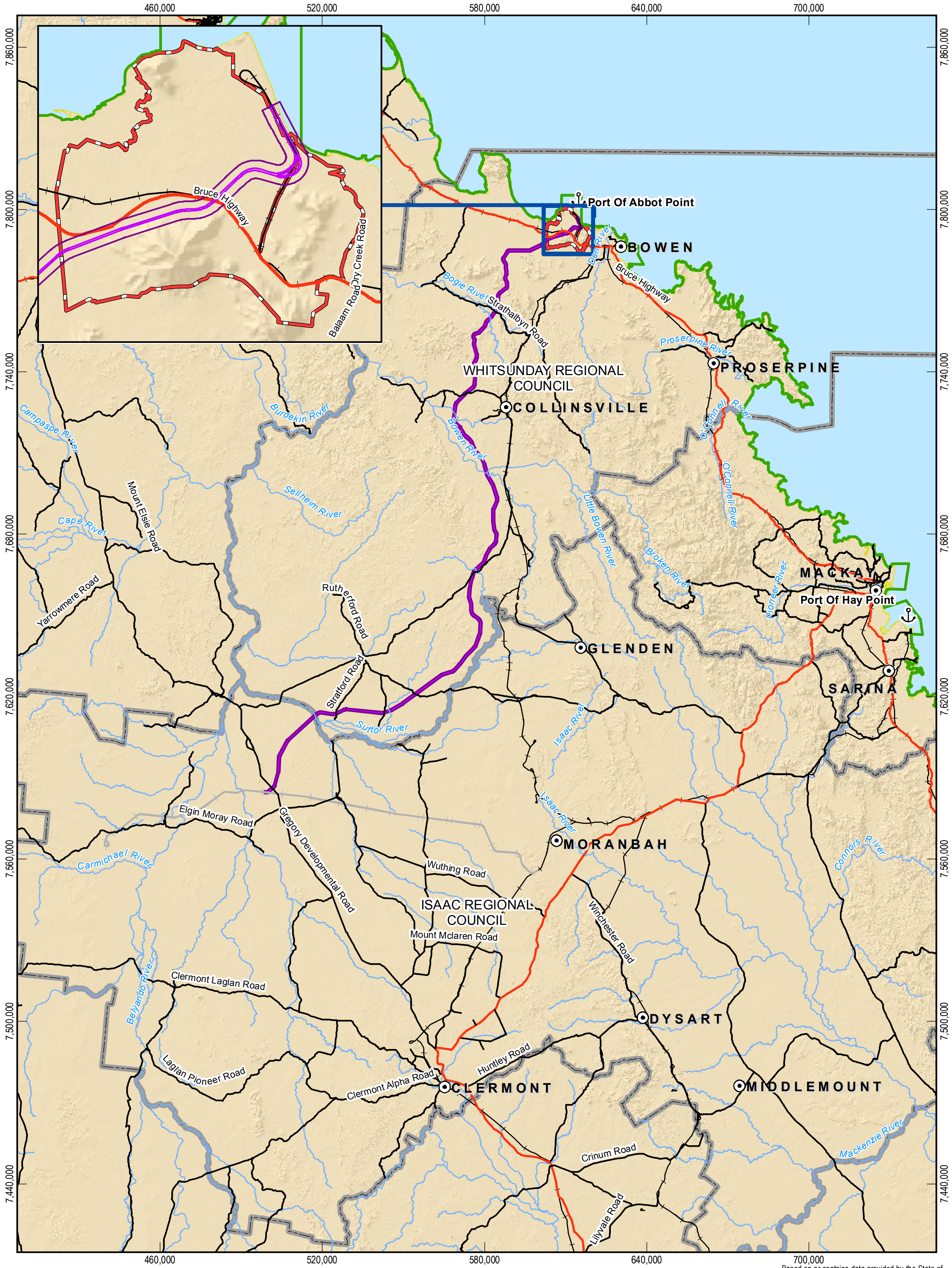
- Properties within the Abbot Point State Development Area regulated by the *Abbot Point State Development Area Development Scheme 2012*
- Properties within the Whitsunday Regional Council area regulated by the *Bowen Shire Planning Scheme 2006*
- Properties within the Isaac Regional Council area regulated by the *Belyando Shire Planning Scheme 2008.*

In general, all proposals for material change of use developments within the Abbot Point State Development Area must comply with the objectives of the *Abbot Point State Development Area Development Scheme 2012* and the intents of the relevant land use precincts. The NGBR Project constitutes an 'infrastructure facility' under the *Abbot Point State Development Area Development Scheme 2012* and is considered to be a use that 'may meet the purpose of the land use designation'. The NGBR Project is considered consistent with intent of the relevant land use precincts.

The NGBR Project is primarily located within the Rural Zones of the *Bowen Shire Planning Scheme 2006 and Belyando Shire Planning Scheme 2008.* The NGBR Project will require a material change of use application to be lodged with Isaac Regional Council and Whitsunday Regional Council for assessment against the relevant codes set out in the respective planning schemes. The NGBR Project has been located and designed to minimise impacts to the natural environment and will be managed in accordance with a detailed Environmental Management Plan (EMP) which will aim to mitigate any residual impacts. The NGBR Project is considered to be generally consistent with the intent of these local planning schemes.

The Great Barrier Reef Marine Park (GBRMP) was established through the *Great Barrier Reef Marine Park Act 1975*. The Act provides a framework for planning and management of the Marine Park and established the Great Barrier Reef Marine Park Authority, a Commonwealth authority responsible for the management of the Marine Park. Note no part of the NGBR Project is within the GBRMP, however there is the potential for the NGBR Project to impact indirectly on water quality within the GBRMP as assessed in Section7.7.

Figure 7-2 illustrates the boundaries of these jurisdictions in relation to the NGBR Project.



LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourse (Major)
- Great Barrier Reef Marine Park boundary
- Abbot Point State Development Area Boundary
- Local Government Area
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Map Projection: Transverse Mercator
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Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd
North Galilee Basin Rail Project

Job Number	41-26457
Revision	A
Date	20 Sep 2013

Relevant jurisdictions

Figure 7-2

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Level 9, 145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013, NGBR Corridor 06/06/2013, Carmichael Project (Rail) 18/06/2013;
DNRM: Roads/2010, Local Government Area/2011, Abbot Point SDA/2011. Created by:MS

7.1.6 Ecologically sustainable development

An important consideration throughout development of the NGBR Project and preparation of this EIS has been consideration of ecologically sustainable development. Table 7-1 provides an overview of how the principles of ecologically sustainable development (as defined in the EPBC Act) have been applied to the NGBR Project.

Table 7-1 Ecologically sustainable development principles

ESD Principle	How applied
(a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations	A key consideration during development of this EIS has been assessment of the beneficial and adverse impacts across the lifetime of the NGBR Project. Mitigation and management measures have been developed that seek a balance between environmental integrity, social development and economic development.
(b) if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation	Evaluation and assessment of alternatives and options has aimed to reduce the risk of serious and irreversible environmental damage. Extensive stakeholder consultation was undertaken and a range of technical specialists were engaged to apply scientific rigour to the assessment of potential impacts. Where lack of full scientific certainty has occurred, the precautionary principle has been applied and a conservative approach used with a clear commitment for further necessary scientific studies prior to construction commencement..
(c) the principle of inter-generational equity-that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations	The NGBR Project represents a long-term investment in Queensland and Australia's rail infrastructure with significant economic and social benefits for current and future generations including: • Substantial employment opportunities during both construction (1,700 people) and operation (369 people) • Increased jobs for local and state suppliers, services and contractors throughout both construction and operation • Increased ability to export coal overseas at higher profit rates due to transport efficiency, thereby aiding in the expansion of the Queensland economy. While the NGBR Project may have short and long-term environmental impacts, a number of mitigation measures will be implemented to avoid and limit serious, long-term and irreversible environmental damage. A benefit of the NGBR Project is that it will be designed as a multi-user railway with a design life of more than 90 years, ensuring it remains available for use by future generations.

ESD Principle	How applied
(d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making	A thorough ecological assessment has been undertaken for the NGBR Project to identify and manage potential impacts on biological diversity and ecological processes. The alignment of the NGBR Project final rail corridor (a nominal 100 m wide corridor) was selected taking into consideration vulnerable and endangered terrestrial and aquatic flora and fauna species, as well as threatened and endangered ecological communities. Where possible, modifications have been made to the NGBR Project design to avoid or minimise its effect on these species and communities.
(e) improved valuation, pricing and incentive mechanisms should be promoted	This EIS assesses the environmental consequences of the NGBR Project and identifies suitable mitigation and management measures for potential adverse impacts. The implementation of these measures represents an economic cost to Adani and will increase the capital cost of construction and operation of the NGBR Project. The appropriateness of proposed mitigation measures (i.e. cost and practicality) was determined based upon the severity of the impact being mitigated which demonstrates that environmental resources were given appropriate valuation.

7.1.7 Consultation

Adani commenced formal consultation with key stakeholders and the broader community for the NGBR Project in early 2013. Public consultation activities have also been implemented to align with requirements for the Social Impact Assessment (SIA) and other components of the EIS.

A preliminary stakeholder list was developed through desk-based research and analysis of existing information materials. This list was subject to ongoing refinement throughout the consultation process, with input from Adani and other NGBR Project stakeholders.

Communication materials were developed to provide stakeholders with information about the NGBR Project, to help facilitate the two-way flow of information between the NGBR Project team and stakeholders, and to record all feedback. These materials included:

- NGBR Project factsheet and posters
- 1800 free call telephone information line
- NGBR Project email address
- Community feedback forms
- Project webpage
- Paid advertising
- PowerPoint presentations.

From May to August 2013, consultation activities including meetings, briefings, community information sessions and interviews were held with NGBR Project stakeholders. The stakeholder feedback from the consultation process identified potential environmental, social and economic impacts and benefits of the NGBR Project. Landholder, infrastructure owner and government agency consultations are ongoing. Key themes raised throughout the consultation program are broadly categorised as follows:

- Support for the NGBR Project due to related economic benefits for the Whitsunday Regional Council and Isaac Regional Council local government areas
- Opportunities for workforce training programs and local procurement programs in readiness for the NGBR Project
- Increase in housing availability and improved housing affordability due to the recent downturn in the mining sector
- A sustainable mix of fly-in/fly-out workforce and local workforce
- Potential environmental impacts of the NGBR Project, notably air quality, flooding and water quality
- Support for Adani to provide a rail line with potential for third-parties to utilise the railway infrastructure to transport coal to the Port of Abbot Point
- Impacts on landholders specifically land fragmentation, potentially impacting agricultural land, infrastructure and property values
- Concerns about the cumulative impacts of resource projects on the region’s roads, notably increased construction-related traffic and public safety concerns, road deterioration, new rail crossings and wait times, driver fatigue risks associated with a DIDO workforce, and emergency service response times.
- Support for Adani to have a long term presence in the Whitsunday Regional Council and Isaac Regional Council local government areas through investment in local towns, business and community life.

These issues, potential impacts and benefits have informed the EIS and were incorporated into technical studies as part of the EIS process.

Following acceptance of the EIS by the Coordinator-General and DotE, the document will be placed on public display for a minimum period of six weeks. Following completion of the public display period, all stakeholder and community submissions will be reviewed and addressed and supplementary information will be provided if required.

A full Consultation Report is provided in Volume 2 Appendix B of this EIS.

7.2 Description of the proposed action

7.2.1 Overview

The NGBR Project is a 303.4 km standard gauge rail route connecting the proposed Carmichael Project rail infrastructure to the Port of Abbot Point (refer Section7.1.1). The NGBR Project will service the Carmichael Project (Mine) and third-party users up to an operational capacity of 100 million tonnes per annum (mtpa).

For the purpose of this EIS, the NGBR Project begins at chainage 3.49 km, in the vicinity of the balloon loop for Adani’s proposed Abbot Point Terminal 0 Project at the Port of Abbot Point in the north. The NGBR Project runs south from this point to its connection with the Carmichael Project (Rail) infrastructure at chainage 306.9 km, west of the Gregory Developmental Road towards Mistake Creek.

The NGBR Project is proposed in accordance with the Galilee Basin Coal Infrastructure Framework (State of Queensland 2013a), being a north-south, multi-user, common access rail corridor from the northern Galilee Basin to the Port of Abbot Point. A north-south corridor promotes the minimisation of impacts to landholders and the broader region.

The key components of the NGBR Project during construction and operation are provided in Table 7-2. It is noted that cut and fill quantities include an additional 3.49 km section of the NGBR Project situated within the Terminal 0 Project area. Each of the key components during construction and operation are described further in Section 7.2.2.

Table 7-2 Key components of the NGBR Project

Component	Quantity	Unit
Construction		
Construction camps	5	no.
Concrete batch plants	5	no.
Bridge laydown area	21	no.
Track laydown area	46	no.
Construction depot	2	no.
Construction yard	1	no.
Turning circle	69	no.
Cut length (total)	103.45	km
Cut volume (total)	15.28 million	m^3
Deep cut length (>15 m depth)	4.5	km
Maximum cut depth	24.2	m
Fill length (total)	213.15	km
Fill volume (total)	15.68	million m^3
Deep fill length (>15 m depth)	3.4	km
Maximum fill depth	24.5	m
Bridge crossings	18	no.
Bridge length (total)[1]	2.57	km
Operation		
Route length (chainage 3.49 km to 306.9 km)	303.41	km
Passing loops	7	no.
Public road treatments	22	no.

Component	Quantity	Unit
At-grade crossings	13	no.
Grade-separated crossings	4	no.
Possible closures	5	no.
Occupational crossings	137	no.
At-grade crossings	38	no.
Grade-separated crossings	16	no.
Closures	83	no.
At-grade stock route crossings[2]	7	no.
Rolling stock maintenance depot	1	no.

Note:

1. 127 bridge spans at 20.2 m length
2. Queensland Stock Route Network (State of Queensland 2013b)

Both construction and operational components of the NGBR Project have the potential to impact on MNES. The potential impacts on each MNES are discussed in the following sections:

- The Great Barrier Reef World Heritage Area (GBRWHA) and Great Barrier Reef National Heritage Place (GBRNHP) are addressed in Section 7.6
- The GBRMP is addressed in Section 7.7
- Listed threatened species are addressed in Section 7.8
- Threatened ecological communities (TECs) are addressed in Section 7.9
- Migratory species are addressed in Section 7.10
- The Commonwealth marine area is addressed in Section 7.11
- Cumulative and consequential impacts are addressed in Section 7.13.

A summary of additional approvals and conditions required for construction and operation of the NGBR Project is provided in Section 7.16and an offsets strategy for residual impacts is provided in Section 7.15.

7.2.1.1 Cost and timing

Capital expenditure for construction of the NGBR Project including all ancillary infrastructure is expected to be in the order of $2.2 billion. Construction is scheduled to start in late 2014 and be completed within approximately two years.

Operational expenditure for the operation and maintenance of the NGBR Project is expected to be in the order of $2.50 per tonne. Operation of the NGBR Project will coincide with completion of construction and commencement of Carmichael Project (Mine) output, currently expected in 2016. The NGBR Project will service the Carmichael Project (Mine) and third-party users throughout its proposed 90 year lifespan.

7.2.1.2 Social and economic context

The construction and operation of the NGBR Project has the potential to generate social and economic benefits as well as impacts on both a local and regional scale. The potential social and economic impacts associated with the NGBR Project in both the construction and operation phases relate to:

- Regional development, local and regional business and employment
- Workforce
- Landholders
- Housing and accommodation
- Community health and wellbeing.

It is estimated that at a regional level, the NGBR Project is expected to generate a significant and positive economic impact in the larger MIW region. Local employment opportunities are also likely to be generated as a result of the NGBR Project, according to modelled workforce profiles. In terms of impacts to landholders, the number of properties to be traversed by the NGBR Project presents the potential for property management issues, particularly in relation to access to various parts of the properties, and movement of stock and equipment across and between properties. Other potential impacts to landholders include alteration to the economic viability of the land, the spread of weeds, and impacts to lifestyle, amenity and livestock.

Potential impacts on landholders will be minimised through the implementation of a range of NGBR Project design elements, for example occupational crossings and design features to minimise impacts of land fragmentation, land access protocols, and negotiation and compensation mechanisms. It is expected that the implementation of a Local Content Strategy will leverage a range of economic and social benefits for the regional study area through increased employment and business development opportunities. Various engagement and development strategies will also be implemented to minimise the impact to amenity, lifestyle change and wellbeing in the community.

7.2.1.3 Environmental design aspects

A number of environmental design aspects have been included in the NGBR Project to minimise the potential impacts on environmental and social values. A set of environmental design principles were developed to aid the decision making process and included the preference to avoid, minimise, rehabilitate, manage and then offset or compensate any potential environmental impacts. A key component of avoiding potential environmental impacts during design was the corridor selection process which considered environmental constraints through a multi-criteria analysis (refer Section 7.3.3). The corridor selection process aimed to minimise potential impacts on environmental and social values by avoiding remnant vegetation, residential areas and water courses.

The design of watercourse crossing structures, such as bridges and culvers, was based on a set of design criteria that aimed to minimise disturbance to watercourse hydrology and morphology. The location and design of water courses structures also aimed to minimise disturbance to riparian vegetation. Similarly, the design of road crossings aimed to minimise impacts to existing road infrastructure and road users.

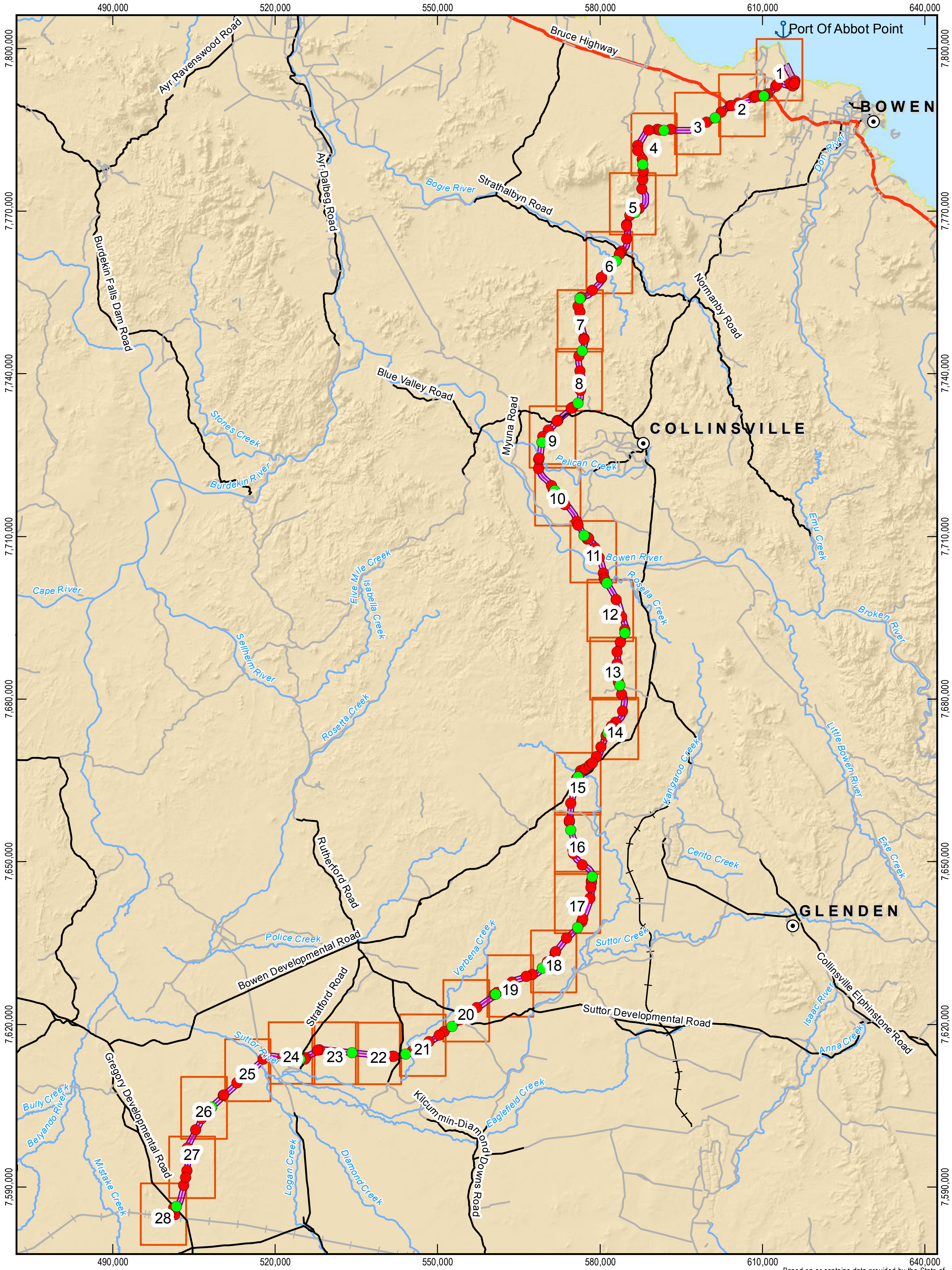
The site selection process for ancillary infrastructure, including construction compounds, laydowns areas and maintenance facilities aimed to utilise previously disturbed areas that were less likely to contain remnant vegetation. The site selection process for ancillary infrastructure also took into consideration the distance to existing homesteads to minimise potential noise and visual impacts, as well as the proximity of watercourses to minimise the potential for accidental spills or sedimentation impacting water quality.

During detailed design, potential impacts to environmental and social values will be considered further and were possible the design refined to avoid or minimised further impacts.

7.2.1.4 Sustainability measures to minimise carbon footprint

The sustainability measures that will be employed to minimise the NGBR Project's carbon footprint will include:

- Avoidance of activities that generate additional GHG in the first instance, if practicable
- Reduce the scale of the activity where it cannot be avoided, if practicable
- Substitute emission-intensive plant, equipment, fuel and power for energy-efficient alternatives, if practicable
- Maintain plant and equipment to maximise their efficiency
- Consider sequestration of GHG emissions through revegetation and the purchase of carbon offsets.



LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Local Road
- Carmichael Project (Rail)
- Railway
- Watercourse (Major)
- Map Sheet
- North Galilee Basin Rail 100m Corridor
- Rail Centre Line Coordinate
- Alignment Functional Areas Coordinate

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd
North Galilee Basin Rail Project

Key features of the NGBR Project - Overview

Job Number	41-26457
Revision	C
Date	24 Sep 2013

Figure 7-3

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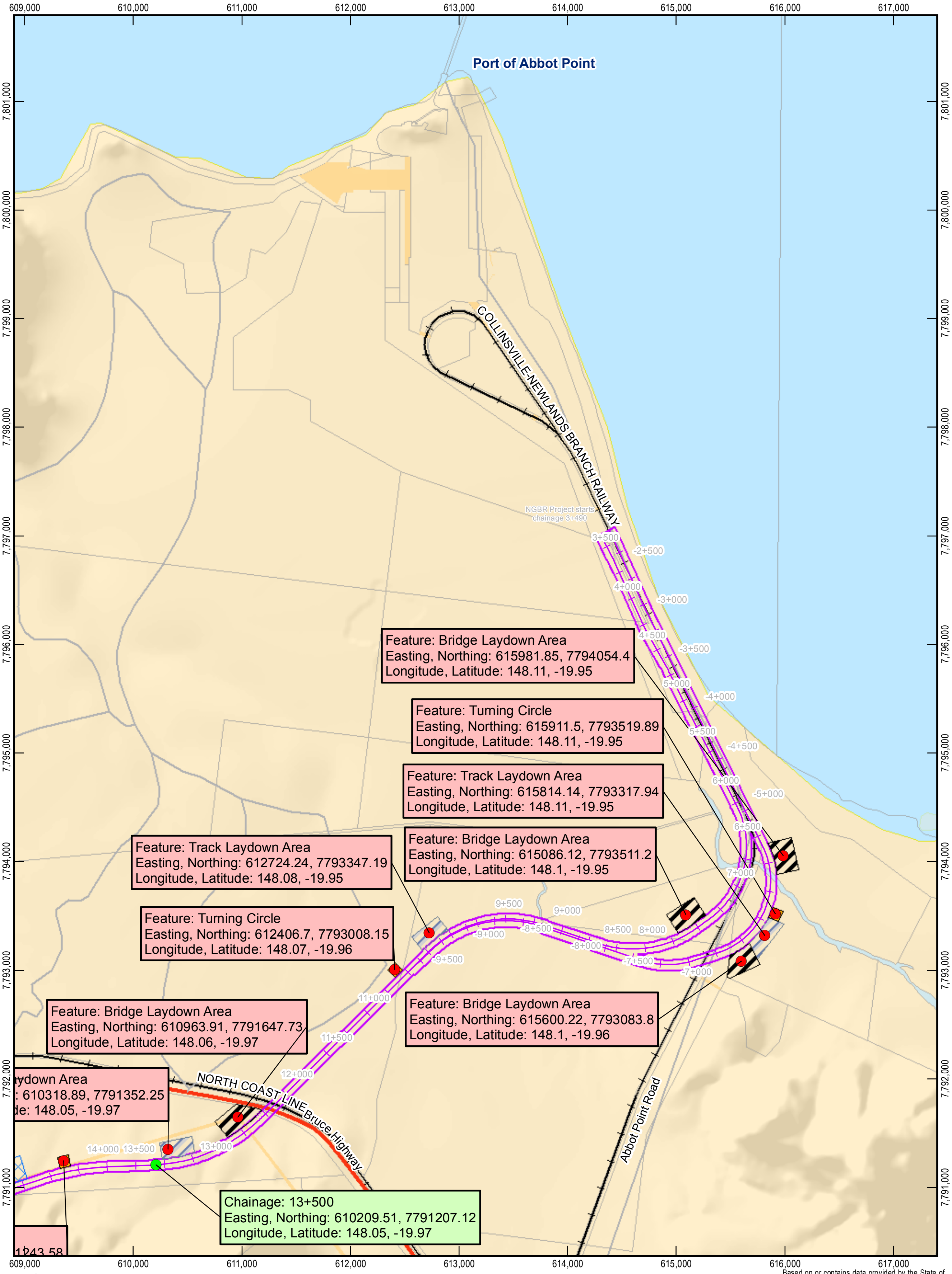
Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013, NGBR Corridor 06/06/2013, Carmichael Project (Rail) 18/06/2013, Quarry Locations /2013 DNRM: Roads/2010. Created by:MS



LEGEND

- Highway
- Local Road
- Railway
- Easement
- Lot
- Water
- North Galilee Basin Rail Alignment
- North Galilee Basin Rail 100m Corridor
- Alignment Functional Areas
  - Bridge Laydown Area
  - Construction Camp
  - Track Laydown Area
  - Turning Circle
- Rail Centre Line Coordinate
- Alignment Functional Areas Coordinate

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd

North Galilee Basin Rail Project

Job Number 41-26457
Revision D
Date 26 Sep 2013

Key features of the NGBR Project

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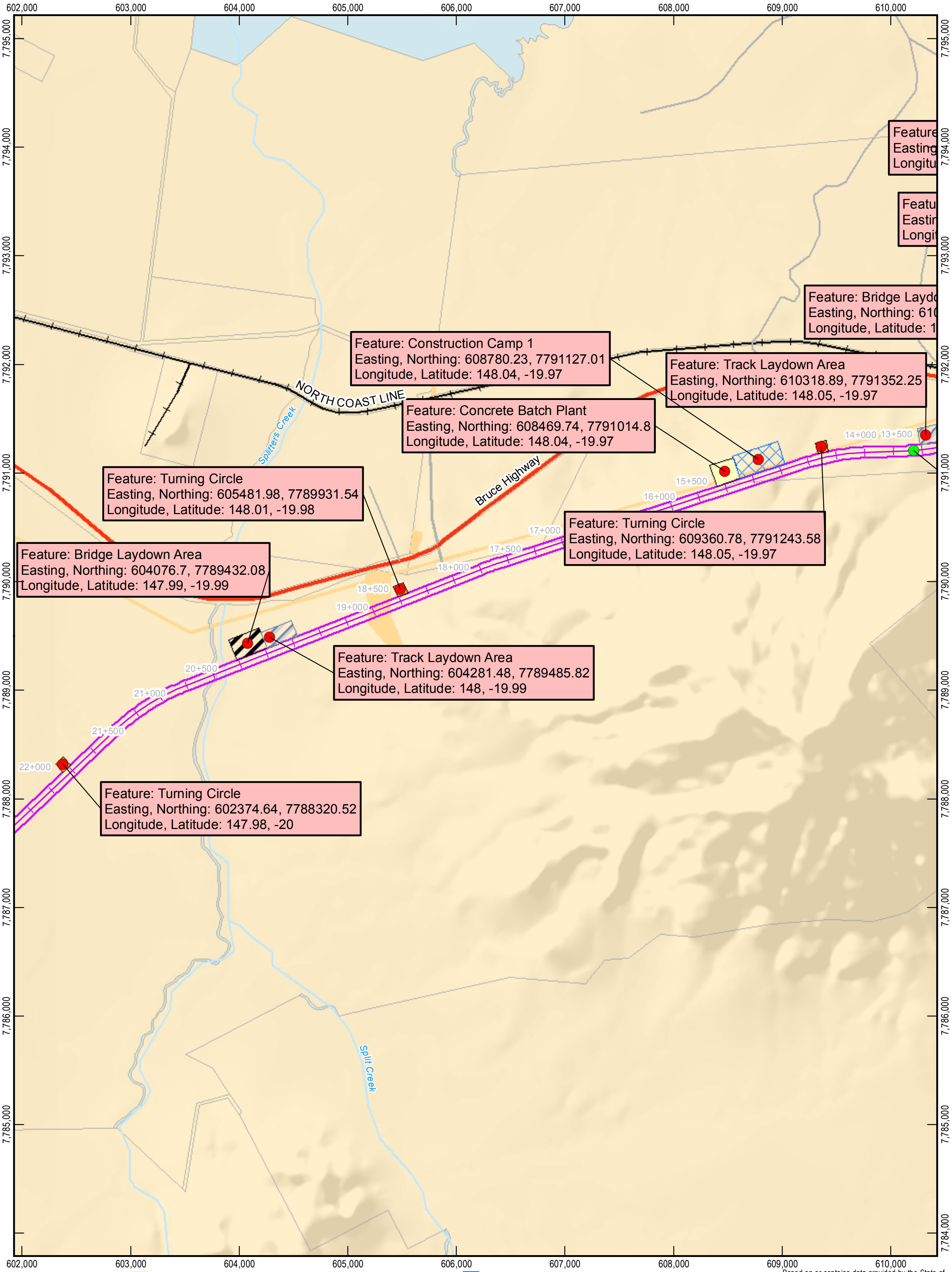

LEGEND

Highway

Local Road

Railway

Watercourse (Minor)

Easement

Lot

Water

North Galilee Basin Rail Alignment

North Galilee Basin Rail 100m Corridor

Alignment Functional Areas

Bridge Laydown Area

Concrete Batch Plant

Construction Camp

Track Laydown Area

Turning Circle

Rail Centre Line Coordinate

Alignment Functional Areas Coordinate

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Adani Mining Pty Ltd

North Galilee Basin Rail Project

Key features of the NGBR Project

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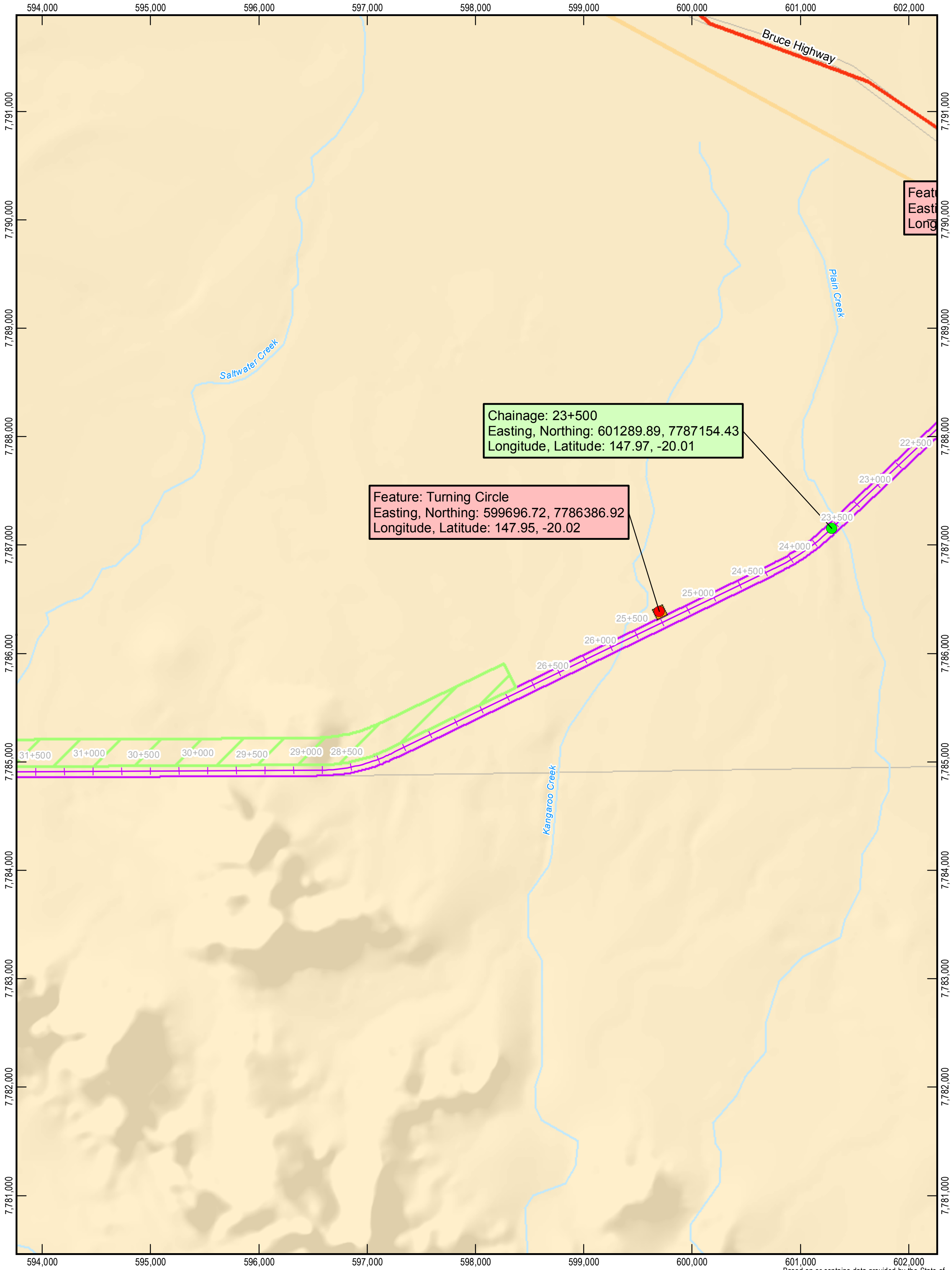

LEGEND

- Highway
- Watercourse (Minor)
- Easement
- Lot
- North Galilee Basin Rail Alignment
- North Galilee Basin Rail 100m Corridor
- Alignment Functional Areas
- Rolling Stock Maintenance Depot
- Turning Circle
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Key features of the NGBR Project

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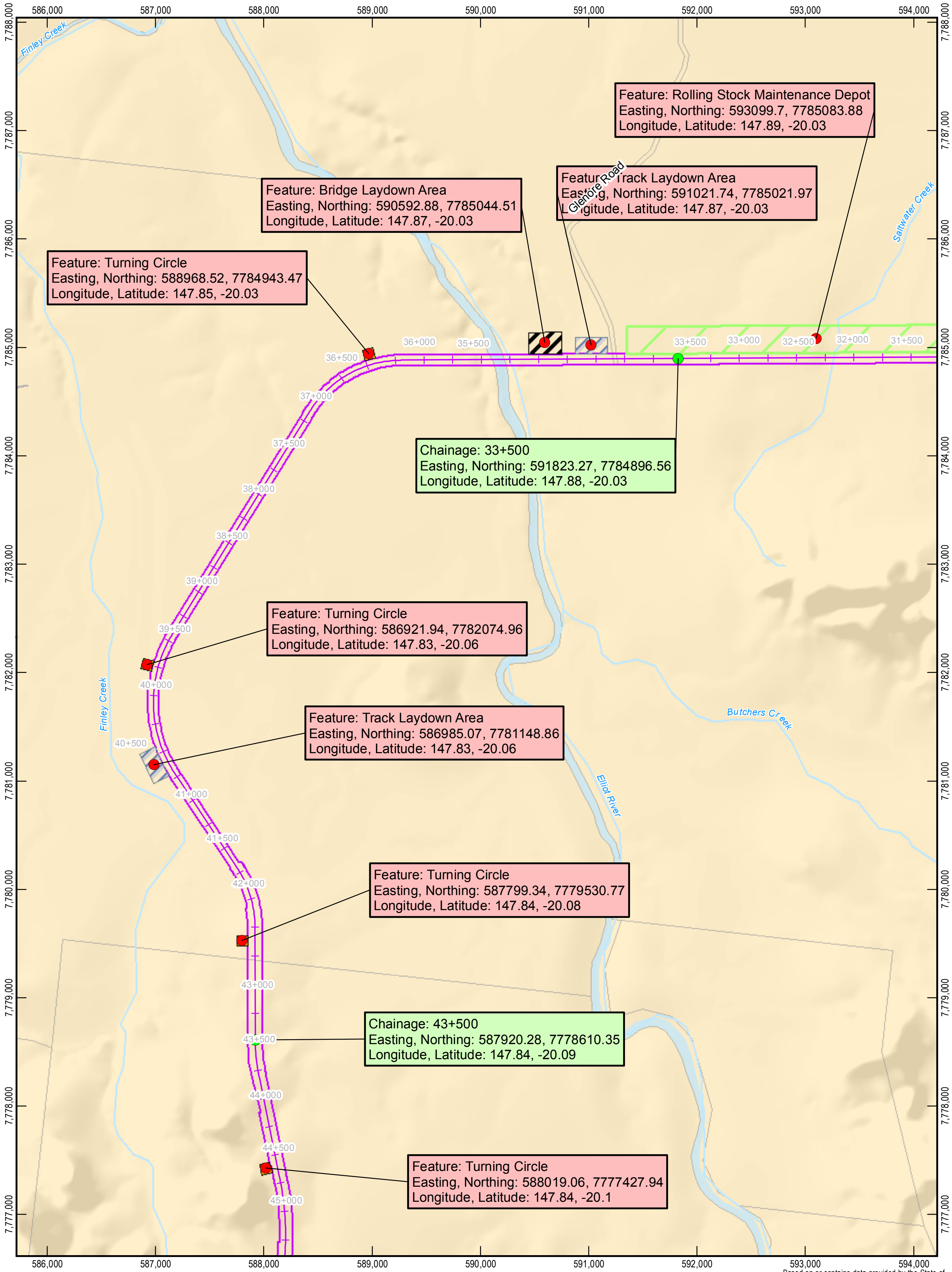

LEGEND

- Local Road
- Watercourse (Minor)
- Lot
- Water
- North Galilee Basin Rail Alignment
- North Galilee Basin Rail 100m Corridor
- Alignment Functional Areas
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Adani Mining Pty Ltd

North Galilee Basin Rail Project

Key features of the NGBR Project

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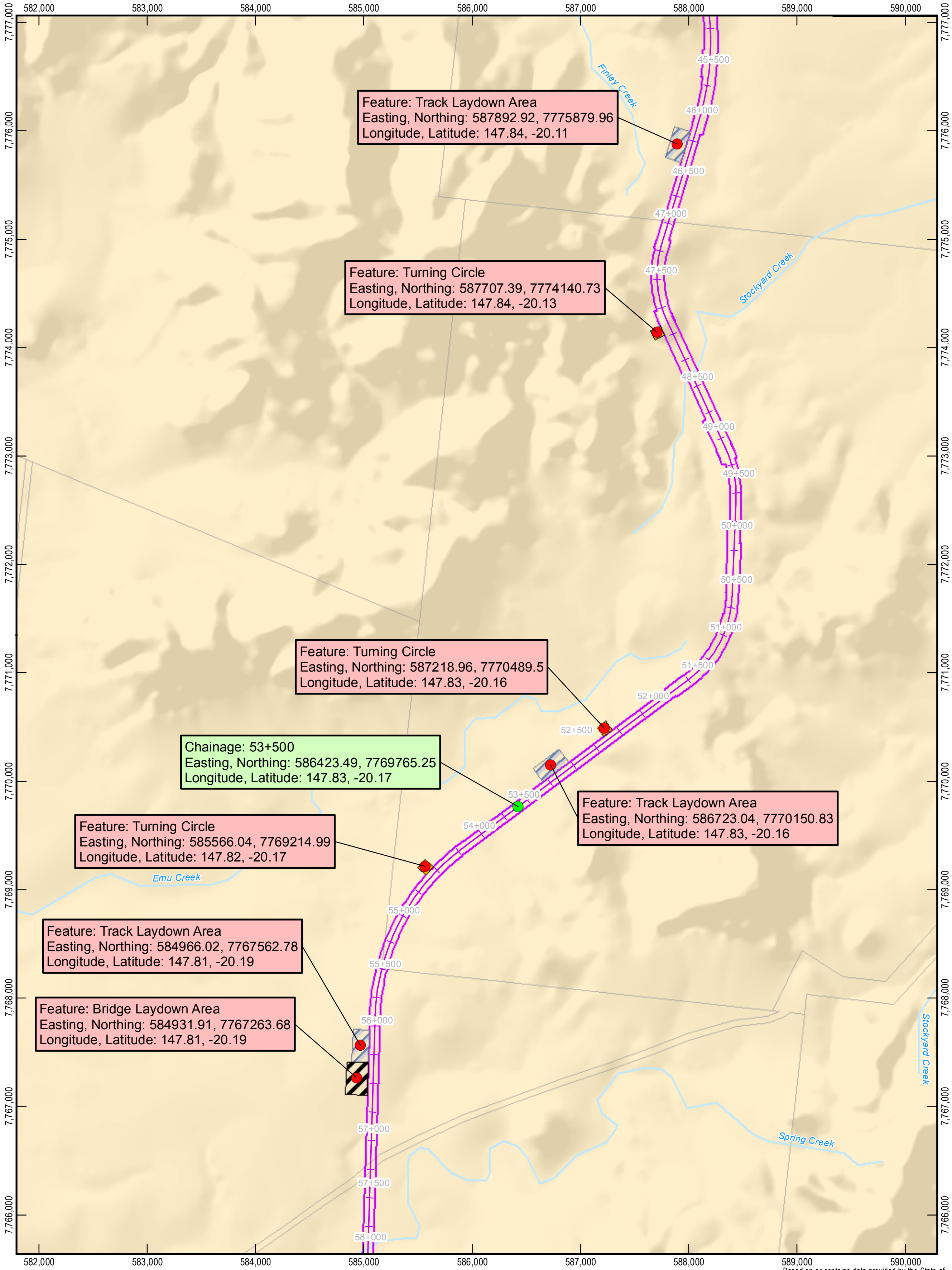

LEGEND

- Watercourse (Minor)
- Lot
- North Galilee Basin Rail Alignment
- North Galilee Basin Rail 100m Corridor

Alignment Functional Areas
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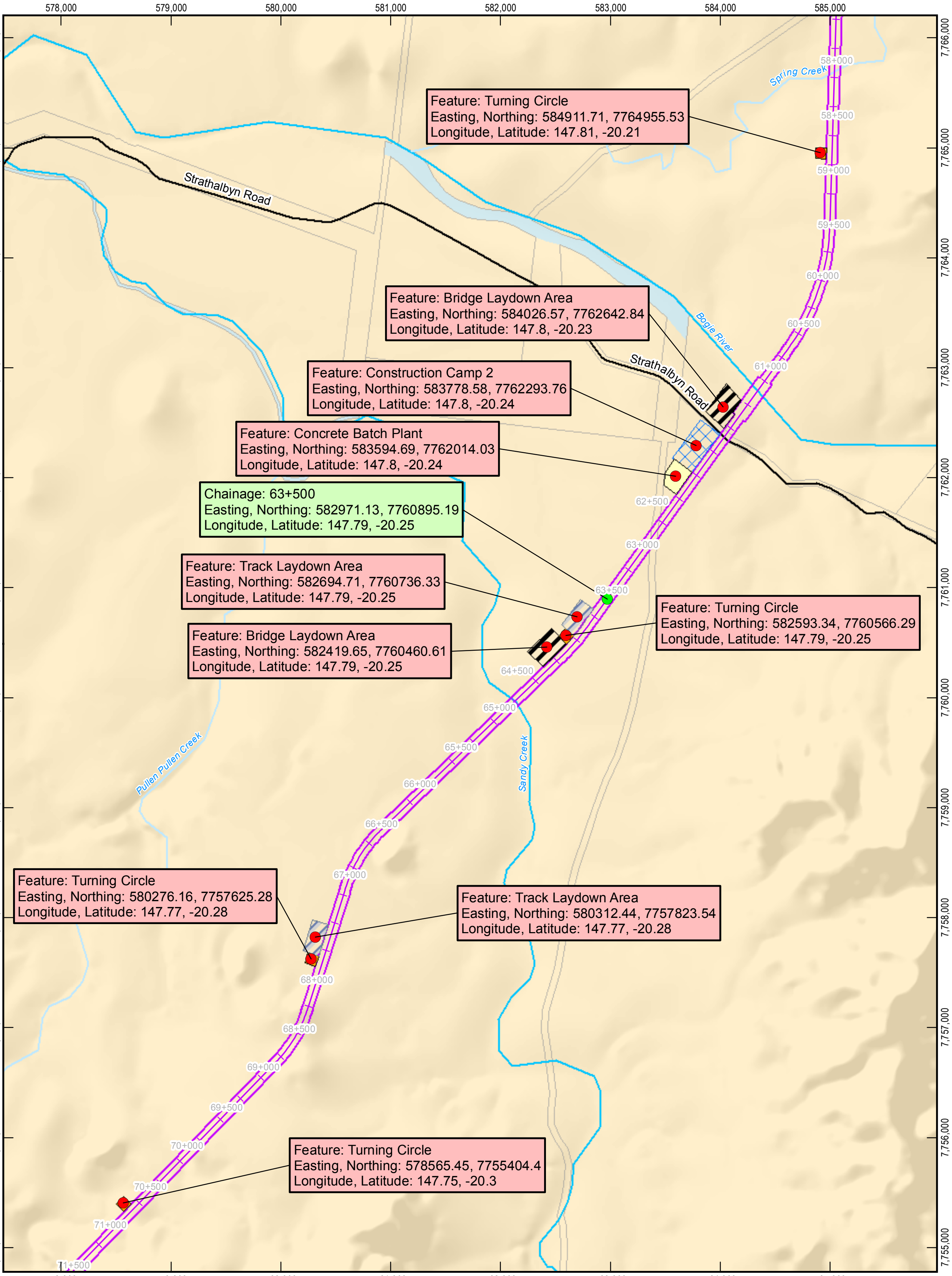

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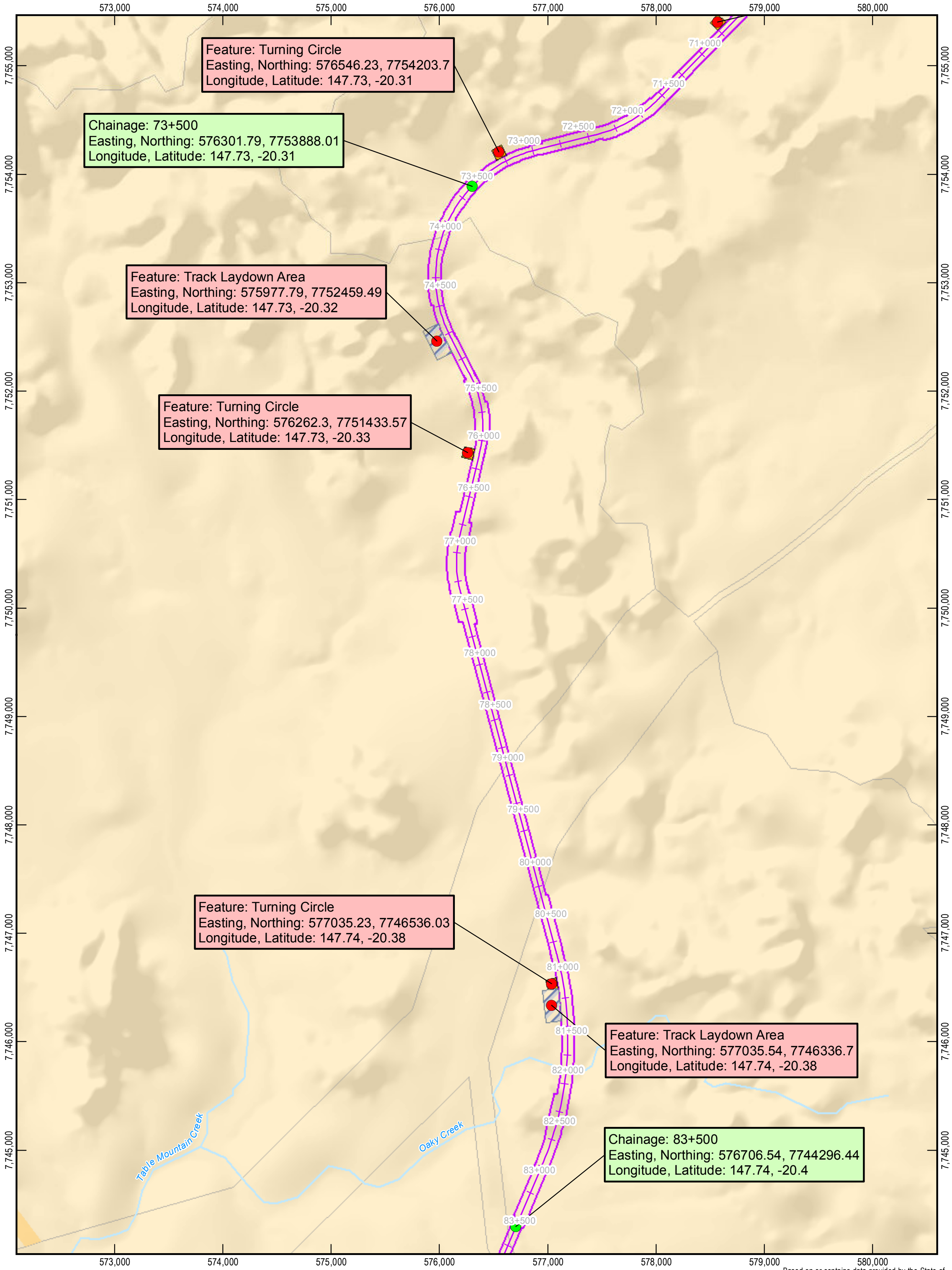

LEGEND

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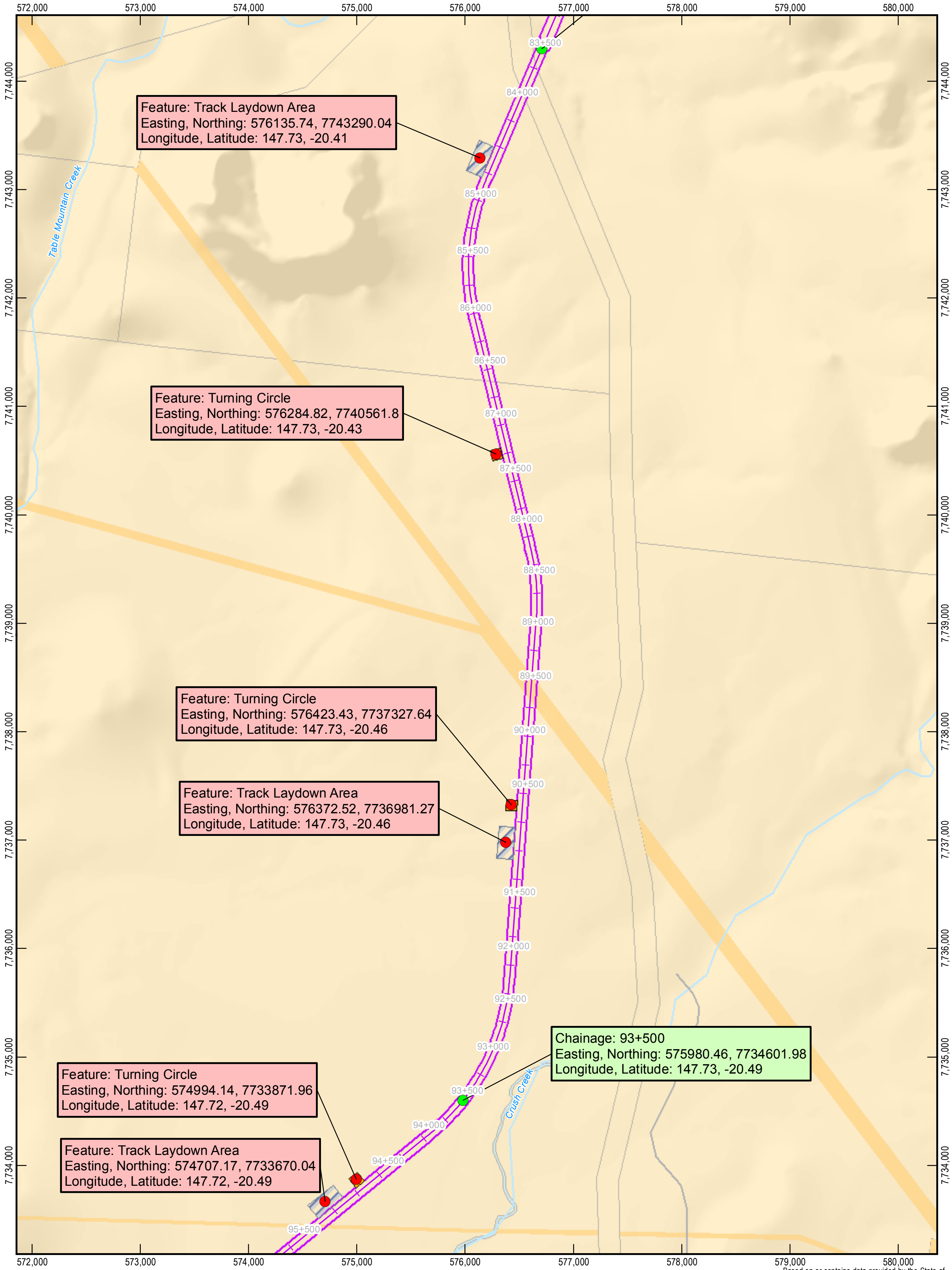

LEGEND

Local Road
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Alignment Functional Areas
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Turning Circle
Rail Centre Line Coordinate
Alignment Functional Areas Coordinate

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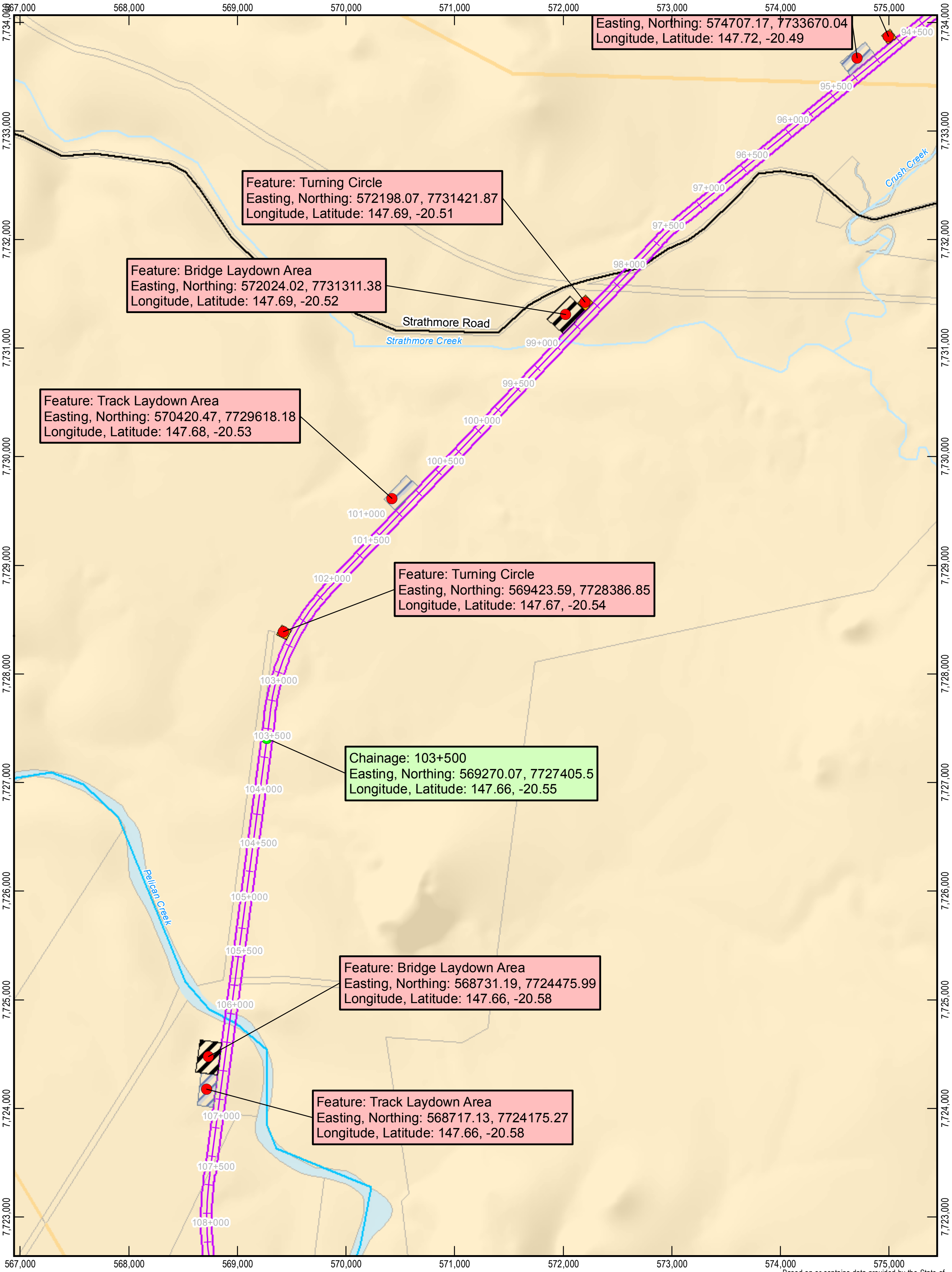
Adani: Project Rail Alignment, Camp Sites, Alignment Functional Areas (2013). Created by: MS



LEGEND

Main Road
Watercourse (Major)
Watercourse (Minor)
Easement
Lot
Water
North Galilee Basin Rail Alignment
North Galilee Basin Rail 100m Corridor
Alignment Functional Areas
Bridge Laydown Area
Track Laydown Area
Turning Circle
Rail Centre Line Coordinate
Alignment Functional Areas Coordinate

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1:50,000 Paper Size A4

0 0.25 0.5 1

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd
North Galilee Basin Rail Project

Key features
of the NGBR Project

Job Number 41-26457
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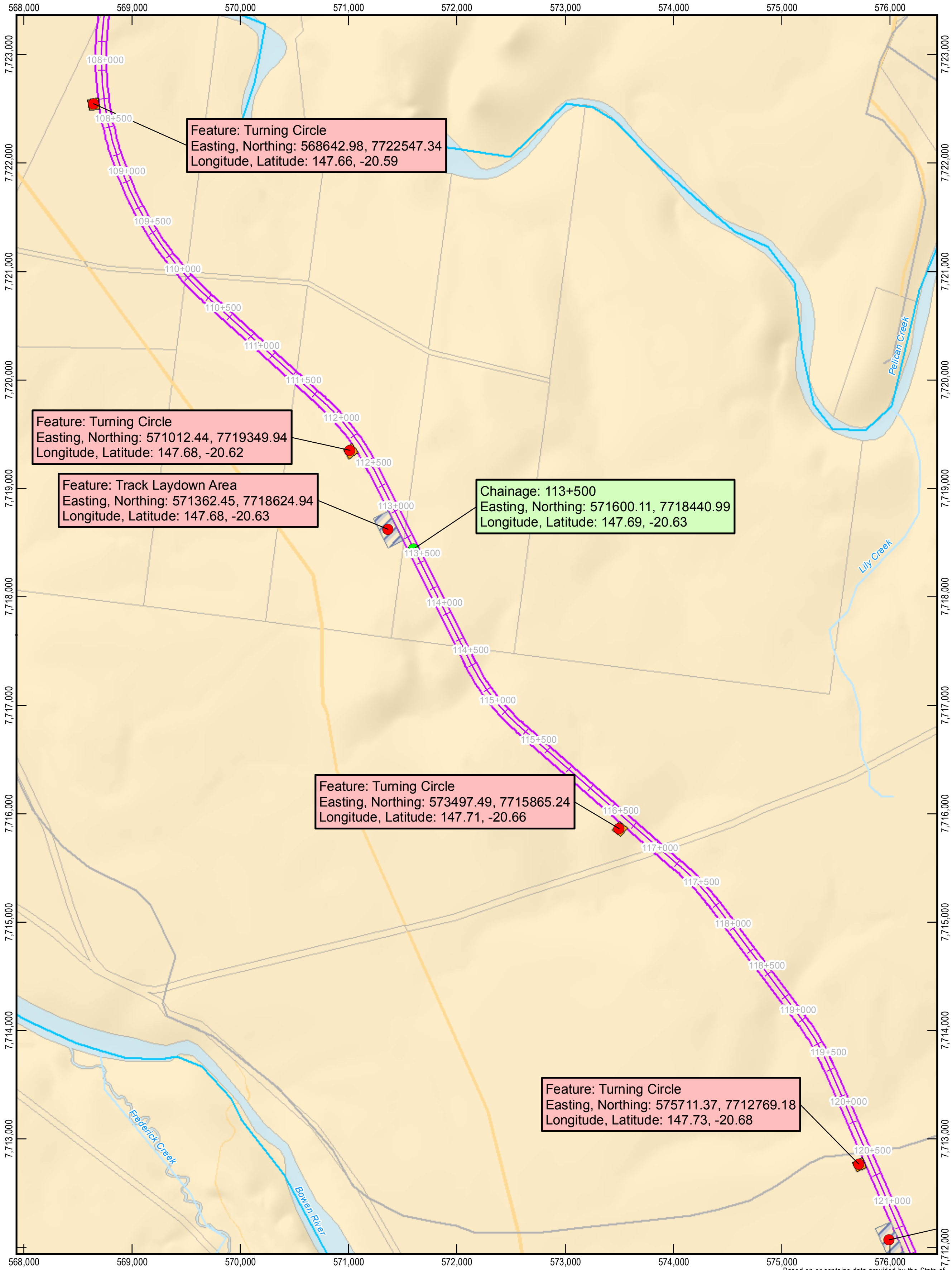

LEGEND

- Local Road
- Watercourse (Major)
- Watercourse (Minor)
- Easement
- Lot
- Water
- North Galilee Basin Rail Alignment
- North Galilee Basin Rail 100m Corridor
- Alignment Functional Areas
- Track Laydown Area
- Turning Circle
- Rail Centre Line Coordinate
- Alignment Functional Areas Coordinate

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Key features of the NGBR Project

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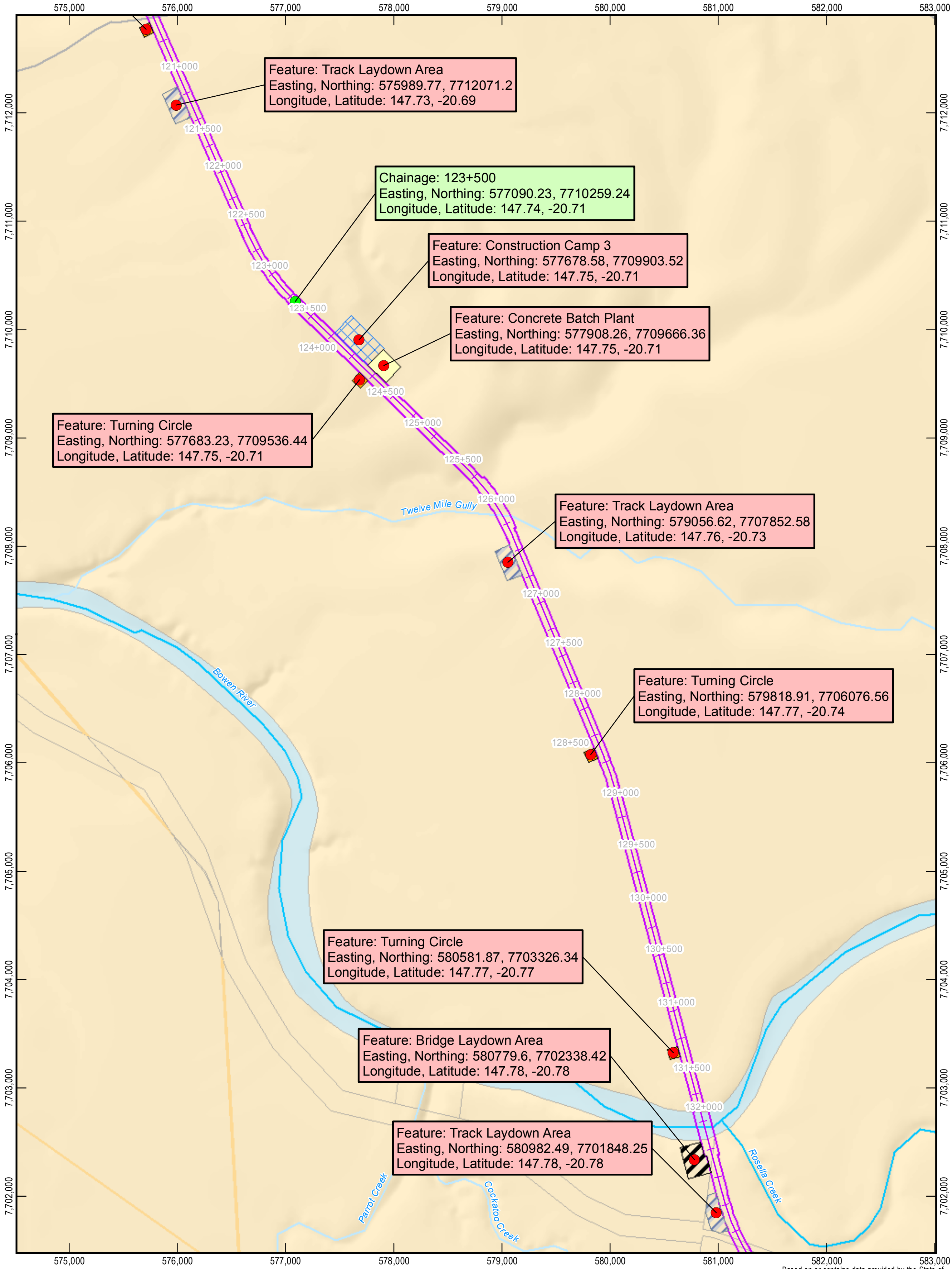

LEGEND

Local Road
Watercourse (Major)
Watercourse (Minor)
Easement
Lot
Water
North Galilee Basin Rail Alignment
North Galilee Basin Rail 100m Corridor
Alignment Functional Areas
Bridge Laydown Area
Concrete Batch Plant
Construction Camp
Track Laydown Area
Turning Circle
Rail Centre Line Coordinate
Alignment Functional Areas Coordinate

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Key features of the NGBR Project

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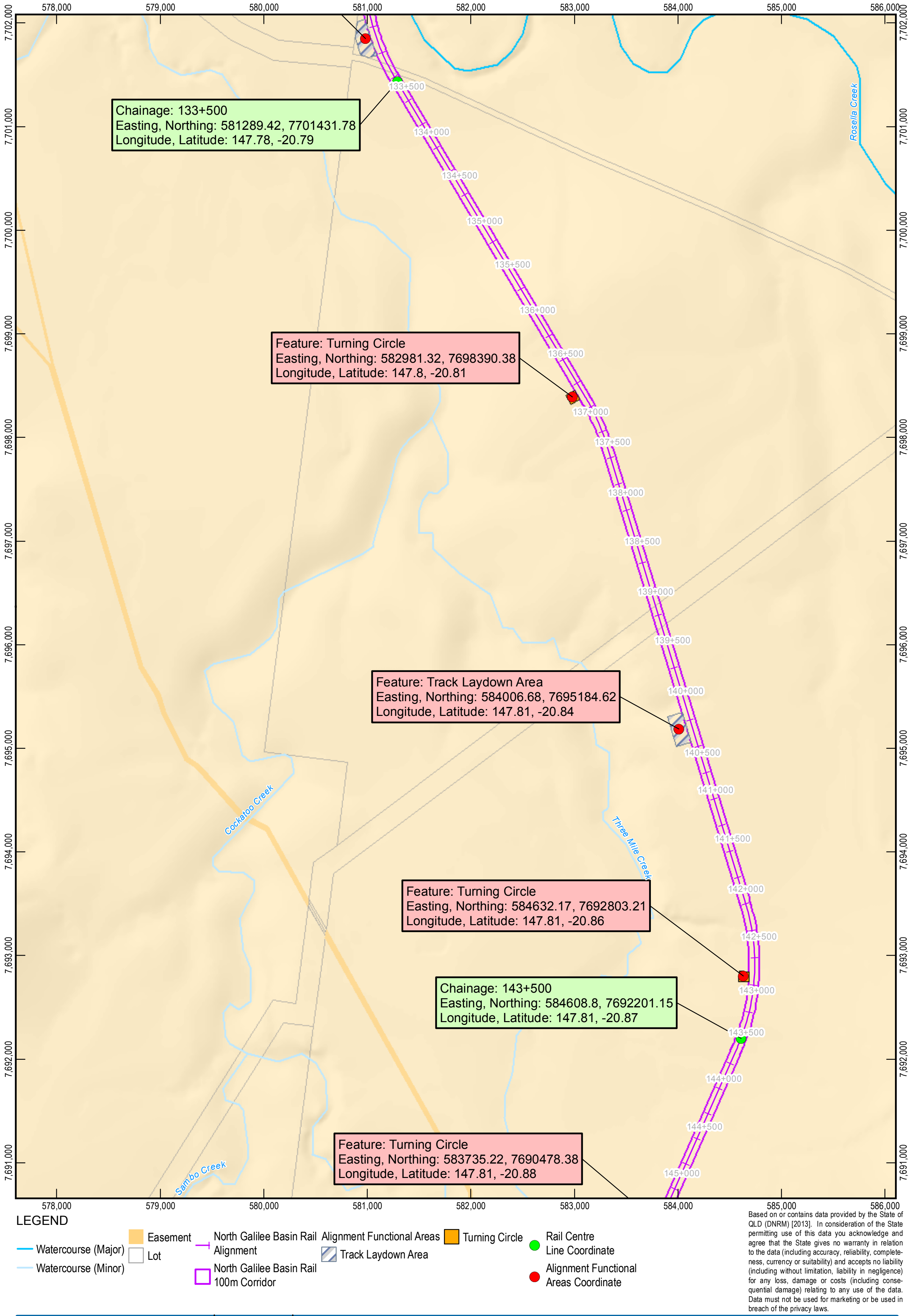

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Key features of the NGBR Project

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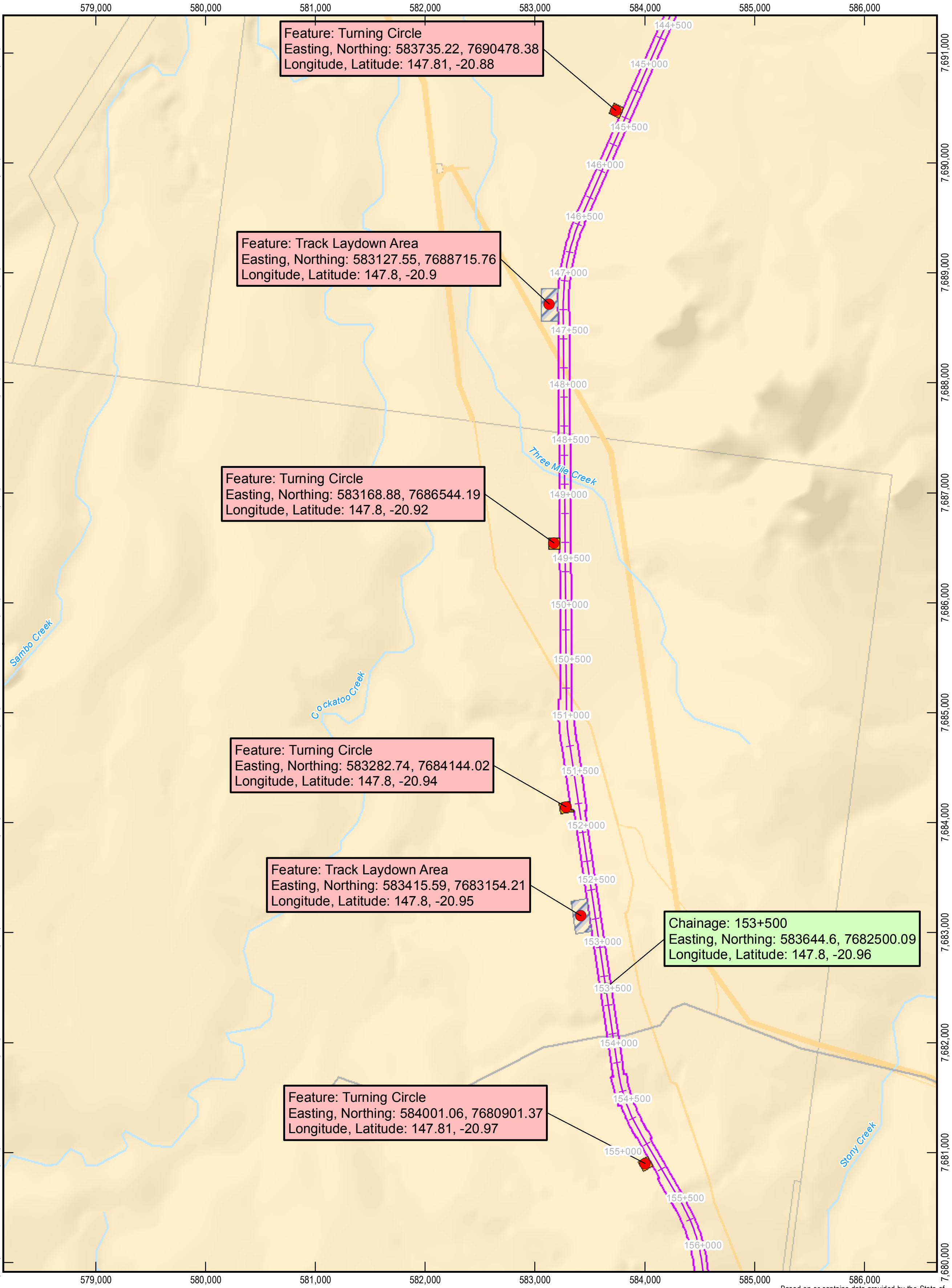

LEGEND

- Local Road
- Watercourse (Minor)
- Easement
- Lot
- North Galilee Basin Rail Alignment
- North Galilee Basin Rail 100m Corridor
- Alignment Functional Areas
  - Turning Circle
  - Track Laydown Area
- Rail Centre Line Coordinate
- Alignment Functional Areas Coordinate

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

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Key features of the NGBR Project

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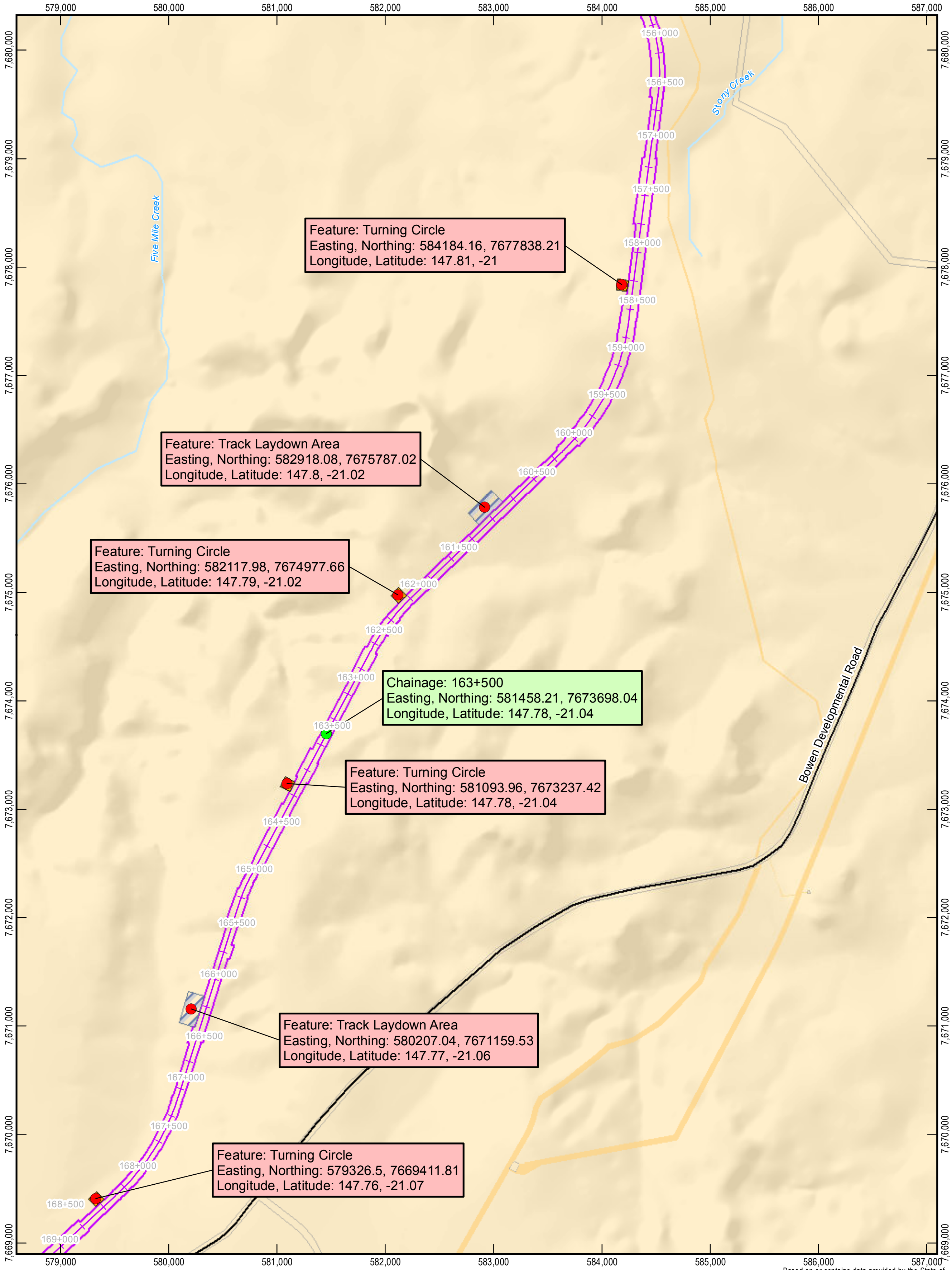

LEGEND

- Main Road
- Watercourse (Minor)
- Easement
- Lot
- North Galilee Basin Rail Alignment
- North Galilee Basin Rail 100m Corridor
- Alignment Functional Areas
  - Turning Circle
  - Track Laydown Area
- Rail Centre Line Coordinate
- Alignment Functional Areas Coordinate

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

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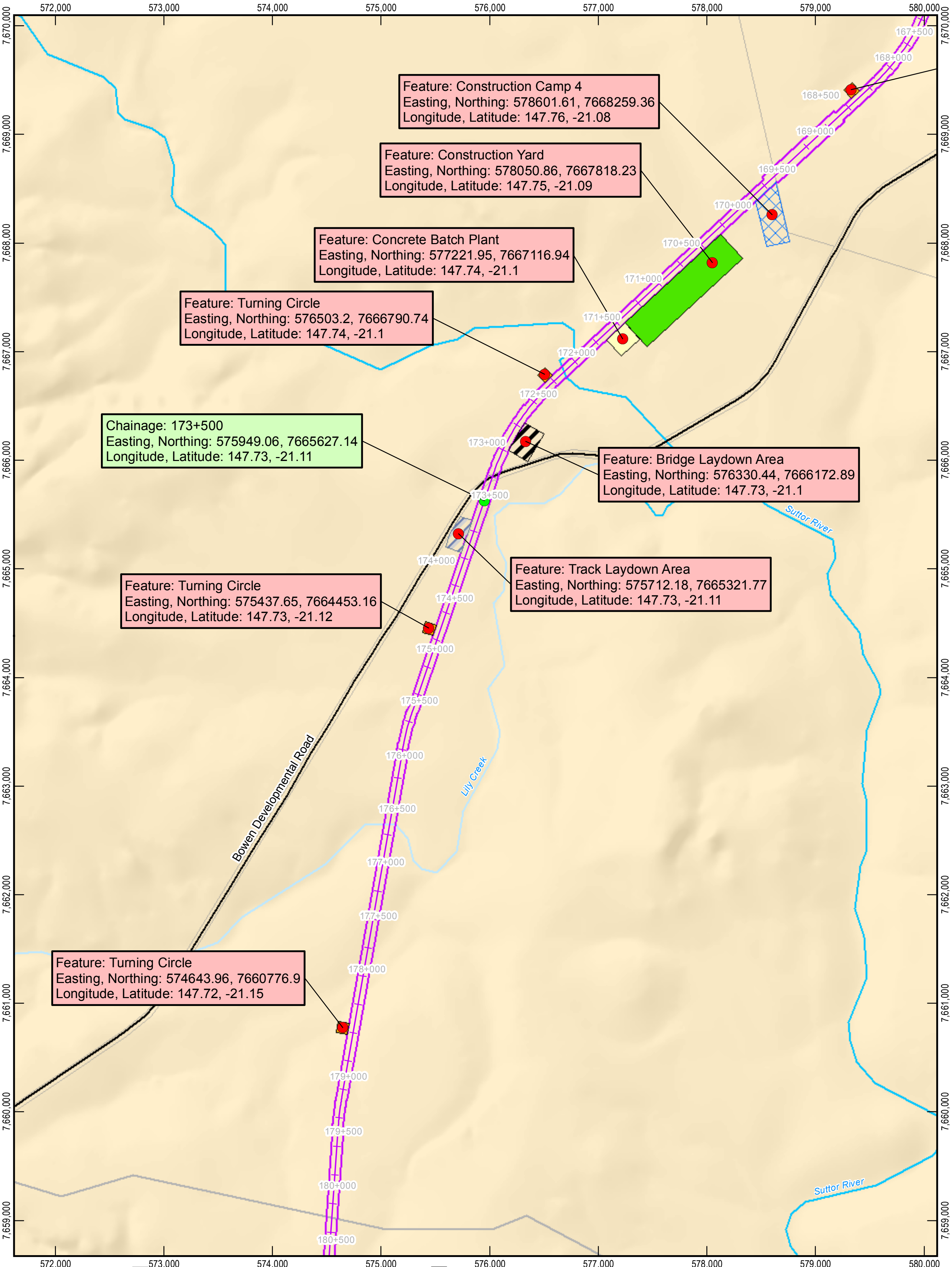

LEGEND

- Main Road
- Local Road
- Watercourse (Major)
- Watercourse (Minor)
- Lot
- North Galilee Basin Rail Alignment
- North Galilee Basin Rail 100m Corridor

Alignment Functional Areas

- Bridge Laydown Area
- Concrete Batch Plant
- Construction Camp
- Construction Yard
- Track Laydown Area
- Turning Circle
- Rail Centre Line Coordinate
- Alignment Functional Areas Coordinate

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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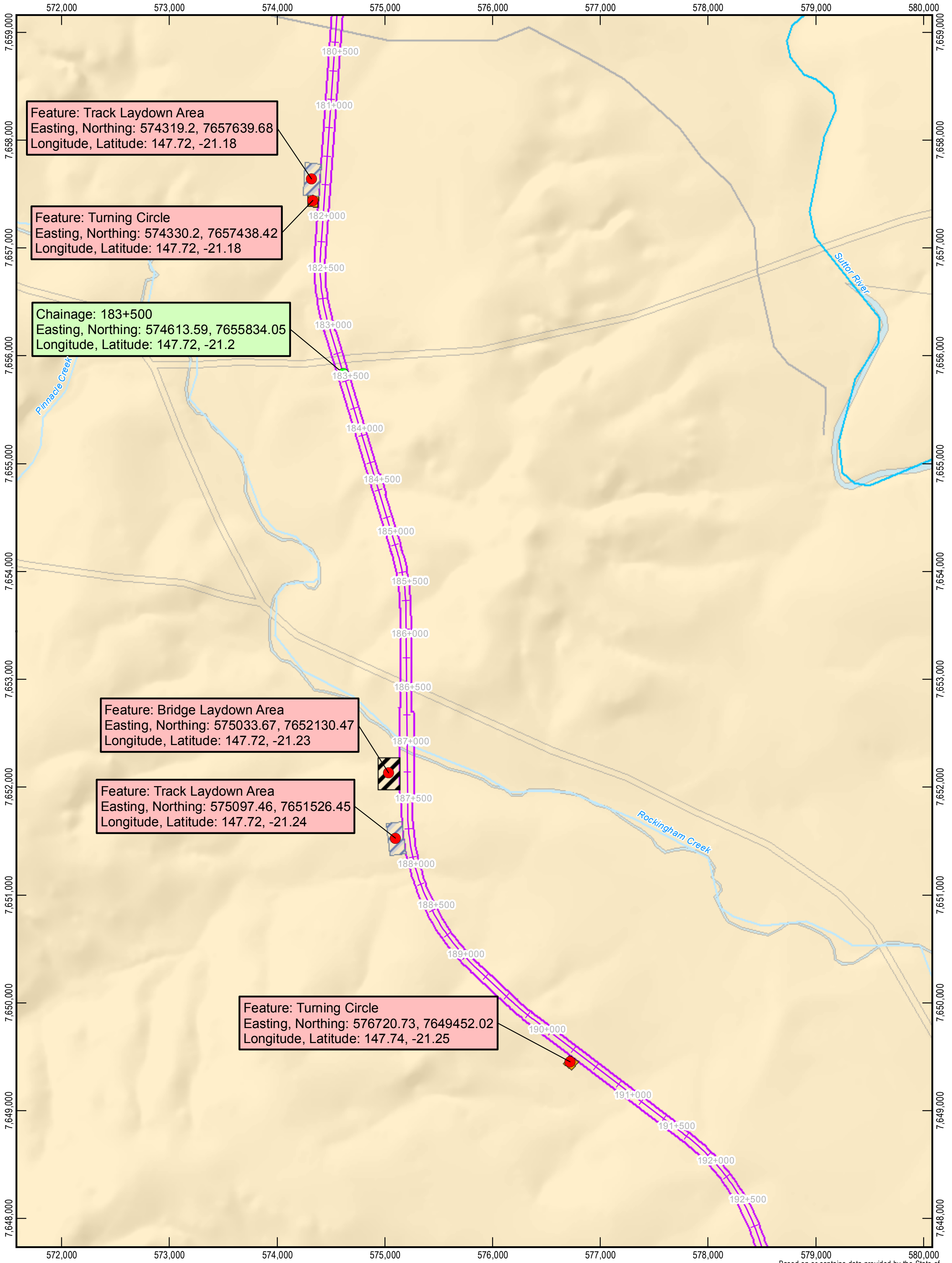

LEGEND

- Local Road
- Watercourse (Major)
- Watercourse (Minor)
- Lot
- Water
- North Galilee Basin Rail Alignment
- North Galilee Basin Rail 100m Corridor
- Alignment Functional Areas
  - Bridge Laydown Area
  - Track Laydown Area
  - Turning Circle
- Rail Centre Line Coordinate
- Alignment Functional Areas Coordinate

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Key features of the NGBR Project

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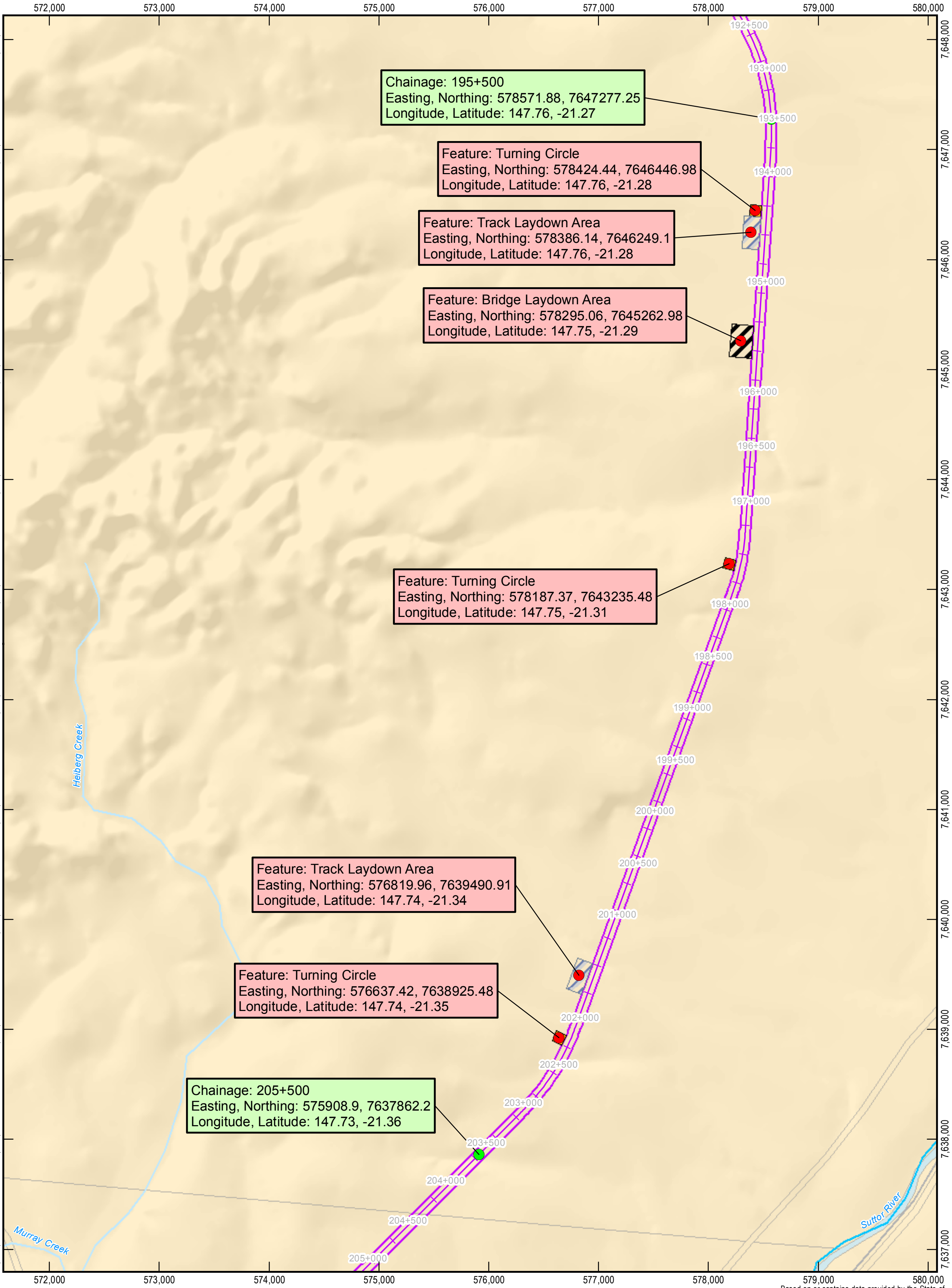

LEGEND

- Local Road
- Watercourse (Major)
- Watercourse (Minor)
- Lot
- Water
- North Galilee Basin Rail Alignment
- North Galilee Basin Rail 100m Corridor
- Alignment Functional Areas
- Bridge Laydown Area
- Track Laydown Area
- Turning Circle
- Rail Centre Line Coordinate
- Alignment Functional Areas Coordinate

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Kilometres

Map Projection: Transverse Mercator
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Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

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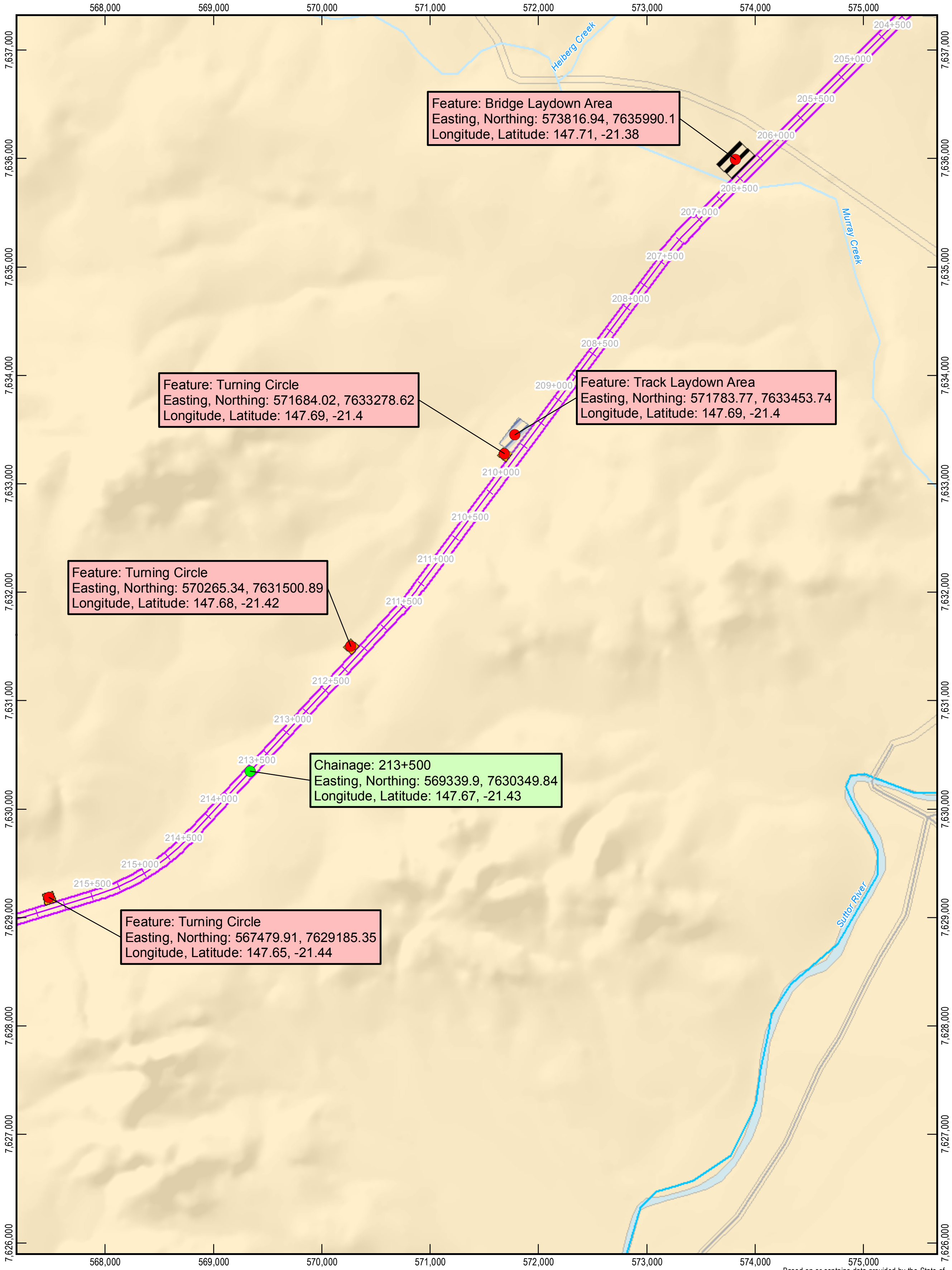

LEGEND

- Local Road
- Watercourse (Major)
- Watercourse (Minor)
- Lot
- Water
- North Galilee Basin Rail Alignment
- North Galilee Basin Rail 100m Corridor
- Alignment Functional Areas
- Bridge Laydown Area
- Track Laydown Area
- Turning Circle
- Rail Centre Line Coordinate
- Alignment Functional Areas Coordinate

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

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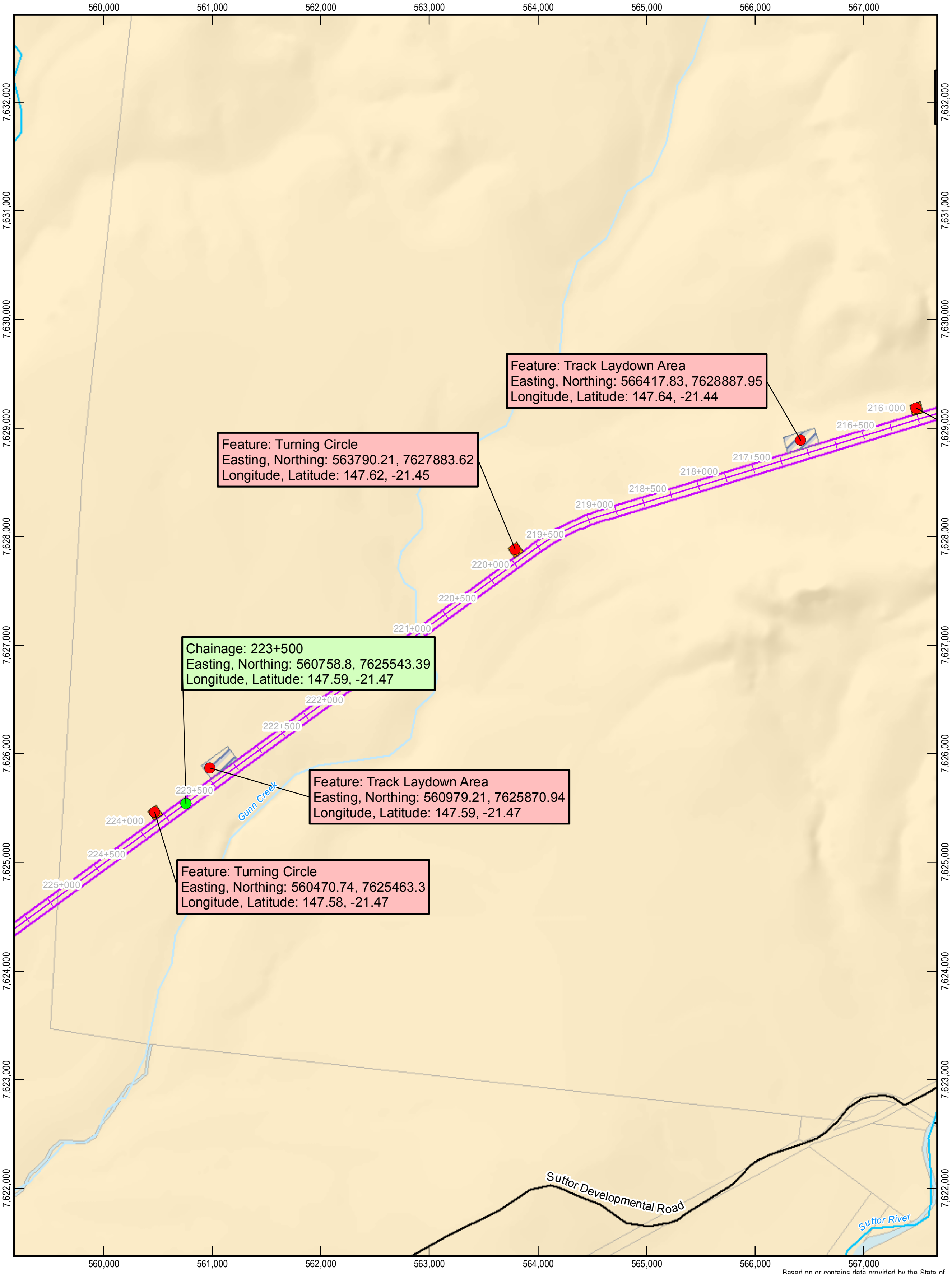

LEGEND

- Main Road
- Watercourse (Major)
- Watercourse (Minor)
- Lot
- Water
- North Galilee Basin Rail Alignment
- North Galilee Basin Rail 100m Corridor
- Alignment Functional Areas
- Track Laydown Area
- Turning Circle
- Rail Centre Line Coordinate
- Alignment Functional Areas Coordinate

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Key features of the NGBR Project

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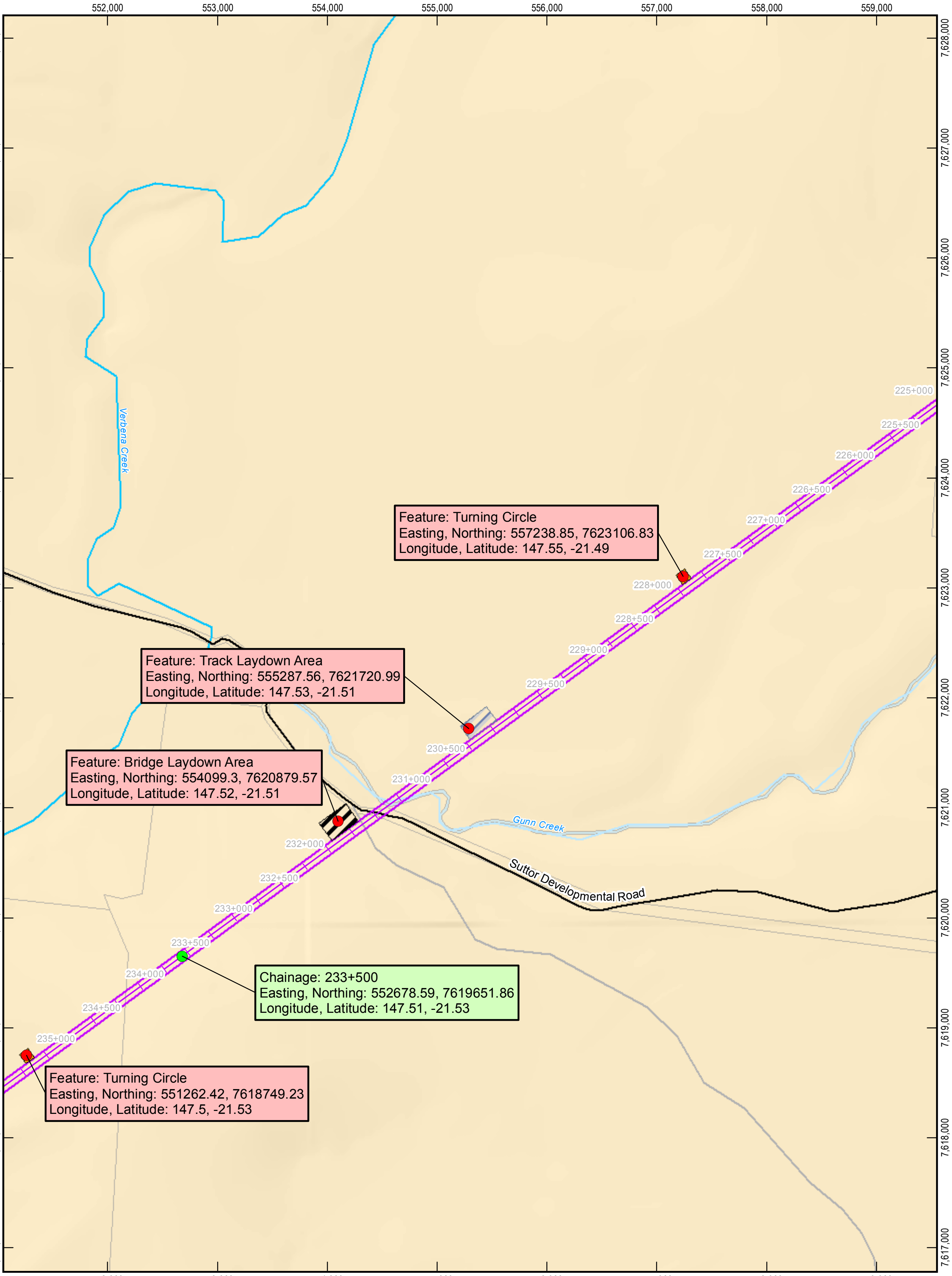

LEGEND

Main Road
Local Road
Watercourse (Major)
Watercourse (Minor)
Lot
Water
North Galilee Basin Rail Alignment
North Galilee Basin Rail 100m Corridor
Alignment Functional Areas
Bridge Laydown Area
Track Laydown Area
Turning Circle
Rail Centre Line Coordinate
Alignment Functional Areas Coordinate

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

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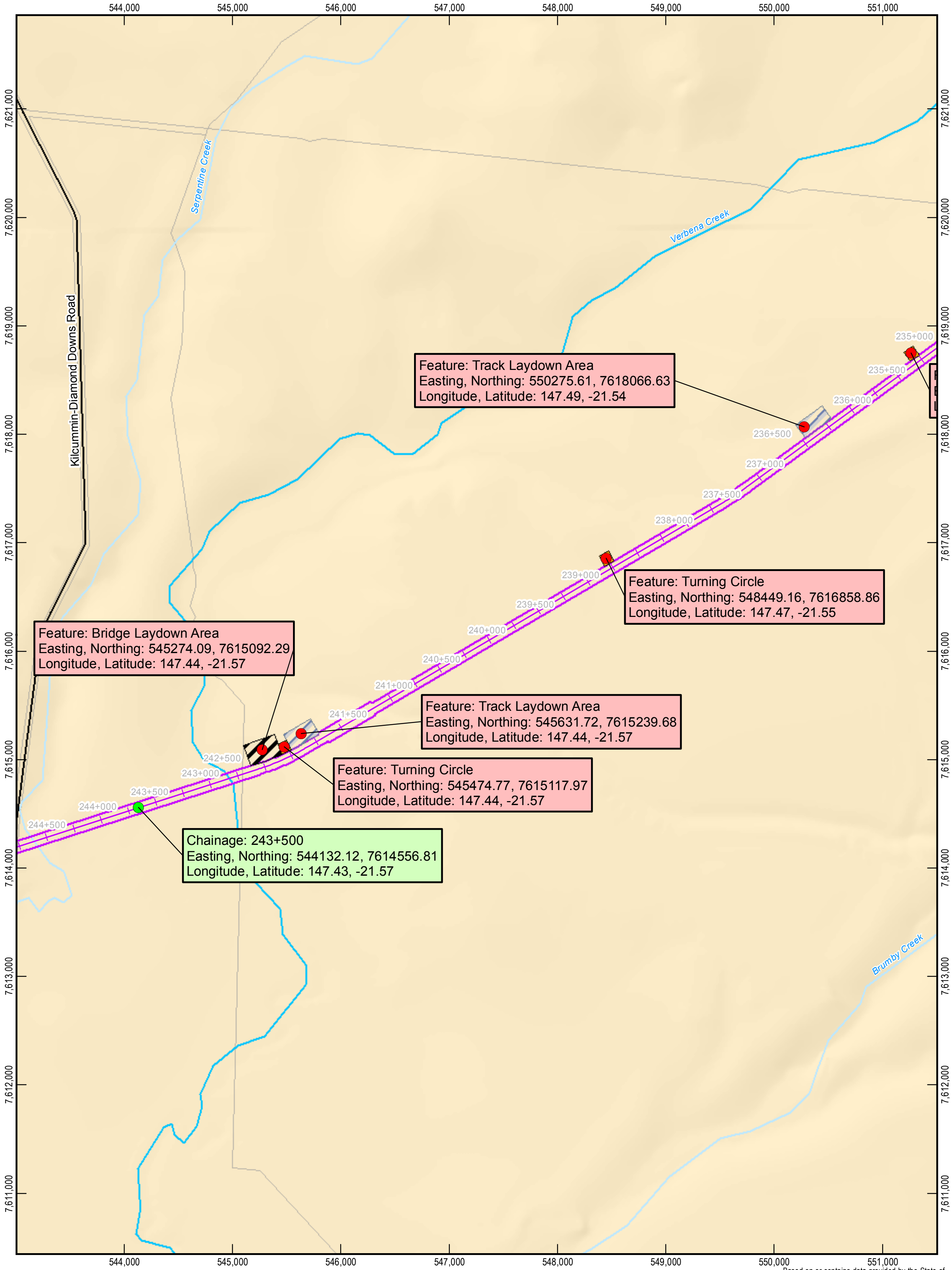

LEGEND

- Main Road
- Watercourse (Major)
- Watercourse (Minor)
- Lot
- North Galilee Basin Rail Alignment
- North Galilee Basin Rail 100m Corridor
- Alignment Functional Areas
- Bridge Laydown Area
- Track Laydown Area
- Turning Circle
- Rail Centre Line Coordinate
- Alignment Functional Areas Coordinate

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Kilometres

Map Projection: Transverse Mercator
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North Galilee Basin Rail Project

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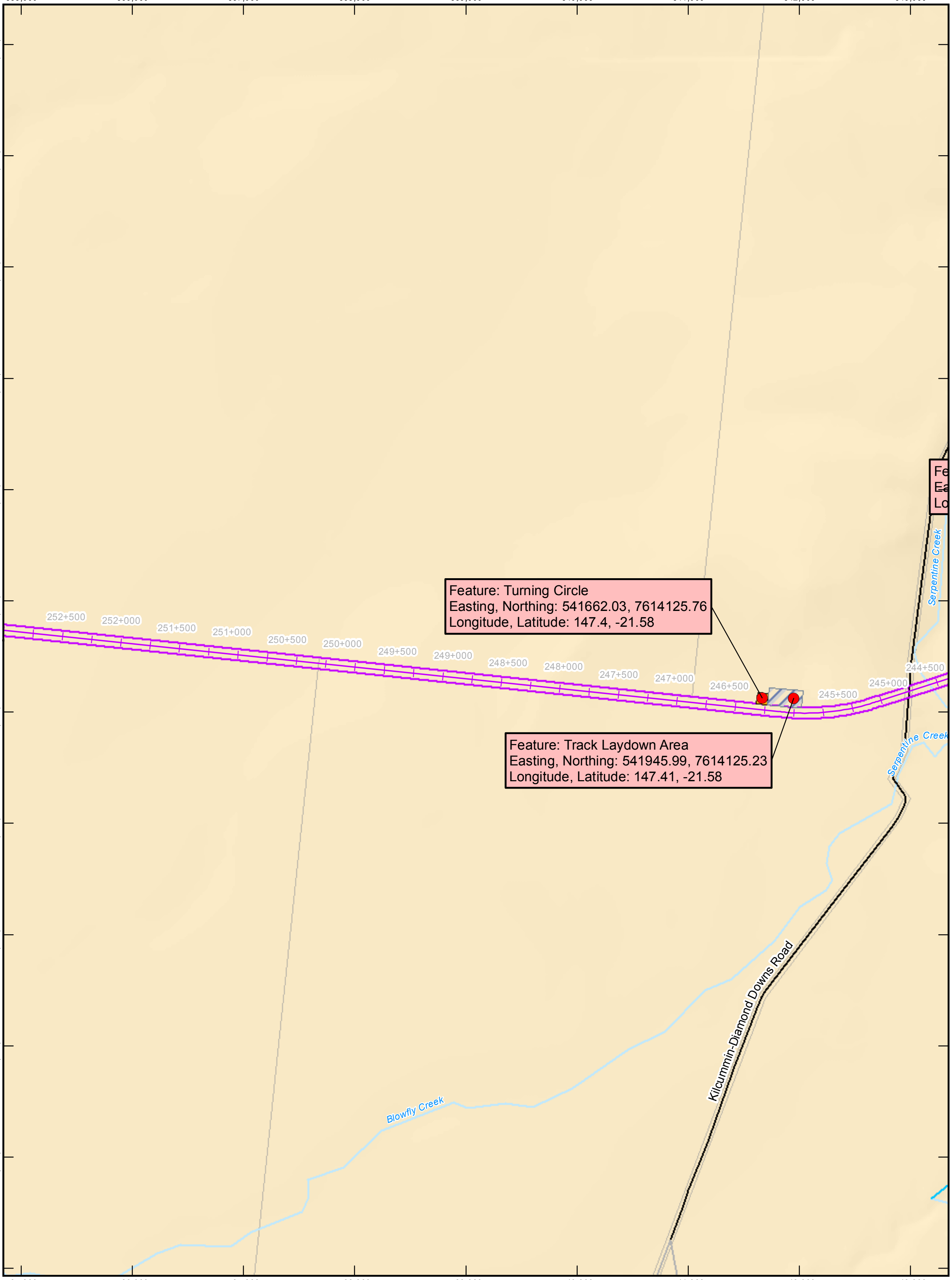

LEGEND

- Main Road
- Local Road
- Watercourse (Major)
- Watercourse (Minor)
- Lot
- North Galilee Basin Rail Alignment
- North Galilee Basin Rail 100m Corridor
- Alignment Functional Areas
- Track Laydown Area
- Turning Circle
- Alignment Functional Areas Coordinate

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Key features of the NGBR Project

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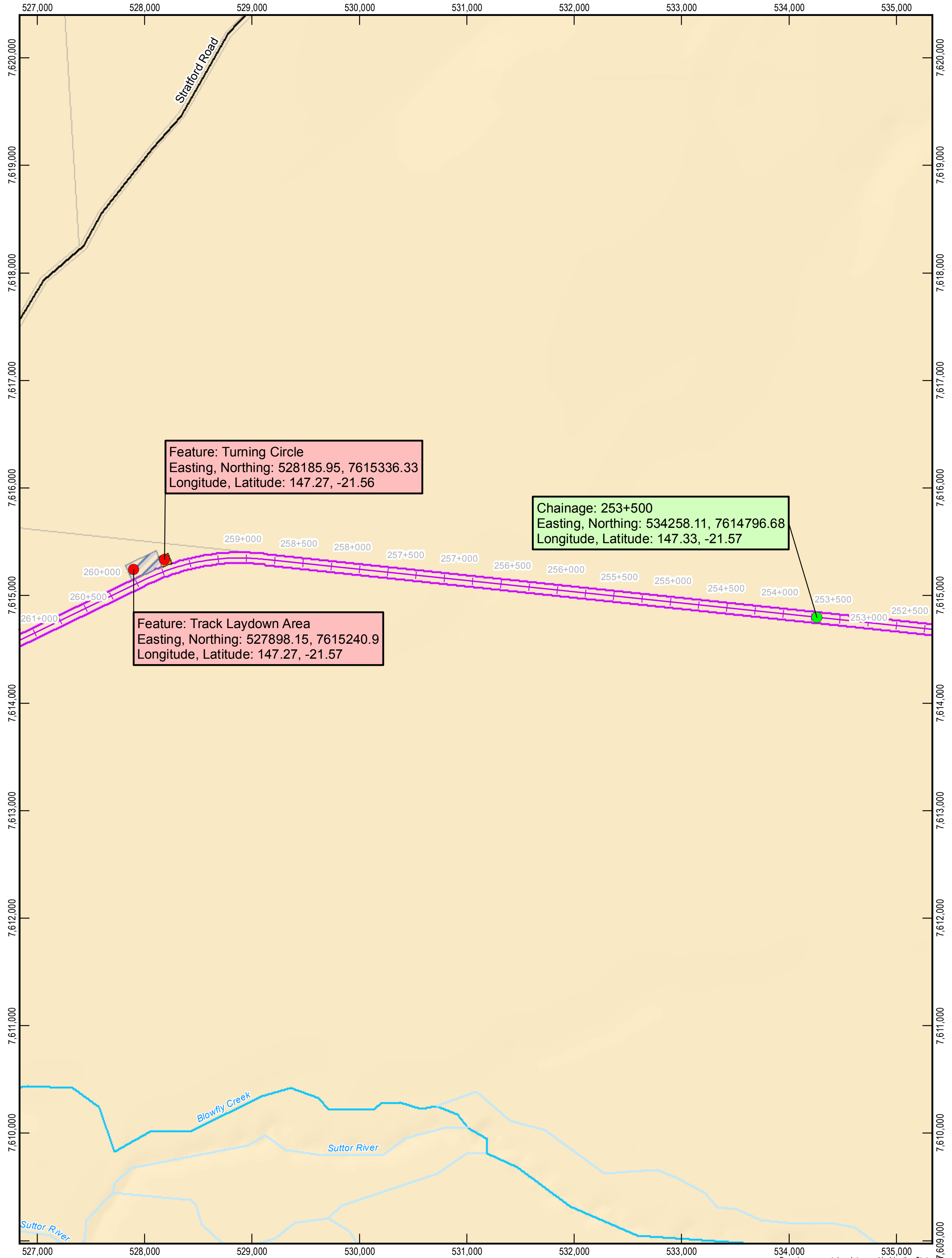

LEGEND

- Main Road
- Watercourse (Major)
- Watercourse (Minor)
- Lot
- North Galilee Basin Rail Alignment
- North Galilee Basin Rail 100m Corridor
- Alignment Functional Areas
- Track Laydown Area
- Turning Circle
- Rail Centre Line Coordinate
- Alignment Functional Areas Coordinate

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Kilometres

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North Galilee Basin Rail Project

Key features of the NGBR Project

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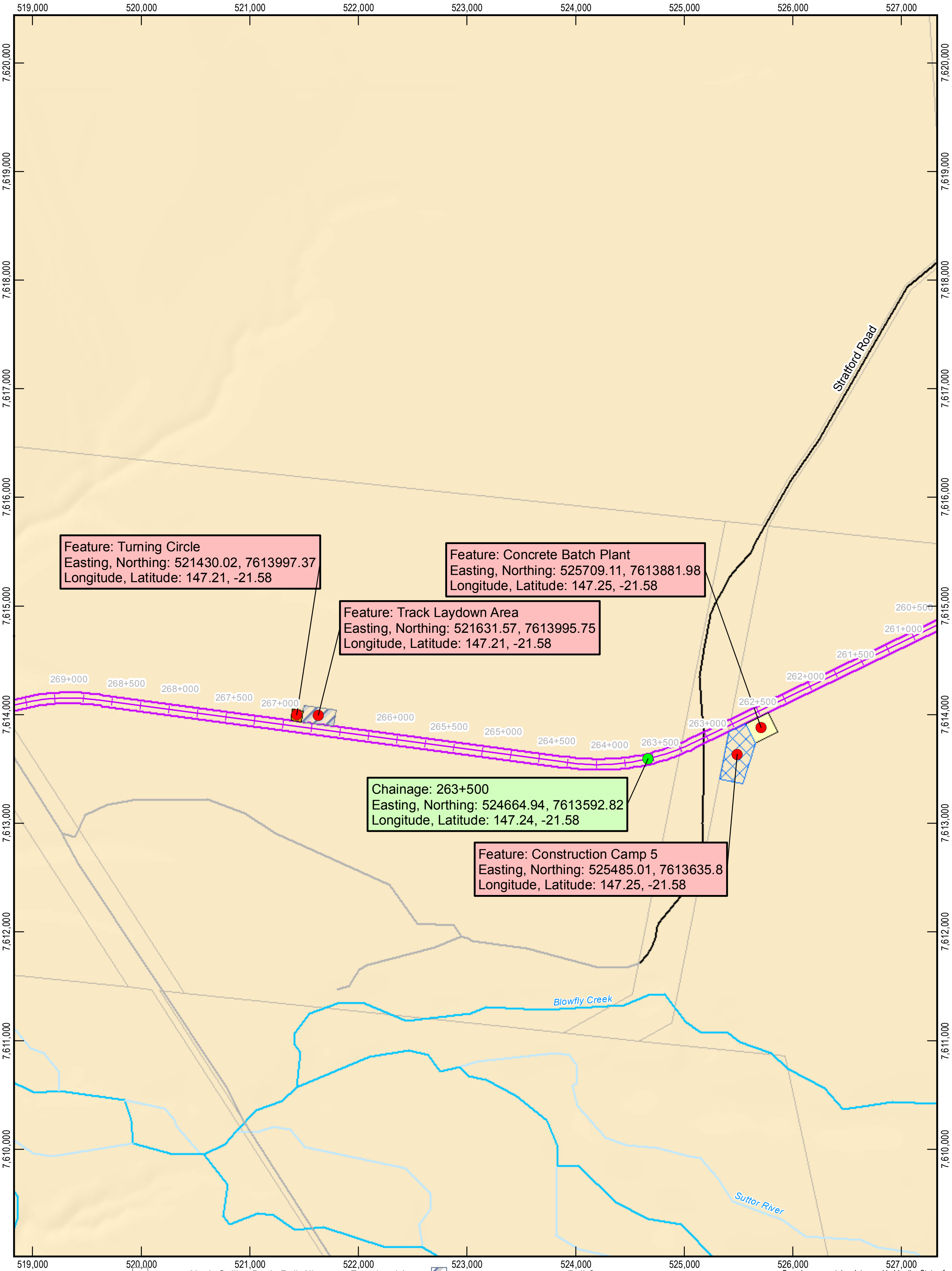
Data source: DNRM: DEM (2008), Cadastre (2013), Roads (2010), © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Watercourse (2007);
Adani: Project Rail Alignment, Camp Sites, Alignment Functional Areas (2013). Created by: MS



LEGEND

Main Road
Local Road
Watercourse (Major)
Watercourse (Minor)
Lot
North Galilee Basin Rail Alignment
North Galilee Basin Rail 100m Corridor
Alignment Functional Areas
Concrete Batch Plant
Construction Camp
Track Laydown Area
Turning Circle
Rail Centre Line Coordinate
Alignment Functional Areas Coordinate

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1:50,000 Paper Size A4

0 0.25 0.5 1

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

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North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
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Figure 7-4
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Data source: DNRM: DEM (2008), Cadastre (2013), Roads (2010), © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Watercourse (2007);
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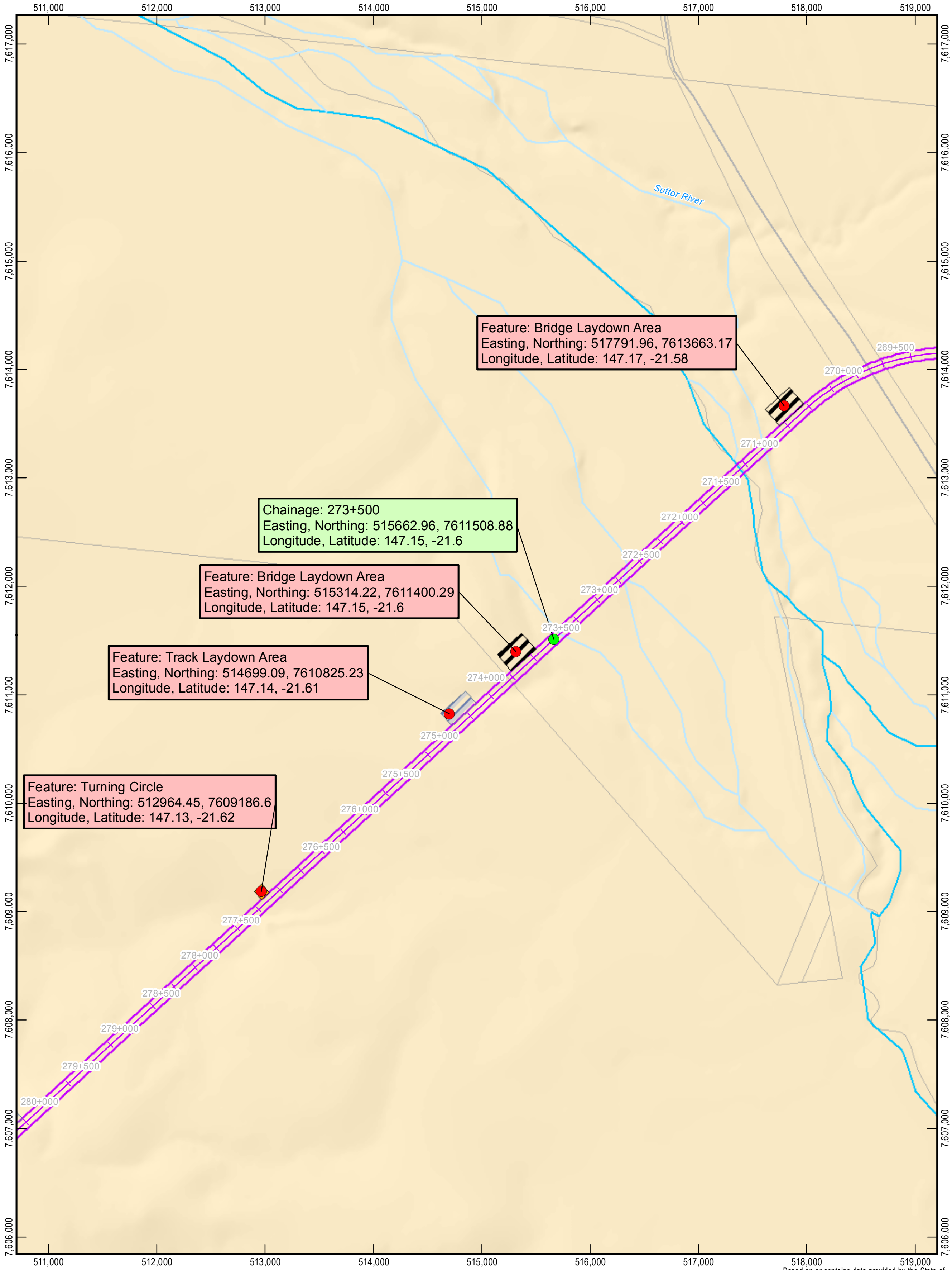

LEGEND

- Local Road
- Watercourse (Major)
- Watercourse (Minor)
- Lot
- North Galilee Basin Rail Alignment
- North Galilee Basin Rail 100m Corridor
- Alignment Functional Areas
  - Bridge Laydown Area
  - Track Laydown Area
  - Turning Circle
- Rail Centre Line Coordinate
- Alignment Functional Areas Coordinate

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Sep 2013

Figure 7-4
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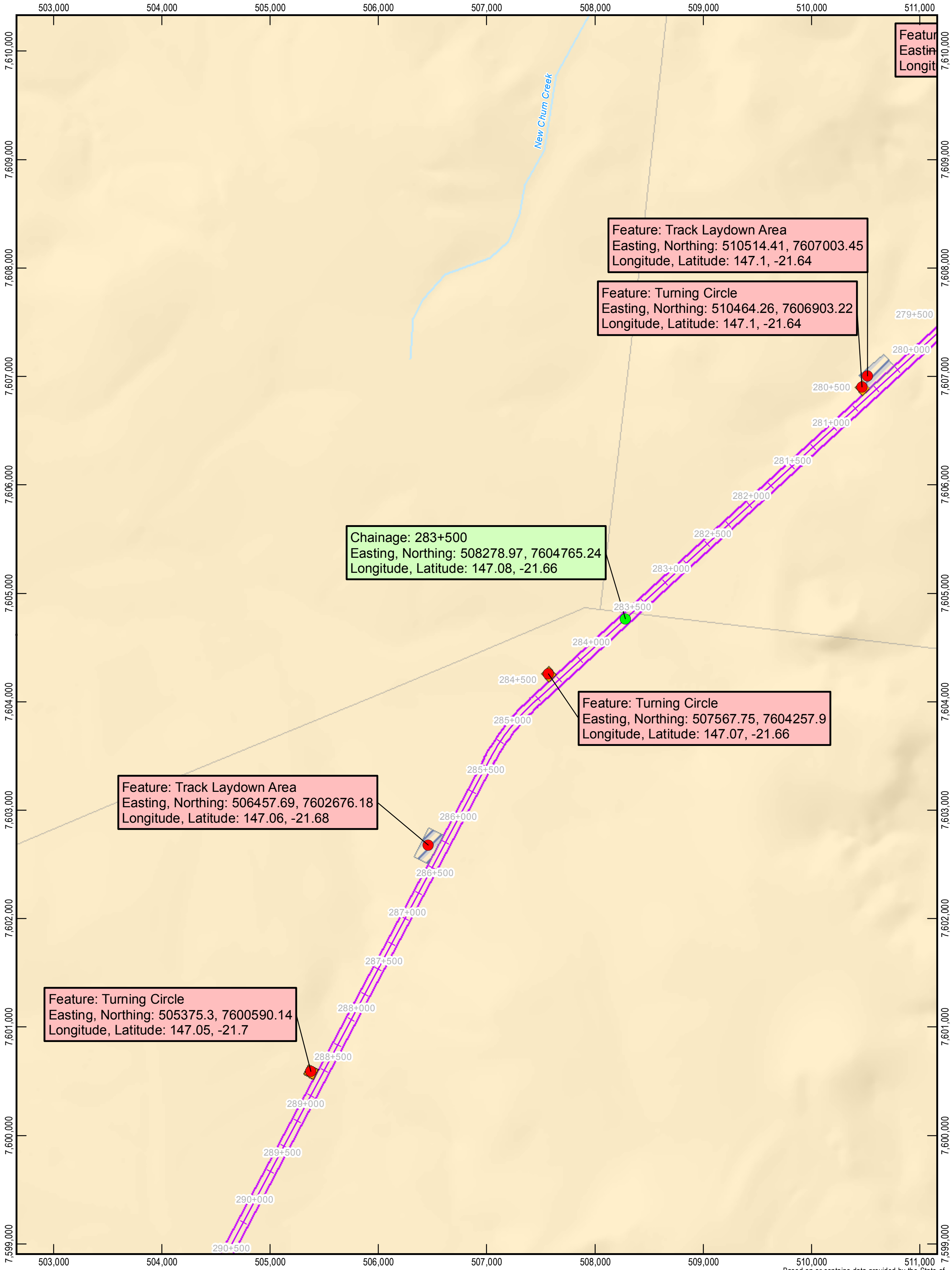

LEGEND

Watercourse (Minor)

Lot

North Galilee Basin Rail Alignment

North Galilee Basin Rail 100m Corridor

Alignment Functional Areas

Track Laydown Area

Turning Circle

Rail Centre Line Coordinate

Alignment Functional Areas Coordinate

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0 0.25 0.5 1

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
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Figure 7-4

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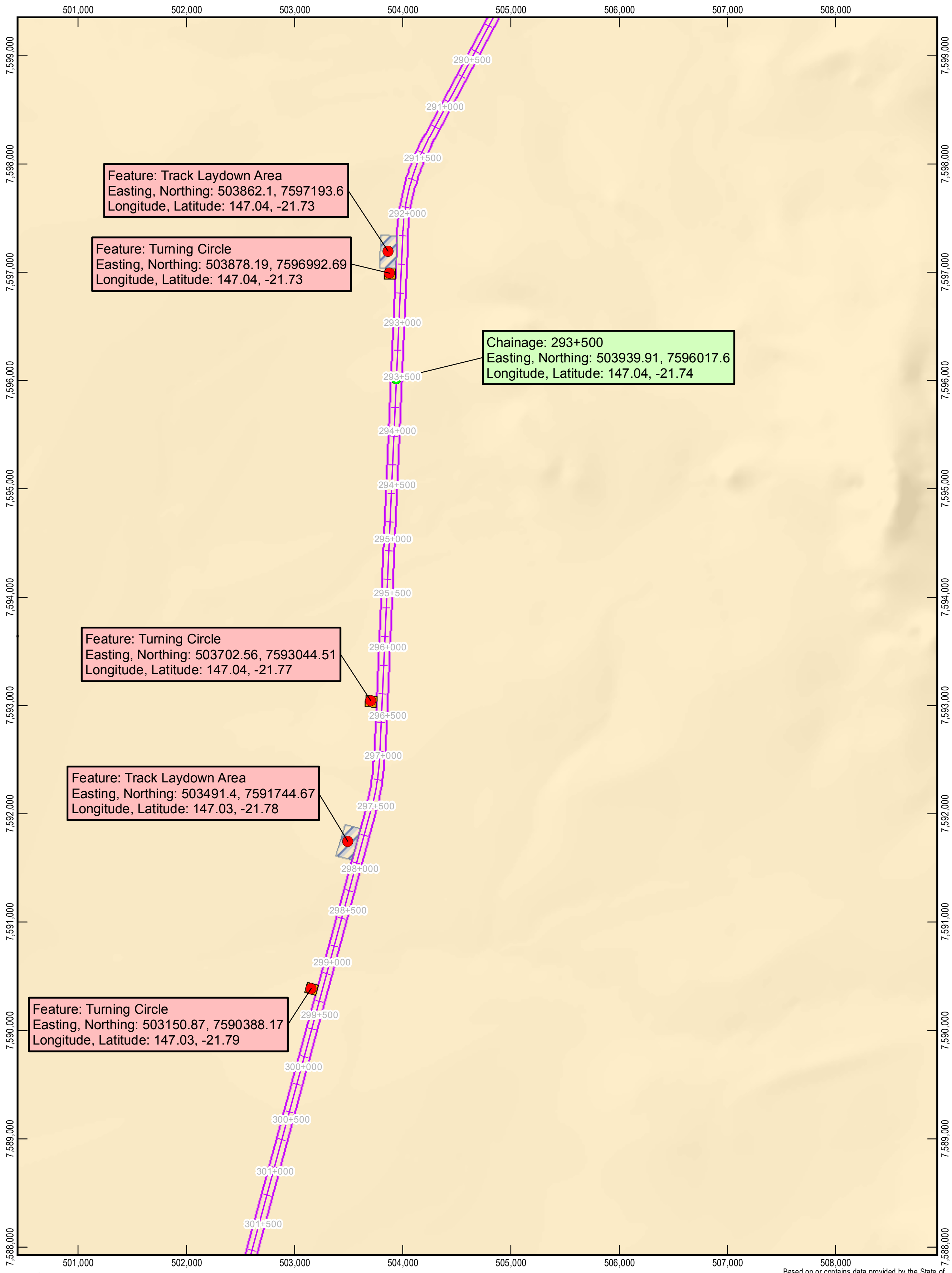

LEGEND

Lot
North Galilee Basin Rail Alignment
North Galilee Basin Rail 100m Corridor
Alignment Functional Areas
Track Laydown Area
Turning Circle
Rail Centre Line Coordinate
Alignment Functional Areas Coordinate

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Key features of the NGBR Project

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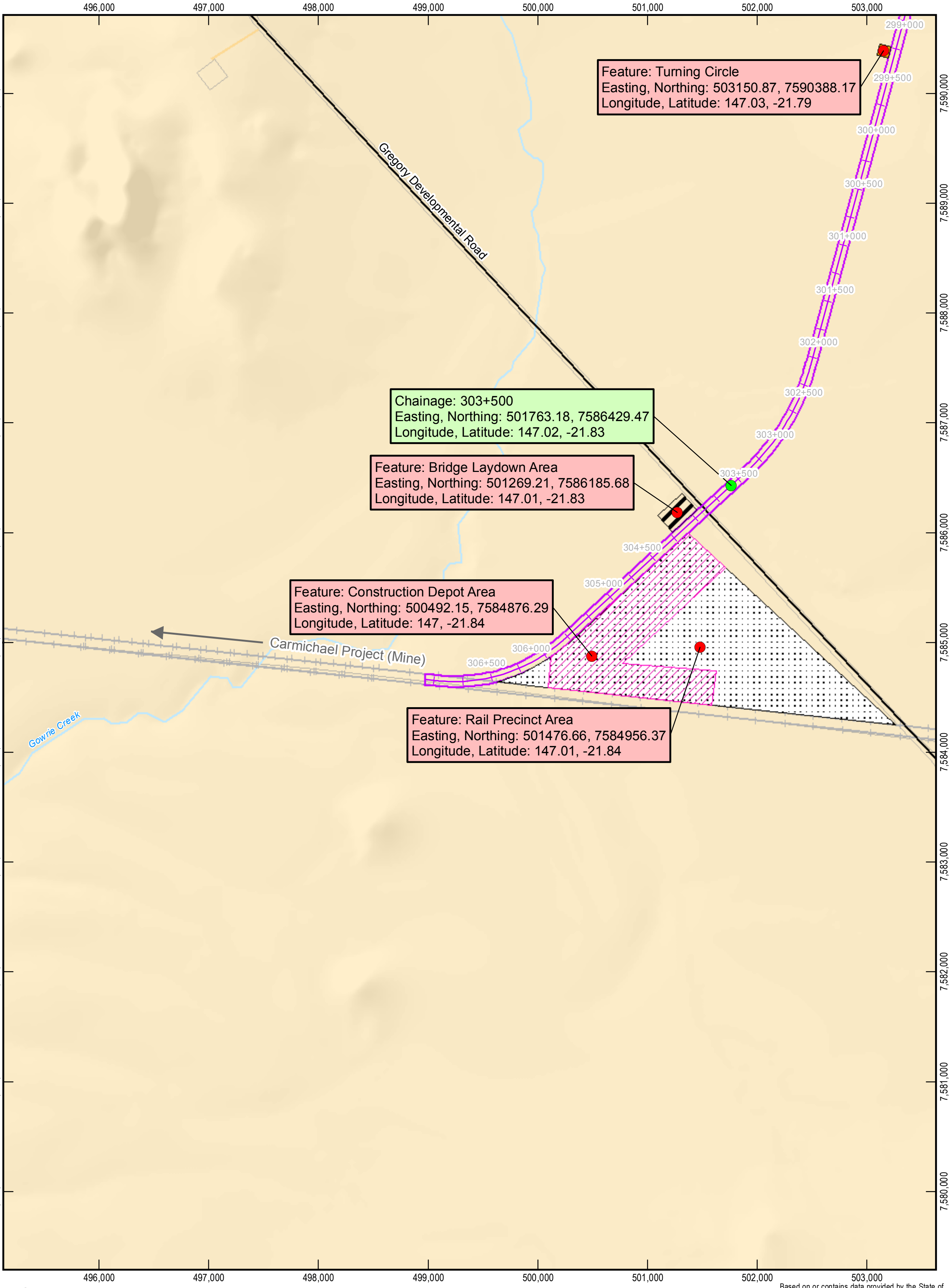

LEGEND
Main Road
Carmichael Project (Rail)
Watercourse (Minor)
Easement
Lot
North Galilee Basin Rail Alignment
North Galilee Basin Rail 100m Corridor
Alignment Functional Areas
Bridge Laydown Area
Construction Depot Area
Rail Precinct Area
Turning Circle
Rail Centre Line Coordinate
Alignment Functional Areas Coordinate

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Key features of the NGBR Project

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Figure 7-4

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Data source: DNRM: DEM (2008), Cadastre (2013), Roads (2010), © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Watercourse (2007); Adani: Project Rail Alignment, Camp Sites, Alignment Functional Areas (2013). Created by: MS

7.2.2 Key components

7.2.2.1 Rail line

The design and configuration criteria of the NGBR Project rail are listed in Table 7-3.

Table 7-3 Rail design criteria

Parameter	
Minimum horizontal curve radii	Mainline – 1,000 m
Maximum vertical grade	Mainline loaded – 1 in 220
	Mainline unloaded – 1 in 100
	Passing loops – 1 in 400
	Maintenance sidings – 1 in 400
Minimum track centre spacing	Mainline – 6 m
	Passing loops – 6 m
	Maintenance sidings – 10 m

7.2.2.2 Passing loops

The NGBR Project is a single rail line, with passing loops to allow for bidirectional train passage. Passing loops are nominally 4.5 km long (minimum clear length, excluding turnouts). A total of seven passing loops are proposed to meet the requirements of 100 mtpa (Aarvee Associates 2013) (refer Table 7-4). The positioning of passing loops along the final rail corridor took into consideration MNES mapping of listed threatened species and TECs, and aimed to avoid areas of remanent vegetation.

The location and number of passing loops will continue to be refined during subsequent design stages, to ensure the optimum number and location of passing loops are available to meet operational capacity requirements. Detailed design of passing loops will also aim to maximise the use of previously disturbed areas to minimise impacts to listed threatened species and TECs. All passing loops will be contained in the nominal 100 m wide final rail corridor. Maintenance sidings will be located at each end of the passing loops.

Table 7-4 Passing loops

Component	Start chainage (km)	End chainage (km)
PL1[1]	26.8	34
PL2	72.6	77.7
PL3	115.8	120.3
PL4	164.7	169.2
PL5	201.5	206
PL6	235	239.5
PL7	238.6	288.1

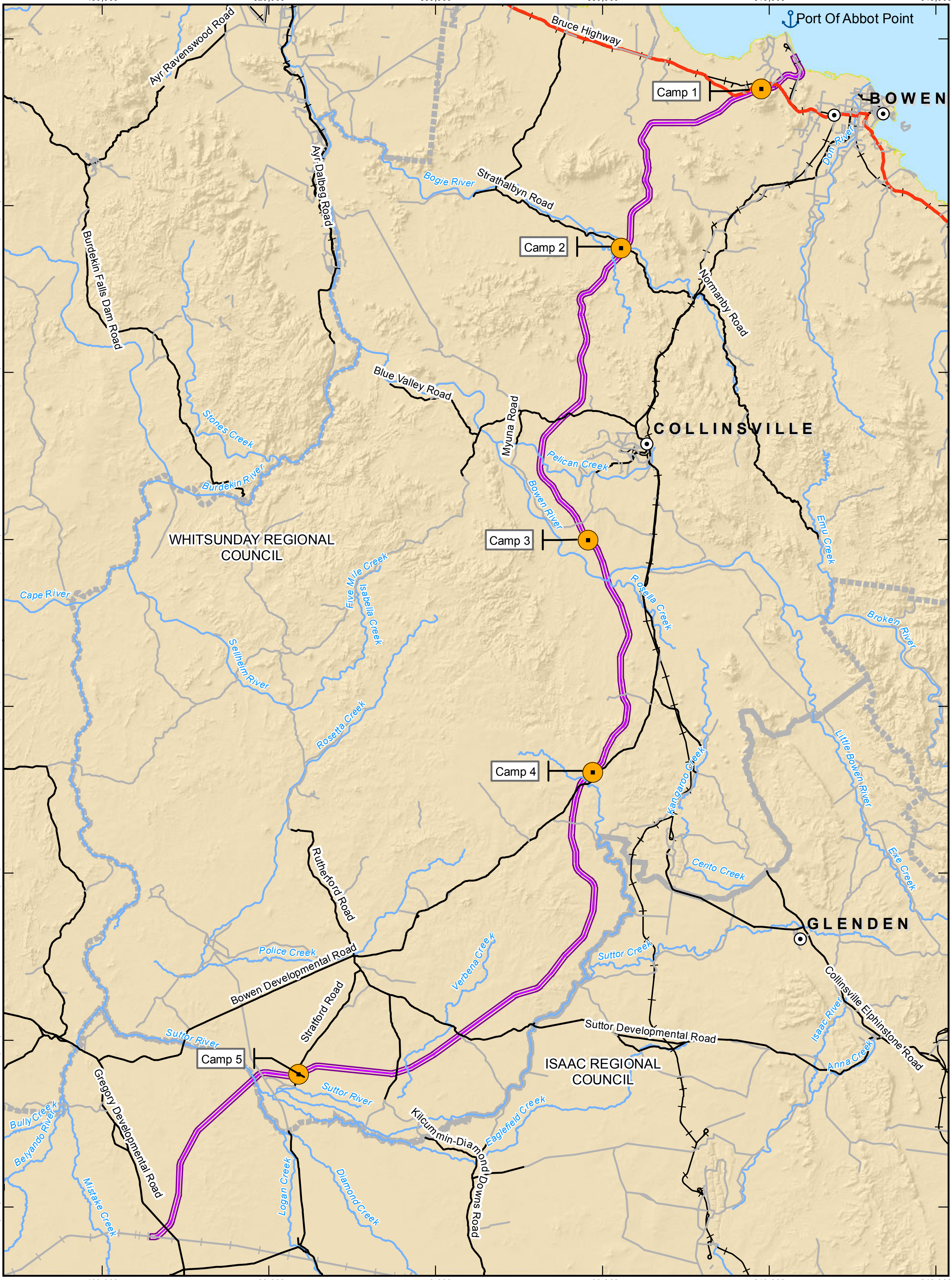
[1] Situated at rolling stock maintenance depot

7.2.2.3 Construction camps

The NGBR Project includes five construction camps to accommodate the construction workforce. The location of the construction camps along the NGBR Project is shown in Figure 7-5. The location and capacity (no. of beds) of the five construction camps is listed in Table 7-5. Construction camp 2 and construction camp 4 are major construction camps, with a 400 person capacity at peak construction, which is based on the distribution of earthworks and concrete works across the NGBR Project. Where possible, the construction camps have been located in previously disturbed areas that are less likely to contain high value remnant vegetation or habitat for listed threatened species. The final layout and design of the construction camps will also aim to further minimise any required clearing of remnant vegetation.

Table 7-5 Construction camps

Chainage (km)	Component	Capacity	Area (ha)
15	Construction camp 1	300	9.5
62	Construction camp 2	400	9.5
124	Construction camp 3	300	9.5
170	Construction camp 4	400	10.9
263	Construction camp 5	300	11.7



LEGEND

- Population Centres
- Major Port
- Construction Camp
- Highway
- Main Road
- Local Road
- Carmichael Project (Rail)
- Railway
- Watercourse (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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0 7.5 15 30

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Job Number	41-26457
Revision	B
Date	26 Sep 2013

Construction camps

Figure 7-5

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Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013, NGBR Corridor 06/06/2013, Carmichael Project (Rail) 18/06/2013, Camps; DNRM: Roads/2010. Created by:MS

7.2.2.4 Construction depots

During construction, the site of the rolling stock maintenance depot from chainage 26.8 km to 34.0 km, adjacent to Glenore Road, will be used as a construction depot. A second construction depot (113.33 ha) will be established from chainage 304.1 km to 305.9 km, adjacent to Gregory Developmental Road. This construction depot will be established as part of the Carmichael Project (Rail), and will subsequently be used for the NGBR Project.

The construction depot areas will include a flash butt welding yard for welding and storage of track and sleepers, and house diesel storage tanks with a capacity of greater than 20,000 litres. Hardstands will be established for the flash butt welding yard and workshops within the construction depot areas.

Both construction depots will serve as permanent maintenance facilities for the NGBR Project and both are located in previously disturbed areas that are less likely to contain habitat for listed threatened species or TECs.

7.2.2.5 Construction yard

A secondary construction yard (36 ha) will be established from chainage 170.2 km to 171.3 km, adjacent to Bowen Developmental Road, to support intermediate construction activities. The construction yard will house diesel storage tanks with a capacity of greater than 20,000 litres.

The construction yard has been located in a previously disturbed area that is less likely to contain habitat for listed threatened species or TECs.

7.2.2.6 Ancillary construction facilities

The construction of the NGBR Project will require a number of temporary ancillary facilities, additional to construction camps, construction depots and the construction yard. These components will be situated adjacent to the final rail corridor, in the vicinity of associated works, and include bridge laydown areas, concrete batch plant, track laydown areas and turning circles.

The location of bridge laydown areas and concrete batch plants are provided in Table 7-6. Track laydown areas will be approximately 4.5 ha in area and occur at six to eight kilometre intervals. Turning circles will be approximately one hectare in area and occur at three to four kilometre intervals (refer Figure 7-3). Hardstands will be established for concrete batch plants and laydown areas.

Table 7-6 Temporary construction infrastructure

Chainage (km)	Component	Area (ha)
-5.5[1]	Bridge laydown area	6.16
-6.5[1]	Bridge laydown area	5.6
7.6	Bridge laydown area	6.12
12.6	Bridge laydown area	6.52
15.2	Concrete batch plant 1	4.6
19.9	Bridge laydown area	6
34.7	Bridge laydown area	6

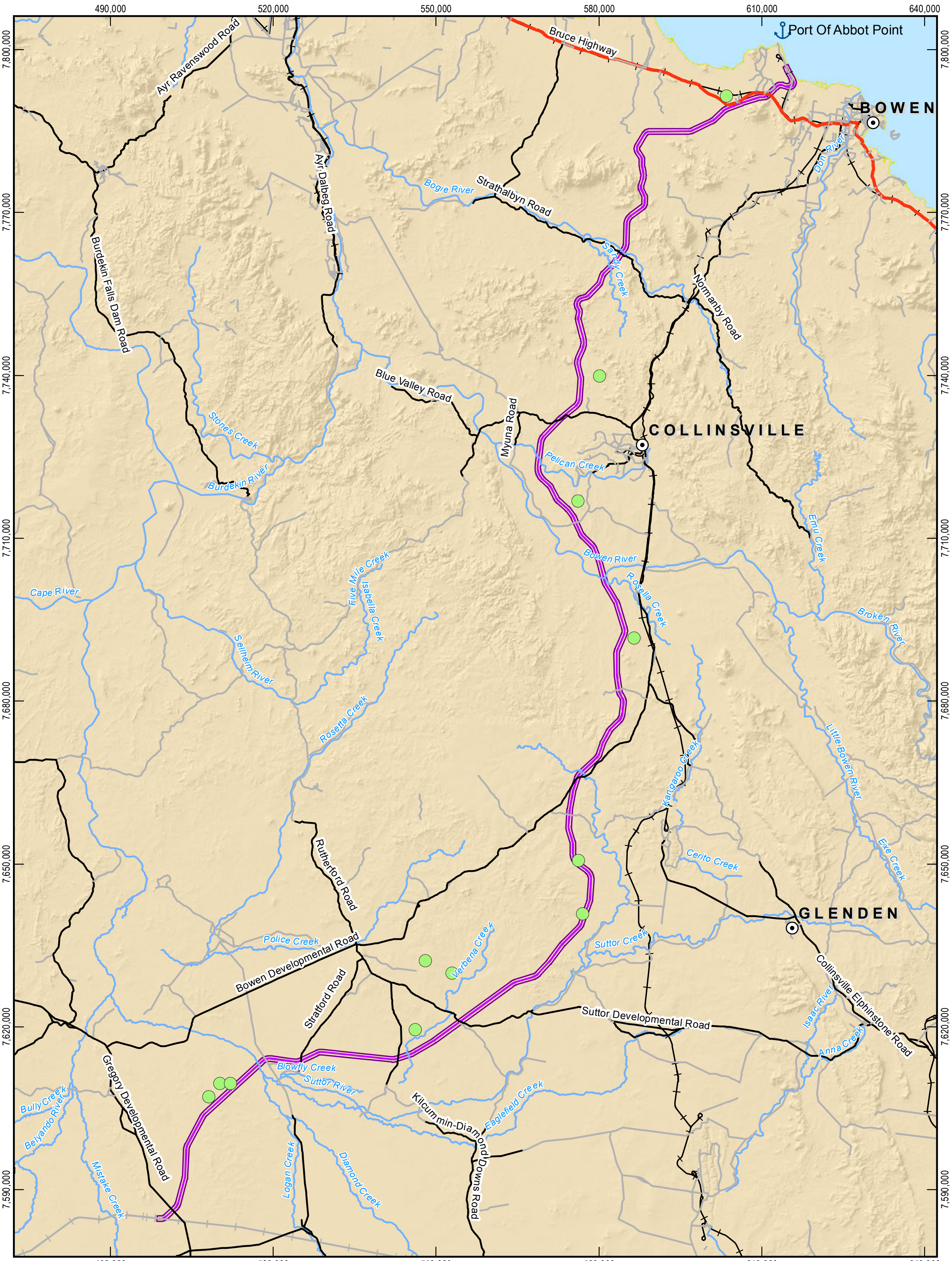
Chainage (km)	Component	Area (ha)
56.5	Bridge laydown area	6
61.4	Bridge laydown area	6.51
62.2	Concrete batch plant 2	4.72
64.2	Bridge laydown area	6.04
98.6	Bridge laydown area	6
106.4	Bridge laydown area	6
124.5	Concrete batch plant 3	4.6
132.5	Bridge laydown area	6.29
171.5	Concrete batch plant 4	4.6
172.8	Bridge laydown area	6.12
187.3	Bridge laydown area	6
195.5	Bridge laydown area	6
206.3	Bridge laydown area	6
231.6	Bridge laydown area	6
242.3	Bridge laydown area	6.1
262.4	Concrete batch plant 5	4.6
270.5	Bridge laydown area	6
273.8	Bridge laydown area	6
304	Bridge laydown area	6

[1] Refers to chainage on balloon loop, off mainline; within the bounds of the NGBR Project for the purpose of the EIS.

The site selection for ancillary construction facilities has taken into consideration MNES vegetation mapping and utilised areas of previously disturbed vegetation that is less likely to support MNES. The final layout and location of ancillary construction facilities will aim to further utilise previously disturbed areas and minimise clearing of remnant vegetation or potential habitat for listed threatened species.

7.2.2.7 Quarries and borrow areas

Quarries and borrow areas will be required to support the construction of the NGBR Project. Materials to be sourced from quarries and borrow areas include fill, gravel, aggregates, ballast and capping layer material. The approximate quantities of materials required during construction are provided in Section 7.2.3. Quarries and borrow pits may include screening and crushing plant to process materials to allowable standards. Potential locations for quarry and borrow areas are depicted in Figure 7-6. Investigation work is ongoing to identify additional sources of appropriate material and will aim to avoid/minimise potential impacts to MNES.



LEGEND

- Population Centres
- Major Port
- Potential Quarry Locations
- Highway
- Main Road
- Local Road
- Carmichael Project (Rail)
- Railway
- Watercourse (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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0 2.5 5 10 15 20

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Potential quarry and borrow locations

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Figure 7-6

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Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013, NGBR Corridor 06/06/2013, Carmichael Project (Rail) 18/06/2013, Quarry Locations /2013 DNRM: Roads/2010. Created by:MS

7.2.2.8 Water supply infrastructure

Water supply options have been investigated to support concrete batching, cut and fill earthworks and potable consumption at construction camps (refer Volume 2 Appendix H3 Construction water supply strategy (page 119)). It is expected that water supply to support the NGBR Project will be a combination of the following.

- In-stream water storages
- Off-stream water storage
- Groundwater bores
- River harvesting
- Purchase of potable water from
  - Isaac Regional Council
  - Whitsunday Regional Council.

Rainwater harvesting is also proposed at the rolling stock maintenance depot during operation.

The water supply strategy will continue to be refined during detailed design. Any water supply dams will be designed in accordance with the *Water Supply (Safety and Reliability) Act 2008* (refer Volume 1 Chapter 20 Legislation and approvals). Construction water demand is detailed in Section 7.2.3.

7.2.2.9 Haul roads and access roads

Construction of the NGBR Project will be supported by a combination of upgrades to local roads and construction of new haul roads and access roads, including intersection development or upgrades as necessary.

A haul road will be established within the final rail corridor, parallel to the NGBR Project rail alignment, on the northern side. The construction road will be a minimum of 10 m in width, allowing for two-way semi-trailer movement.

The haul road will be repurposed as a rail maintenance access road, constructed of 200 mm crushed rock material, at the end of construction. Within cuts, the rail maintenance access road will be four metres wide and at formation level, while within fills, it will be six metres wide and adjacent to the foot of the embankment.

Upgrades to local roads and construction of new access roads will be undertaken to provide access to the construction road or rail maintenance access road, as well as laydown areas, quarries and borrow areas, from the external road network. Access roads utilised during construction will be variously rehabilitated or repurposed as maintenance access roads.

7.2.2.10 Road crossings

The NGBR Project includes 22 road crossings (refer Table 7-7). Proposed treatment criteria are subject to further consultation with the Department of Transport and Main Roads (DTMR) and local councils, and will undergo further review during subsequent design stages.

Indicative concept design drawings of road crossings are provided in Volume 2 Appendix T Concept design drawings.

Table 7-7 Road treatments

Chainage (km)	Name	Treatment
6.1	Abbot Point Road	At grade (passive)
-5.3[1]	Abbot Point Road	At grade (passive)
-6.3[1]	Abbot Point Road	Below-grade
12.3	Bruce Highway	Below-grade
34	Glenore Road	At-grade (passive)
57.3	Minor Road	At grade (passive)
61.6	Strathalbyn Road	At-grade (passive)
79.6	Minor Road	At grade (passive). Realignment
83.7	Road reserve	Closure
97.9	Strathmore Road	At-grade (passive). Realignment
117.1	Road reserve	Closure
120.5	Minor road	At-grade (passive)
139.3	Road reserve	Closure
153.9	Minor road	At-grade (passive). Realignment
173.2	Bowen Developmental Road	Above-grade. Realignment
177.8	Minor road	Closure
180.3	Minor road	At-grade (passive). Realignment
205.8	Road reserve	Closure
231.3	Suttor Developmental Road	At grade[2]. Realignment
244.7	Kilcummin Diamond Downs Road	At-grade (passive)
263	Stratford Road	At-grade (passive)
303.8	Gregory Developmental Road	Above-grade

Notes:

1. Refers to chainage on balloon loop, off mainline

2. An appropriate level of protection for the at-grade crossing subject to risk assessment (for example using the Australian Level Crossing Assessment Model (ALCAM)), and negotiation with DTMR.

7.2.2.11 Occupational crossings and stock route crossings

The NGBR Project includes 54 occupational crossings and seven national stock route crossings. Proposed treatments for each stock route crossing are provided in Table 7-8. The proposed treatments are subject to further consultation with the Department of Natural Resources and Mines (DNRM), local government and landholders, and will undergo further review during subsequent design stages.

Indicative concept design drawings of occupational crossings are provided in Volume 2 Appendix T Concept design drawings.

Table 7-8 Stock route crossings

Chainage (km)	Gazettal no.	Treatment
57.3[1]	U398BOWN05	At-grade with holding yards
62.8	U398BOWN04	At-grade with holding yards Realignment
79.6[1]	U398BOWN04	At-grade with holding yards Realignment
97.9[1]	U321BOWN01	At-grade with holding yards Realignment
133.3	U409BOWN02	At-grade with holding yards
186.4	U403BOWN02	At-grade with holding yards
269.6	U402BOWN01	At-grade with holding yards

Note: 1. Shared with road crossing

7.2.2.12 Service crossings

A 'dial before you dig' search was undertaken for the NGBR Project, which identified two pipeline crossings, three optic fibre cable crossings and 13 power line crossings (refer Table 7-9). Treatments for each crossing will be negotiated with service authorities.

Table 7-9 Service crossings

Chainage (km)	Service
12.24	Optic fibre cable (Optus)
12.24	Optic fibre cable (Telstra)
12.24	Optic fibre cable (Reef Networks)
12.55	Power line
37.65	Power line
50.28	Power line
63.45	Power line
89.5	Power line
95.25	Power line

Chainage (km)	Service
101.65	Power line
110.82	Power line
147.53	Power line
150.7	SunWater Water Pipeline
150.77	North Queensland Gas Pipeline
155.98	Power line
189.54	Power line
232.13	Power line
266.29	Power line

7.2.2.13 Rail network crossings

At chainage 12.1 km, the NGBR Project crosses the existing North Coast Line, part of the Queensland Rail network. The proposed treatment for this crossing is for the NGBR Project to cross over the North Coast Line via a grade-separated crossing.

At chainage 6.75 km, the NGBR Project crosses the existing Abbot Point branch of the Newlands system, part of the Aurizon network. The proposed treatment for this crossing is for the NGBR Project to cross over the Abbot Point branch via a grade-separated crossing.

The final treatment at this crossing and any subsequent interfaces with the rail network will be subject to negotiations and infrastructure agreements between all relevant asset owners.

7.2.2.14 Waterway crossings

A desktop hydrological study of the NGBR Project identified 567 waterway crossings (refer Volume 2 Appendix H2 Hydrology and hydraulics (page 9).

Preliminary engineering design of drainage structures at identified waterway crossings has been undertaken for the 50 year ARI event. A combination of bridges, pipe culverts and box culverts is proposed. Bridges were selected at locations with design flow rate greater than or equal to 250 m^3/s, major culverts were selected at locations with design flow rate greater than or equal to 50 m^3/s and minor culverts were selected at locations with design flow rate less than 50 m^3/s. The particular cross-drainage structure applied was determined by the design flow rate and annual recurrence interval (ARI) rainfall event, as well as desired freeboard, maximum velocity and scour protection. Bridges were designed for a 1 in 100 year ARI rainfall event with 300 mm freeboard to the soffit of the bridge deck. The design flow rate for culverts was based upon a 1 in 50 year ARI rainfall event. The top of the rail was designed based upon a 1 in 100 year ARI rainfall event while the formation was designed based upon a 1 in 50 year ARI rainfall event.

A span of 20.2 m was adopted for all bridge structures; box culverts and pipe culverts were variously sized. Pipe culverts and boxed culverts are expected to be reinforced concrete. Crossing structures at major waterways are summarised in Table 7-10.

Table 7-10 Major waterways and crossing structures

Chainage (km)	Waterway	Crossing structure
20.23	Splitters Creek	Bridge (3 span) Box culverts (4 cell)
35.08	Elliot River	Bridge (4 span)
61.22	Bogie River	Bridge (9 span)
64.78	Sandy Creek	Bridge (3 span)
98.78	Strathmore Creek	Bridge (2 span)
106.05	Pelican Creek	Bridge (8 span)
132.20	Bowen River	Bridge (20 span) Box culverts (15 cell)
172.06	Suttor River (Upper)	Bridge (2 span)
176.58	Lily Creek	Box culverts (15 cell) Pipe culverts (4 cell)
187.00	Rockingham Creek	Bridge (2 span)
206.51	Murray Creek	Bridge (3 span)
220.86	Upper Gunn Creek	Box culverts (6 cell)
231.20	Gunn Creek	Pipe culverts (25 cell) Box culverts (13 cell)
242.53	Verbena Creek	Bridge (3 span)
244.49	Serpentine Creek	Box culverts (12 cell)
271.06 - 273.37	Suttor River (Lower)	Bridge (55 span) Box culverts (18 cell)

Catchments smaller than 25 km^2 are considered to be minor catchments, catchments between 25 km^2 and100 km^2 are considered moderate catchments and catchments larger than 100 km^2 are considered major catchments.

Indicative concept design drawings of drainage structures are provided in Volume 2 Appendix T Concept design drawings.

7.2.2.15 Longitudinal drainage

In areas along the final rail corridor where multiple drainage lines are clustered together, it may be practical to link these by means of longitudinal drainage on the upstream side. The proposed longitudinal drainage will combine flows and direct them through an appropriately sized cross drainage structure. Where the final rail corridor passes through significant cuts, longitudinal drainage may also be required to convey overland flow to the next viable cross drainage structure (for example, at the top and toe of batters). Longitudinal drainage will continue to be developed and refined during detailed design.

7.2.2.16 Corridor fencing

The entire NGBR Project final rail corridor will be fenced, due to the concentration of stock on adjacent properties. Livestock-type fencing will typically comprise of four strand barbed wire, however fencing design will be finalised in consultation with landholders. Consideration will be given to the use of ‘spear gates’ (i.e. non-lethal exit-only gates) or similar mechanisms that allow for stock to escape the rail corridor. Security fencing will also be provided around the construction depots, construction yards, construction camps, construction laydown areas and the rolling stock maintenance depot.

7.2.2.17 Signalling and communications

The signalling and communications system will be rolled out gradually via a staged approach through construction and operation of the NGBR Project. During construction, a communications backbone of underground cables (optical fibre) will be laid. The communications backbone will facilitate communication during construction and operation. Main signalling control will be operated out of the Adani office, based in Brisbane, Queensland.

7.2.2.18 Rolling stock maintenance depot

The NGBR Project includes a rolling stock maintenance depot (178.22 ha) located between chainage 26.8 km and chainage 34 km. The depot will include the following components:

- Train test and examination area – for servicing and repairs
- Two locomotive maintenance areas – for fuelling and under body maintenance
- Wagon maintenance area – for wagon repair
- Warehouse and storage area – for component storage
- Diesel storage area – for storage of diesel for locomotive refuelling; 10 diesel storage tanks of approximately 264,150 litre total capacity
- Hazardous and dangerous chemicals storage area – for storage of oil, lubricants, cleaning goods and so forth
- Mobile equipment storage area – for storage of heavy vehicles and equipment
- Train washing area – for washing of locomotives and wagons
- Water storage area – for storage of 300,000 litres of rainwater for potable uses, and storage of one million litres of stormwater for train washing
- Rainwater treatment area – for treatment of rainwater and stormwater for their respective uses
- Administrative facilities, parking and security.

7.2.2.19 Rolling stock

The locomotives and wagons proposed to operate on the NGBR Project, from the Carmichael Project (Mine), are described in Table 7-11.

Table 7-11 Rolling stock specifications

Parameter	Locomotive	Wagon	Full consist
Model	SD70 ACe	Standard gauge	4 locomotives, 240 wagons
Length	22.63 m	16.18 m	3,974 m
Weight (empty)	191 tonne	22 tonne	6,044 tonne
Weight (loaded)	191 tonne	130 tonne	31,964 tonne
Axles	6	4	984
Continuous power	3,200 kW	NA	12,800 kW

7.2.3 Pre-construction and construction

7.2.3.1 Overview

Construction of the NGBR Project will occur over four phases. The phases and the activities that make them up are itemised below. Track laying is expected to progress at a rate of 1.8 km per day.

- Phase 1, site preparation – including:
  - Construction camp establishment
  - Temporary drainage construction
  - Clearing and grubbing
  - Topsoil stripping
  - Service removal or treatment
  - Haul roads, access road and laydown construction
  - Installation of water supply infrastructure
  - Fencing (temporary and permanent)
  - Communication cable laying
- Phase 2, drainage structure, earthworks and bridges – including:
  - Drainage construction
  - Cut and fill earthworks
  - Capping layer application
  - Bridge construction
- Phase 3, track laying – including:
  - Welding
  - Track and sleeper laying
  - Ballasting and tamping
- Phase 4, signal and communications – including:
  - Installation of signalling equipment
  - Installation of wayside equipment
  - Provision of main signalling control centre.

7.2.3.2 Schedule

Construction of the NGBR Project will be separated across the following construction fronts:

- Front 1, northern section – chainage 3.49 km to chainage 95 km
- Front 2, central section – chainage 95 km to chainage 205 km
- Front 3, southern section – chainage 205 km to chainage 306.9 km.

The schedule for construction of the NGBR Project is summarised in Table 7-12. Timing of activities may differ considerably from front to front, due to varying constraints. The schedule for construction of the NGBR Project is preliminary and will continue to be refined during detailed design.

Table 7-12 Construction schedule

Phase	Timeframe (estimated)
Phase 1, site preparation	Late 2014 – 2nd quarter 2015
Phase 2, drainage structure, earthworks and bridges	4th quarter 2014 – 1st quarter 2016
Phase 3, track laying	4th quarter 2015 – 3rd quarter 2016
Phase 4, signalling and communications	3rd quarter 2016 – 4th quarter 2016

Construction will generally take place during daytime working hours (6 am to 7 pm). Night-time construction works may include those that will be inhibited during daytime working hours, such as:

- Embankment moisture conditioning
- Work within an operational rail corridor
- Road works where required to avoid peak traffic
- Materials delivery by oversize vehicles.

Other night-time construction works may be undertaken where they can be conducted safely and have limitd noise and light impacts on sensitive receptors, such as:

- Welding to support track construction
- Concrete casting
- Utilities adjustment
- Investigations or testing.

7.2.3.3 Construction workforce

An estimate of the yearly peak workforce numbers (full-time equivalent) for each year of construction is provided in Table 7-13.

Table 7-13 Peak workforce

	2014	2015	2016
Total	775	1,700	785

The majority of the construction workforce (approximately 80 per cent) will fly-in-fly-out from somewhere on the east coast of Australia, to regional airports in Townsville, Moranbah, Mackay, Emerald or Bowen. From these locations, the workforce will be transferred to any of the five construction camps by bus.

Some labour may be sourced from regional townships in the vicinity of the NGBR Project. Workforce local to these regional townships (approximately 20 per cent) may drive-in-drive-out individually or by a group bus arrangement, to minimise traffic generation.

Once accommodated at a construction camp, the construction workforce will be transported to and from work sites by four-wheel drive or bus.

7.2.3.4 Construction water

The NGBR Project will require water to support construction. A construction water supply strategy was prepared for the NGBR Project (refer Volume 2 Appendix H3 Construction water supply strategy (page 78)). Water requirements for the construction of the NGBR Project include potable water and water compliant with AS 1379-2007 Specification and supply of concrete. The water supply strategy identified the following water requirements during construction:

- Cut and fill earthworks – approximately 4,273 mega litres of raw water, over the two year construction period
- Concrete batch plant – 52,000 litres of AS 1379 compliant water per plant per day
- Construction camps 1, 2, 3, 4 and 5:
  - 60,000 litres per camp per day
- Construction depot – approximately 1.6 mega litres per day.

A preliminary estimate of additional construction water requirements for activities such as dust suppression and material conditioning has also been undertaken and includes:

- Clearing – 60,000 litres per day
- Topsoil – 203 litres per m^3
- Haul road construction – 250,000 litres per section per day
- Haul road maintenance – 200,000 litres per section per day
- Imported quarry or borrow material – 119 litres per m^3
- Weed hygiene and management.

Water supply during construction will be achieved utilising the proposed NGBR Project water supply infrastructure (refer Volume 2 Appendix H3 Construction water supply strategy (page 119)). Potable water may be sourced from regional townships and transported to the construction site by road train where it is not feasible to treat and supply from non-potable sources.

7.2.3.5 Plant and equipment

The indicative make and model of general construction plant and equipment required during construction is listed below.

- Cut and fill earthworks:
  - D10 dozers

  - D11 dozers
  - 651 open bowl scrapers
  - 631 open bowl scrapers
  - 623 elevating scrapers
  - 825 compactors
  - 16 G Graders
  - 30,000 L water carts
  - 85 tonne excavator
  - 740 rear dump trucks
  - side tippers
- Drainage construction:
  - 30 tonne excavators
  - 60 tonne rough terrain hydraulic cranes
  - 20 tonne rough terrain Franna type cranes
  - front end loaders / backhoes
  - 20,000 L water carts
  - 10 tonne self-propelled pad-foot rollers
  - miscellaneous small hand held compaction equipment
- Capping layer application:
  - 140 G Graders (will have machine control)
  - 825 compactors
  - paving machines
  - 15 tonne vibrating smooth drum rollers
  - 20,000 litre water carts
- Bridge construction:
  - 160 / 220 Tonne hydraulic cranes
  - 20 tonne rough terrain Franna type crane
  - rough terrain tele-hoist with forklift attachments
  - 30 tonne excavator (part time)
  - 950 front end loader
  - 10 tonne self-propelled pad-foot roller
  - Front end loader/backhoe
  - 20,000 litre water carts
- haul road and access road maintenance:
  - 140 G grader
  - 30,000 L water carts x 4
  - 30 tonne excavator
- track laying:
  - Plasser K355-ZW flash butt welder
  - Plasser / Harsco / Holland mobile flash butt welder

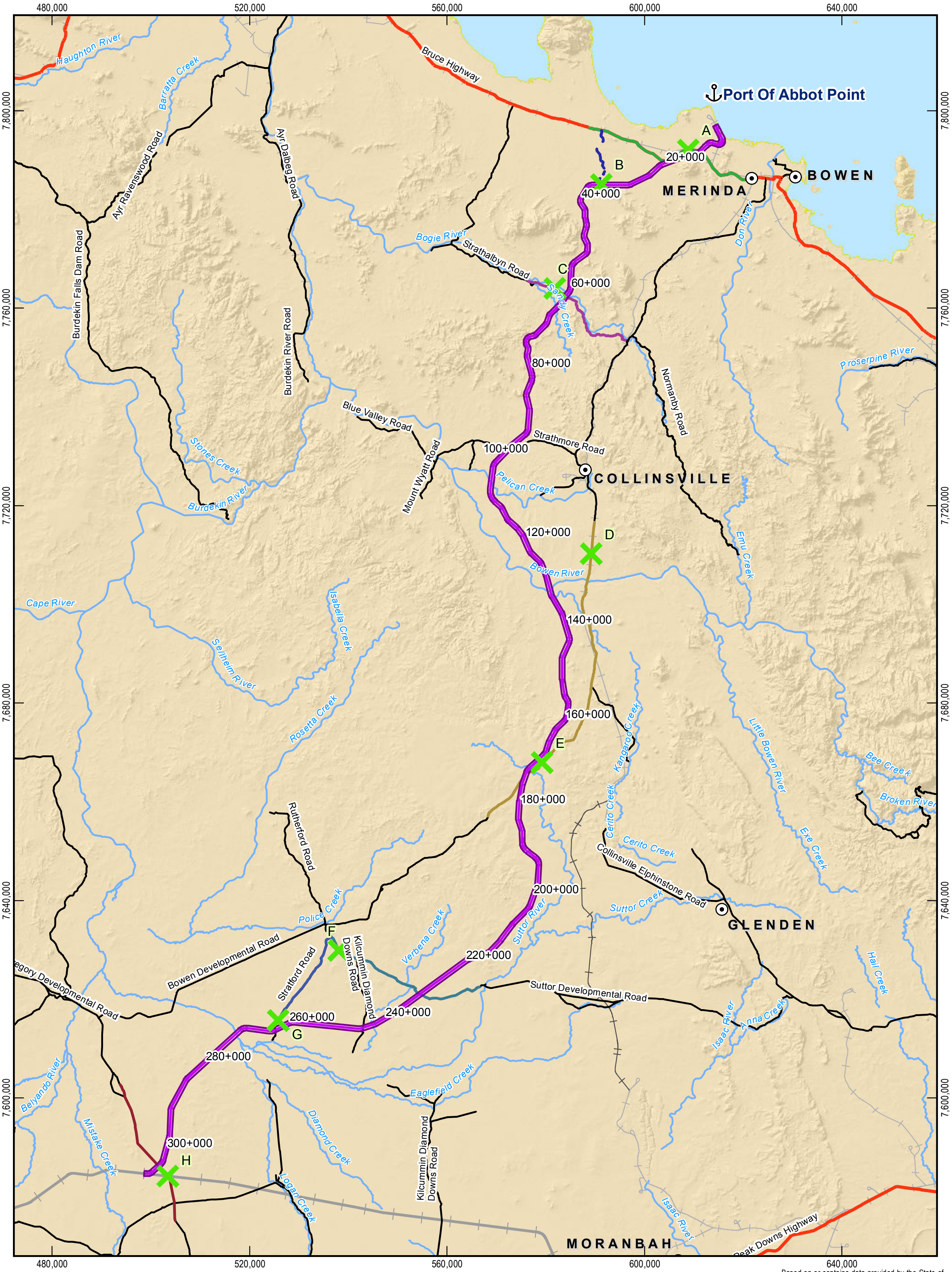
- Harsco New Track Construction tracklaying machine
- CAT 954 Track excavator
- Plasser 09-3X main line tamper
- track lifter
- UNIMAT 04-27C main line tamper
- Plasser 08-16H switch tamper
- SSP305 regulator
- JBR -10 regulator
- Harsco sleeper gantry
- Ballast wagons and locomotives
- Portal cranes and rollers
- Cat 988H loaders
- 16T track excavator
- Volvo 120F loaders
- Octopus attachment for excavator.

7.2.3.6 Construction traffic

The construction of the NGBR Project will generate additional heavy and light vehicle traffic on the external road network. Key approach roads to be used by the NGBR Project are:

- Bruce Highway, approaching chainage 14 km
- Glenore Road, approaching chainage 34 km
- Strathalbyn Road, approaching chainage 64 km
- Bowen Developmental Road, approaching chainage 120 km and 170 km
- Suttor Developmental Road, approaching chainage 230 km
- Stratford Road, approaching chainage 262 km
- Gregory Developmental Road, approaching chainage 305 km.

Key access roads and intersections with the NGBR Project are depicted in Figure 7-7.



LEGEND

Population Centres	Highway	Bruce Highway	Strathalbyn Road	Watercourses (Major)
Major Port	Main Road	Glenore Road	Suttor Developmental Road	North Galilee Basin Rail 1000m Corridor
	Key Roads	Gregory Developmental Road	Carmichael Project (Rail)	
Key Intersections	Bowen Developmental Road	Stratford Road	Existing/Other Rail Network	North Galilee Basin Rail 100m Corridor

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Adani Mining Pty Ltd
North Galilee Basin Rail Project

Job Number	41-26457
Revision	B
Date	26 Sep 2013

Key access roads

Figure 7-7

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Level 9, 145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2013, Chainage/2013;
DNRM: Roads/2010; GHD: Study Intersections/2013. Created by:MS

7.2.3.7 Construction materials

Indicative quantities of construction materials required for the formation and rail line are provided in Table 7-14.

Table 7-14 Construction materials

Material	Quantity	Unit
Imported fill	310,000	m^3
Structural fill	1,960,000	m^3
Capping material*	700,000	m^3
Concrete	55,000	m^3
Ballast*	650,000	m^3
Sleepers	580,000	no.
Rail lengths (25 m)	30,000	no.
Long welded rail lengths (300 m)	2,500	no.

* denotes material proposed to be sourced from quarry and borrow locations as discussed in Section 7.2.2

7.2.3.8 Cut and fill earthworks

Despite the adherence of the NGBR Project to the natural ground profile where practicable, significant cut and fill activities will be required to maintain ruling gradients and flood resilience. The majority of significant cut and fill operations will be concentrated around the Leichhardt Range and Clarke Range due to the high relief of these areas.

The NGBR Project is expected to include areas of unbalanced earthworks (cut not equal to fill), including the coastal plains at Abbot Point, and flood plains associated with the Bowen River and Suttor River. Potential quarry and borrow areas have been identified to supplement the fill requirement (refer Figure 7-6).

Deep cuts (>15 m depth) and deep fills (>15 m depth) will occur over a relatively small portion of the alignment. The need for deep cuts has been identified at nine discrete locations and the need for deep fills has been identified at 11 discrete locations. Significant cut and fill operations such as these will be concentrated around the Leichhardt Range and Clarke Range.

Cut and fill treatments will continue to be refined during detailed design and with the availability of more detailed geotechnical field data. The predicted earthwork volumes are expected to reduce significantly.

7.2.3.9 Construction of watercourse crossings

The final rail corridor will intersect a number of regional surface water features and smaller ephemeral streams. The major waterway and bridge structure crossings along the preliminary investigation corridor are listed in Table 7-10. The preliminary investigation corridor with respect to major watercourses and catchments is shown in Figure 7-4.

During construction, temporary structures in watercourses will be required which have the potential to impact surface water flow and hydrology. Temporary structures may include culvert causeways for construction access roads and coffer dams for the construction of bridge piers and cross drainage culverts. The application of coffer dams will be limited and will only be used where dry river bed construction methodology is not an option. The impact of temporary structures in waterways has the potential to alter channel flow velocities causing bed and bank disturbances. A total of 196 watercourses along the final rail corridor have been identified as requiring cross drainage structures.

All temporary waterway barriers (including partial barriers) required during construction will be designed in accordance with the Fisheries Act 1994 and *Sustainable Planning Act 2009* (refer Volume 1 Chapter 20 Legislation and approvals and Volume 1 Chapter 6 Nature conservation).

At the completion of construction works within the waterway, the in-stream barrier will be removed and the waterway bed and banks returned to their original profile and stability so that channel morphology and surface water flow at the site is not compromised once the temporary barrier is removed.

Existing disturbed areas will be utilised to access waterways and construction of waterway crossings will be scheduled during dry or low flow periods. The route used by machinery in and out of the work sites on waterways will be controlled and the need for access of heavy machinery to the bed of the waterways will be avoided. Works will be undertaken from the top of waterway banks where possible.

Additional hydrology and hydraulic modelling will be undertaken during detailed design to refine bridge design, culvert design and afflux values. Causeways and other temporary drainage structures will be designed to provide sufficient hydraulic capacity such that there is minimal increase in velocity of natural flows.

Further investigation into scour protection to determine the appropriate depth of cover or scour protection required at each crossing and the appropriate permanent scour protection measures provided for abutments, piers, culverts, inlets and outlets.

Water quality during construction will be managed through a Water Quality Management Plan and upstream/downstream water quality monitoring (refer Section 7.14.3).

7.2.4 Operation

The operation of the NGBR Project is expected to commence in 2016 and reach peak capacity of 100 mtpa by 2026. The ramp-up to peak capacity is shown in Table 7-15. Rail and rolling stock maintenance activities will be required throughout operation.

Table 7-15 Capacity ramp up

Year	Capacity (mtpa)
2016	4
2017	20
2018	30
2019	40
2020	50

Year	Capacity (mtpa)
2021	60
2022	70
2023	80
2024	90
2025	95
2026	100

7.2.4.1 Rolling stock

The utilisation of the capacity of the NGBR Project will reflect the production of coal from the Carmichael Project (Mine) and utilisation by third-party users. The number of full consists and train paths per day in the ramp-up to full production was estimated by static modelling of the NGBR Project rail system (Aarvee Associates 2013), the output of which is shown in Table 7-16.

Each train path in Table 7-16 comprises one loaded movement and one unloaded movement (i.e. one return trip). Therefore, at full capacity (100 mtpa) the following will occur daily:

- Nine loaded train movements (day)
- Nine unloaded trains movements (day)
- Five loaded train movements (night)
- Five unloaded train movements (night).

Unloaded trains will travel at up to 100 km per hour and loaded trains will travel at up to 80 km per hour. Within passing loops and maintenance sidings, trains will slow to 50 km per hour and 25 km per hour respective to each location.

Table 7-16 Rolling stock requirement

Capacity (mtpa)	Full consists	Train paths per day (two-way journeys)
12.5	2	1.77
25	4	3.55
30	5	4.26
50	8	7.09
60	10	8.51
100	16	14.18

7.2.4.2 Operational workforce

An estimate of the yearly peak workforce numbers (full-time equivalent) for each year of construction is provided in Table 7-17. This workforce will be accommodated alternately at Bowen and the Carmichael Project (Mine) camp while off-shift and on-shift respectively.

The size of the operational workforce required at any time will vary depending on the number of trains in operation. It is expected that 10 train crew members per train will be required. Up to 15 crew members per train may be necessary where trains are few in the early phase of operation.

It is anticipated that the majority of the operational workforce will be based out of Bowen, with overnight accommodation provided at the Carmichael Project (Mine) camp for changes in shift. A small number of drivers may be based at the yards and provisioning facilities.

Cycle times show that crews working the loaded trains will work a 12 hour shift, with change-overs occurring at the mine-end and port-end respectively.

Table 7-17 Operational workforce requirements

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Total	66	103	141	173	209	254	315	327	350	361	369

7.2.4.3 Maintenance

Maintenance activities throughout operation include the following:

- Rolling stock maintenance, including:
  - Unit train maintenance
  - Block maintenance
- Track maintenance, including:
  - Routine maintenance
  - Major periodic maintenance
  - Emergency response.

There are several anticipated construction legacies that will be utilised for maintenance activities, including:

- Haul and access roads – for repurpose as maintenance access roads, as necessary, and storage of maintenance materials
- Track work at construction depots and maintenance sidings and rail loops – for stabling of track maintenance plant
- Ballast siding at construction depots and construction yard – for reduction and use for storage of maintenance materials, as well as stabling of track maintenance plant
- Passing loop locations – for storage of turnout components by prefabricating panel or complete system on site
- Buildings – for administrative requirements of maintenance teams.

Rolling stock maintenance will be conducted on-track or at the rolling stock maintenance yard. Locomotives can be maintained in situ or replaced by a maintenance spare for more extensive services. Wagons requiring wheel repairs will be hydro-lifted in situ to maximize asset utilisation.

Locomotives and wagons that cannot be maintained during unit train maintenance will be shunted-off for shed servicing.

Block maintenance will be conducted at the rolling stock maintenance depot. Trains entering the rolling stock maintenance depot for block maintenance will attach to a lead block of 40 wagons and a locomotive at the outgoing departure signal. After attaching at the lead, a rail vehicle placer will haul the blocks of 40 wagons and a locomotive back and place in maintenance arrival lines. Wagons previously placed on the entry side of the wagon repair lines will progress along the line after receiving scheduled attention and repairs. Up to 40 wagons will be held on the wagon repair exit lines after maintenance is complete. After block maintenance, a locomotive and 40 wagons will be placed ready for the next scheduled block change-out attachment.

The rolling stock maintenance depot will require 105,000 L of water per month for train washing, plus 150,000 L of potable water. Water demand at the rolling stock maintenance depot will be met by capturing and treating rainwater. Prior to use, rain water will be treated by removal of solids, oil separation, disinfection, filtration and chlorine dosing. Runoff from wash-down activities will be captured and treated for use by the same process.

The primary on-going track maintenance activities will include:

- Track inspections and repairs
- Signal compliance and operations checks
- Structures inspections and repairs (both bridge and drainage)
- Turnout maintenance
- Minor faults and defect repair works
- First contact emergency response.

The primary major periodic maintenance activities include:

- Structures cleaning and repairs
- Drainage works
- Re-railing
- Turnout replacement
- Rail grinding
- Resurfacing
- Rail stress management
- Re-ballasting

Emergency response activities will be governed by an emergency management plan. A preliminary emergency management plan has been developed for the NGBR Project and is included in Volume 2 Appendix P Environmental management plan framework (page 22). The emergency management plan imposes the following emergency requirements for emergency preparedness:

- Safety in design, under the Queensland *Work Health and Safety Act 2011*
- Fire safety, achieved through a fire management sub-plan
- Contractor emergency sub-plan, to respond to accidents involving contractors

- Emergency specific plans, including
  - Vehicle accident response
  - Spill response
  - Train derailment or collision response
  - Natural hazard response.

The emergency management plan also defines an emergency response team, necessary equipment and training measures, all required to reliably implement the plan.

7.2.5 Decommissioning and rehabilitation

As far as practicable, material cleared during construction will be chipped, mulched and stockpiled for reuse during rehabilitation. Materials with special habitat value, such as hollow bearing logs or trees, will be selectively removed for reuse during rehabilitation, or placed in nearby bushland. Topsoil will be stockpiled for future use in rehabilitation.

A decommissioning and rehabilitation management plan will be developed for areas temporarily disturbed during construction. These areas include:

- Construction camps
- Borrow areas
- Stockpiles
- Haul roads and access roads
- Turkey nest dams
- Laydown areas
- Turning circles
- Temporary work platforms.

Temporary construction infrastructure will be decommissioned as soon as they cease to serve their intended purpose. It is noted that some haul roads and access roads will be repurposed as permanent maintenance roads. Turkey nest dams and water supply bores may also be retained, subject to consultation with landholders.

The decommissioning and rehabilitation management plan for temporarily disturbed areas during construction will include landform design and completion criteria. Specific rehabilitation measures include:

- Removal of potentially hazardous stored substances
- Reuse, recycling or disposal option for removal facilities, structure and materials
- Remediation of any contaminated areas
- Regrading of landscape to a state consistent with natural environment
- Ripping of compacted areas
- Application of topsoil and revegetation with native species
- Application of materials with special habitat value, such as hollow bearing logs or trees
- Creation of supplementary habitats, such as nesting boxing, where necessary
- Weed control during reestablishment of vegetation

- Monitoring and other checks will be undertaken to confirm that completion criteria are met. These measures will be detailed in the decommissioning and rehabilitation management plan and will include: Hazardous material and contamination audit
- Monitoring and comparison with analogue site
- Certification by appropriately qualified person.

Further decommissioning activities will occur at the end of the 90 year life of the NGBR Project. End of life decommissioning and rehabilitation will be planned and refined throughout the life of the NGBR Project and incorporated into the decommissioning and rehabilitation plan. This will enable compliance with any legislated requirements closer to the time of intended end-of-life decommissioning.

7.3 Assessment of alternatives

7.3.1 Project concept

There are currently no developed options for the direct transportation of product coal out of the Galilee Basin. Aurizon's Goonyella and Newlands systems have capacity constraints and limited options for upgrade due to the existing low axle load narrow gauge rail infrastructure and the bottleneck that exists at the Moranbah junction. In addition, there are currently no rail lines connecting either of these Aurizon rail systems to the vast Galilee Basin coal reserves.

The proposed Carmichael Coal Mine and Rail Project includes a 120 km portion of dual gauge rail that will run west to east from the mine site to Diamond Creek, and a 69 km narrow gauge portion that will run east from Diamond Creek and connect to the Goonyella rail system south of Moranbah. This will enable carriage of product coal over the existing narrow gauge networks either directly to the Port of Hay Point (Dudgeon Point Expansion) or indirectly to the Port of Abbot Point. As such, the Carmichael Project rail infrastructure offers a short-term incremental solution that maintains port optionality, but is primarily only a medium- to long-term solution for export directly to Dudgeon Point.

Dual port capability for the export of coal is required by Adani to insure against potential force majeure conditions that may affect one of the mine-to-port supply chain routes. In addition, dual port capability will help to accommodate any future production increases from Adani and/or third-party mines in the Galilee Basin, which may exceed the capacity of one port. Given Adani's interests in the existing and proposed export facilities at the Port of Abbot Point, a highly efficient, long-term and more direct transport route to the port was identified as a key business requirement.

A high-level desktop assessment and analysis was undertaken to identify possible south to north rail alignments branching off the Carmichael Project rail infrastructure heading to the Port of Abbot Point. The assessment and analysis included consideration of environmental, hydrological, geotechnical and engineering constraints including:

- River and waterway crossings
- Topography and landforms
- Threatened ecological communities and regional ecosystems (in particular endangered and of concern regional ecosystems), high value regrowth vegetation and essential habitat

- Other existing infrastructure including homesteads and settlements, mining and exploration lease and permit boundaries, coal resource areas, roads, power lines and pipelines
- Strategic cropping land.

The preferred option is the development of the NGBR Project, as described in Section 7.2.2, which comprises the construction and operation of approximately 300 km of standard gauge railway connecting the proposed Carmichael Project rail infrastructure (near Mistake Creek) directly with supporting infrastructure (including rail loop/s and port infrastructure, the subject of separate investigations) at the Port of Abbot Point. This preferred option will facilitate transport of up to 100 mtpa product coal directly to the Port of Abbot Point.

7.3.2 Co-location and co-use

Adani have investigated various other options for routing a rail corridor to the Port of Abbot Point using co-location and/or co-use.

As outlined in Section 7.3.1, the proposed Carmichael Project, while enabling direct transportation of coal to the Port of Hay Point (Dudgeon Point expansion), only allows for indirect transportation to the Port of Abbot Point via the already constrained Goonyella rail system. As well as being indirect, the Goonyella system has a much lower axle load with very limited capacity for upgrade, all of which combined will act to increase coal prices and reduce the cost-competitiveness of Galilee Basin coal in the global market.

Adani has considered developing and / or utilising a consolidated corridor with Waratah Coal's proposed China First Project, however, due to uncertain timeframes and the identification of a more favourable and technically better route, opportunities for co-use and / or co-alignment with the China First Project are limited. Adani has also previously considered co-utilising a consolidated corridor with Hancock Coal Infrastructure's proposed Alpha Coal Project (Alpha) however, with the railway's 60 mtpa capacity already fully allocated, uncertain development timeframes and a route that traverses large flood plains, the potential for co-use of the railway is limited.

Aurizon is seeking to develop an integrated rail system to service existing and proposed coal mines in the Galilee Basin. The proposed Central Queensland Integrated Rail Project alignment is a narrow gauge solution connecting to already congested and less scalable network on the Newlands system. Moreover, the proposed Central Queensland Integrated Rail is a much longer, and therefore less cost-effective, route to the Port of Abbot Point, besides being an operationally less efficient narrow gauge system as compared to the heavy haul standard gauge NGBR Project. Opportunities to consolidate the Aurizon and Adani alignments have been explored, however, due to uncertainty with regard to Aurizon's development timelines, in addition to the above technical aspects, Adani has decided to propose the much shorter, standard gauge, NGBR Project.

The NGBR Project does offer the opportunity to provide a co-use outcome for the China Stone Coal Project located north of the proposed Carmichael Coal Mine.

7.3.3 Corridor selection

The NGBR Project final rail corridor was determined through a corridor selection study and multi-criteria analysis (Worley Parsons 2013) which aimed to minimise environmental and social impacts. The geographical study area was defined by the proposed Carmichael Coal Mine to the south and west, Abbot Point to the north and Moranbah to the east. The corridor selection study considered the following aspects:

- Topography
- Geology
- Hydrology
- Environment
- Railway operation
- Existing infrastructure.

A number of ‘no go’ zones relating to national parks, extreme topographical features, major floodplains and social centres were defined and, through the initial corridor assessment, eight potential corridors were identified. A multi-criteria analysis was then applied to consistently and objectively assess the various attributes of each corridor.

The environmental constraints that were considered during selection of the preferred rail corridor study included mapped TECs and referrable wetlands (which are defined in accordance with State Planning Policy 4/11 as wetlands of high ecological significance within Great Barrier Reef catchments), in addition to other environmental values that are not MNES. As all of the potential rail corridors terminate at the Port of Abbot Point, the GBRWHA, GBRNHP, GBRMP and Commonwealth marine area (CMA) were not specifically included within the multi-criteria analysis as they will not differentiate between options.

Figure 7-8 illustrates the mapped TECs along the eight corridors that were assessed in the multi-criteria analysis and Figure 7-9 illustrates the referrable wetlands. All of the potential corridors will require some level of disturbance to both mapped TECs and referrable wetlands, as outlined in Table 7-18.

Table 7-18 Assessment of environmental constraints

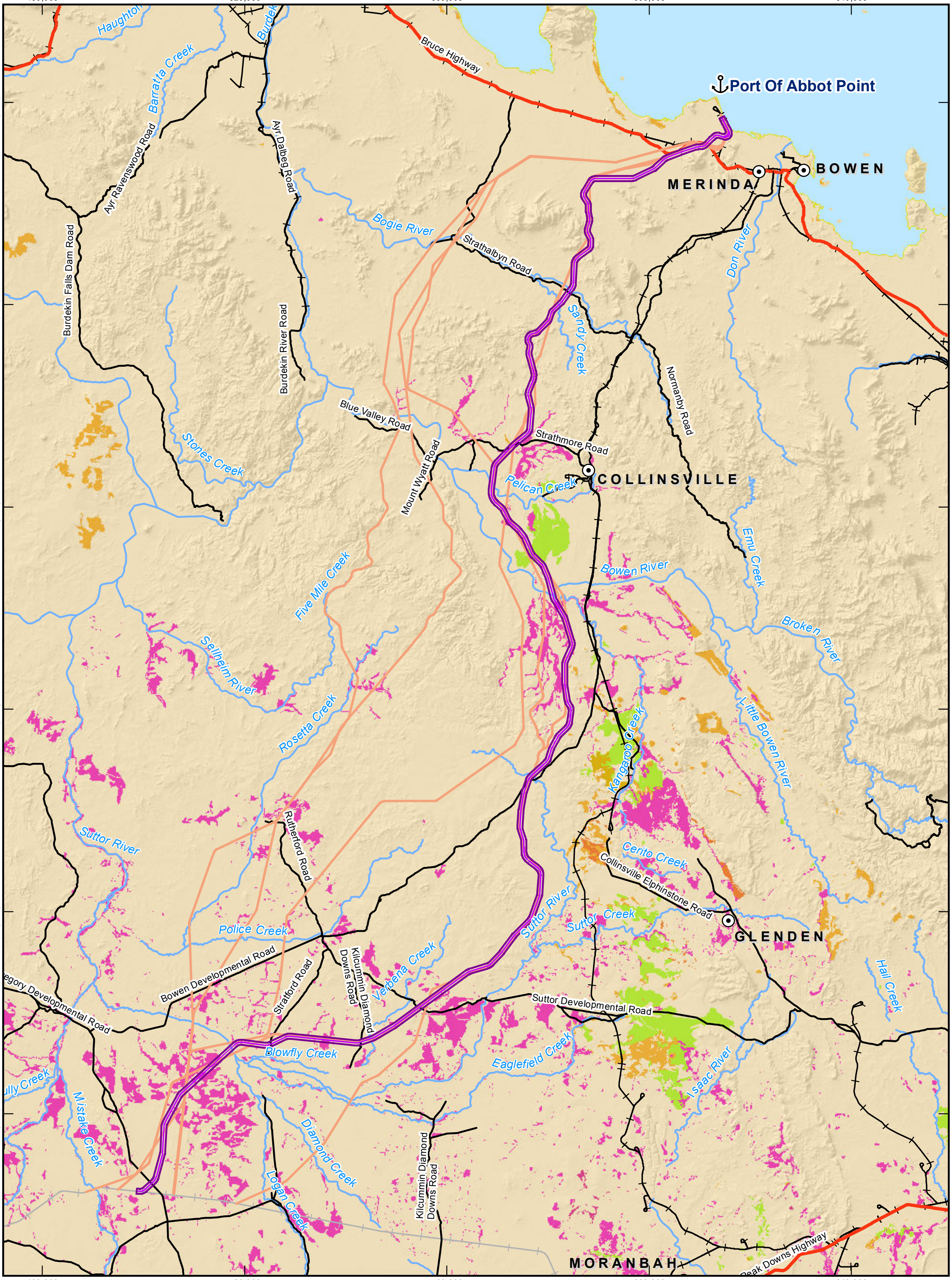
Constraint area	Distance (km) traversed by corridor option						
	1	2A	3	4	4A	4B	**4C**	5
Threatened ecological community	27.63	33.77	26.44	43.46	39.84	32.89	**31.81**	27.51
Referrable wetland	19.78	15.3	20.18	18.98	16.24	16.95	**17.19**	25.68

The multi-criteria analysis recommended Option 4C as the preferred corridor. Option 4C ranked fourth preferred for both TECs and referrable wetlands; no other corridor option was ranked higher when taking into consideration both of these constraints. Corridor Option 4C was refined to the preliminary investigation corridor (a nominally 1,000 m wide corridor for further engineering and environmental investigations) and subsequently to the final rail corridor through concept level engineering and design work undertaken by Aarvee Associates (refer Figure 7-8).

Investigations for the purposes of the EIS and ongoing engineering design, including field surveys, were generally undertaken over the preliminary investigation corridor (or broader areas, as required by individual studies) to ensure a robust assessment and to allow for potential future design changes to be adequately considered.

7.3.4 Do nothing scenario

The development of the NGBR Project will provide a direct link between the Galilee Basin's vast thermal coal resources to the Port of Abbot Point. The 'do nothing' option will result in increased traffic on Aurizon's Goonyella and Newlands rail systems and thus increase the bottleneck situation currently being experienced on the existing rail system near Moranbah. This will subsequently result in the need for upgrades to large sections of each rail line and result in social and environmental disturbances. The transportation of such a large quantity of coal over the much longer narrow gauge route will increase costs of producing the thermal coal, which in turn will reduce the cost-competitiveness of Galilee Basin coal in the global market.



LEGEND

- Population Centres
- Major Port
- Alternative Options
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourse (Major)
- Semi-evergreen Vine Thickets of the Brigalow Belt Bioregions (North and South)
- Brigalow (*Acacia harpophylla* dominant and co-dominant)
- Natural Grasslands of the Queensland Central Highlands and the Northern Fitzroy Basin
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:1,100,000 Paper Size A4

0 10 20 40

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Adani Mining Pty Ltd
North Galilee Basin Rail Project

Corridor identification study – mapped TECs

Job Number	41-26457
Revision	A
Date	27 Sep 2013

Figure 7-8

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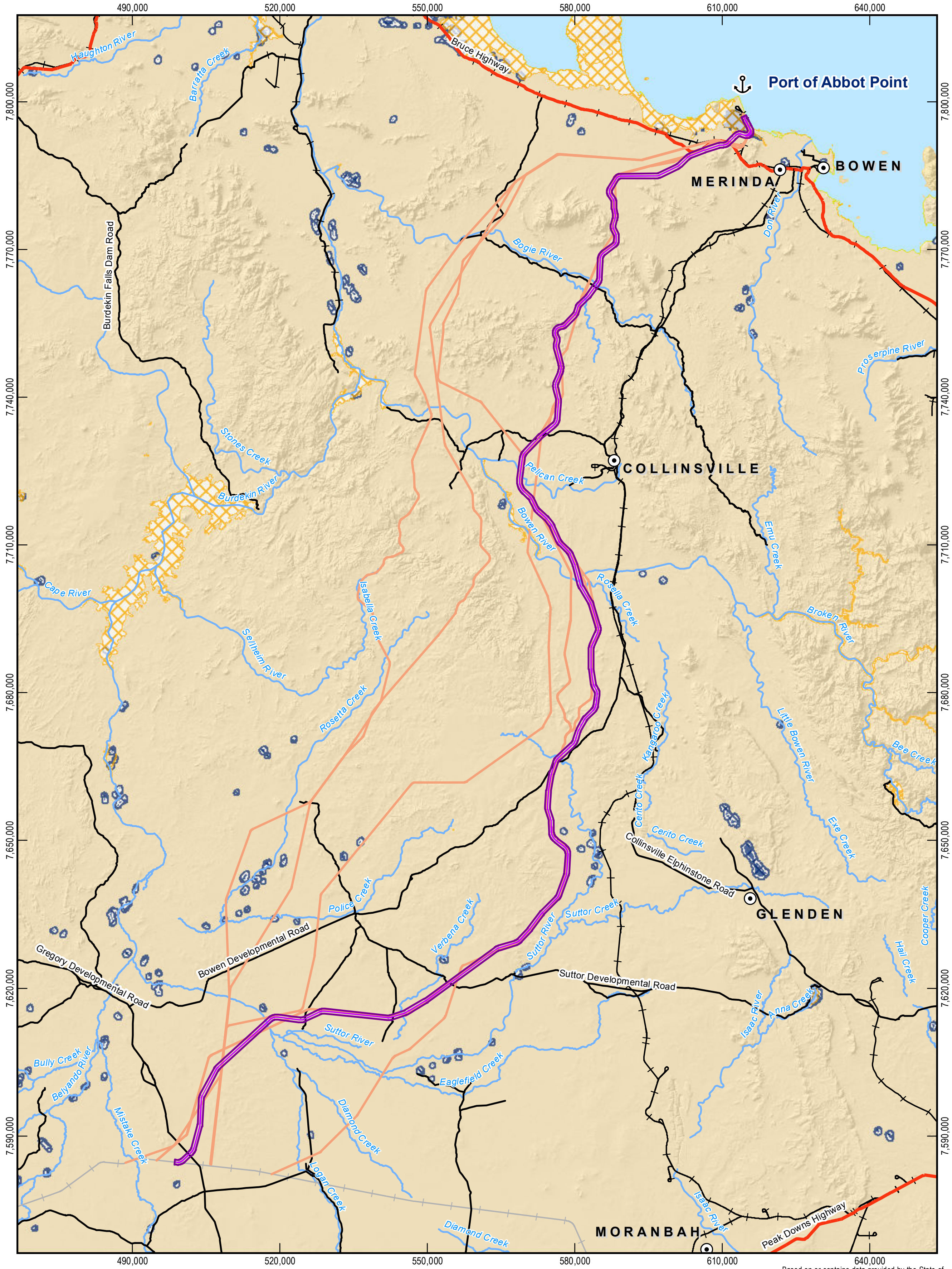
Level 9, 145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012, NGBR Alternative Options/2013; DNRM: Roads/2010, TEC/2011. Created by: AJ



LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- Directory of Important Wetlands
- Wetland Protection Area
- Wetland Protection Area Trigger
- Alternative Options
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:1,100,000 Paper Size A4
0 7.5 15 30
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Adani Mining Pty Ltd
North Galilee Basin Rail Project

Corridor identification study
- referrable wetlands

Job Number	41-26457
Revision	A
Date	27 Sep 2013

Figure 7-9

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145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012, NGBR Alternative Options/2013; DNRM: Roads/2010, Wetland Protection Area/2011, DOIW/2010. Created by:MS

7.4 Methodology

Desktop assessment and field surveys were conducted to assess the existing MNES values of the preliminary investigation corridor and wider study area. Steps in the methodology included:

- Review of existing studies and available data relevant to MNES within the study area
- Undertake field survey and inspection of numerous representative sites
- Describe the potential MNES values of the NGBR Project preliminary investigation corridor and, where their presence is uncertain, assign a likelihood of their occurrence
- Describe the potential MNES values within a wider study area and, where their presence is uncertain, assign a likelihood of their occurrence
- Define the potential direct (nominal 100 m final rail corridor) and indirect (wider study area) impacts associated with the NGBR Project
- Identify appropriate avoidance, mitigation and management measures to minimise potential impacts
- Assess the significance of residual impacts on MNES in accordance with the EPBC Act Matters of National Environmental Significance Significant Impact Guidelines 1.1 (DEWHA 2009, hereafter referred to as the Significant Impact Guidelines).

7.4.1 Study area

A hierarchical categorisation of the landscape was taken to understand MNES and identify potential impacts. Consequently, the study area for the MNES assessment is discussed at three levels:

- The NGBR Project preliminary investigation corridor is approximately 300 km in length and nominally 1,000 m in width
- The broader landscape is referred to as the wider study area and includes areas directly adjacent to the preliminary investigation corridor as well as areas further downstream that have an indirect hydrological connection to the preliminary investigation corridor
- The NGBR Project footprint, consisting of a nominal 100 m wide final rail corridor and ancillary infrastructure (both temporary and permanent) which was used for calculating vegetation (habitat) clearing impacts (i.e. direct impacts)(refer Figure 7-3).

Where the NGBR Project connects with the Adani Terminal 0 balloon loop at the Port of Abbot Point, full identification and description of the existing environment has not been undertaken as part of the NGBR Project. Values associated with the balloon loop, including the coal dumping station for unloading coal trains, increased shipping movement and the surrounding landscape/seascape, is being assessed as part of the Terminal 0 project (EPBC 2011/6194).

7.4.2 Desktop assessment

A desktop assessment sourcing existing information enabled initial characterisation of the environmental values of the preliminary investigation corridor and surrounding landscape. This provided an understanding of the regional diversity in these values and assisted in identifying the key values of conservation significance that may be of relevance to the preliminary investigation corridor. The desktop assessment also provided a basis for the development of a field methodology targeting the potential MNES values within or of relevance to the preliminary investigation corridor. For the purposes of the desktop database queries, an additional 10 km buffer was added to the preliminary investigation corridor, in order to capture all ecological information of potential relevance to the NGBR Project. This desktop assessment involved searching publicly available sources for information on the ecological values of the preliminary investigation corridor. Historical records from the area were used to supplement findings from the field investigation. A list of these sources is presented in Table 7-19 with information on the nature of the source and any known limitations to its use.

Table 7-19 Data sources utilised

Source and name (alphabetical)	Description of information source	Database/mapping search extent (if applicable)	Limitations of use	Relevant information
Abbot Point cumulative impact assessment report *GHD 2012*	Technical studies relating to potential cumulative impacts of development at the Abbot Point State Development Area.	N/A – no search conducted – species lists and other information consulted.	Nil	Technical reports provide information about existing ecological values of Abbot Point State Development Area as determined during previous ecological studies and a cumulative impact assessment for a number of previous projects.
Aquatic Conservation Assessments, using Aquatic Biodiversity Assessment and Mapping Methodology (AquaBAMM), for the Riverine and Non-Riverine Wetlands of the Great Barrier Reef Catchment *Inglis and Howell (2009a); Inglis and Howell (2009b)*	The Aquatic Conservation Assessments (ACAs) focus on the Great Barrier Reef (GBR) catchments. Assessments utilise the aquatic Biodiversity Assessment and Mapping Methodology (AquaBAMM) (Clayton *et al.* 2006), which is a uses available data and expert opinion to identify ecological values within a given catchment.	N/A – no search conducted – species lists and other information consulted.	This publication relies on results based on the opinions of an experienced panel of ecologists, without additional field survey.	Aquatic values identified by a panel of experts for the Burdekin catchment, in which the preliminary investigation corridor occurs.
Bird Atlas data *Birds Australia*	Birds Australia maintains a database of bird sighting records from across Australia.	Two rectangular search extents encompassing the preliminary investigation corridor were provided to Birds Australia for the purposes of searching the Bird Atlas database.	The age and lack of spatial precision of species records limits the accuracy of these records. In addition, these sightings are by Birds Australia members and the general public, whose levels of expertise vary greatly. These records are not confirmed by experts.	These records provide a list of birds previously recorded by Birds Australia in the landscape encompassing the preliminary investigation corridor.

Source and name (alphabetical)	Description of information source	Database/mapping search extent (if applicable)	Limitations of use	Relevant information
Biodiversity planning assessment (BPA) expert panel report and **BPA mapping – Brigalow Belt bioregion** *Department of Environment and Resource Management (DERM) (2008)*	Expert panel reports provide information on the landscape-scale values of bioregions, and in some instances identify bioregional priority taxa. This information is mapped at varying levels of significance (local, regional, state). This mapping utilises Department of Natural Resources and Mines (DNRM) regional ecosystem (RE) mapping in identifying the location and extent of vegetation communities and habitats.	Mapping was obtained for the preliminary investigation corridor and surrounding landscape in an electronic data layer using a Geographic Information System (GIS).	BPA mapping is heavily reliant on regional ecosystem (RE) mapping, which in the Brigalow Belt may not be ground-truthed. Therefore, if the underlying RE polygon on which a BPA map unit is based is incorrect, the BPA map unit may also be incorrect.	BPA expert reports and the associated mapping are primarily terrestrial. They discuss and map corridors and wildlife refugia identified by the expert panel in the preliminary investigation corridor and adjacent areas. This information is used in the report to identify potentially sensitive environmental areas within the preliminary investigation corridor and adjacent areas.
Burdekin NRM Region Back on Track Actions for Biodiversity report *Department of Environment and Resource Management (2010)*	These documents identify priority species in the Burdekin NRM region, detail the regional threatening processes impacting upon these species, and propose a range of actions to address regional threats. Priority taxa are identified through the DERM (2010) 'back on track' species prioritisation framework, in consultation with a range of stakeholders from the region. The documents seek to guide priority species conservation in the respective regions over the period 2010 – 2015.	N/A – no search conducted – species lists and other information consulted.	Some species/impacts listed in this document do not occur in the study area, as the NRM region encompasses the entire Burdekin catchment. This document does not cover species found in other catchments in which the preliminary investigation corridor occurs – the Don, Elliot and Belyando River catchments.	Identifies priority species and threatening processes for these species.
Directory of Important Wetlands *Department of Sustainability, Environment, Water,*	This mapping identifies the location of wetlands that satisfy at least one criterion agreed upon by the Australian and New Zealand Environment and	Line search approximating with the centreline of the rail corridor with a 10 km buffer.	The mapping is now almost 20 years old.	The location of wetlands within the preliminary investigation corridor and adjacent areas listed and mapped as important wetlands under this directory.

Source and name (alphabetical)	Description of information source	Database/mapping search extent (if applicable)	Limitations of use	Relevant information
Population and Communities (SEWPaC, 2011)	Conservation Council (ANZECC) Wetlands Network in 1994. The SEWPaC Protected Matters Search Tool lists nationally important wetlands occurring within or related to prescribed search extents.			
Essential habitat mapping (Version 3) *Department of Natural Resources and Mines (2013)*	Essential habitat is defined as 'vegetation in which a species that is endangered, vulnerable or near threatened under the *Nature Conservation Act 1992* has been known to occur' (DNRM 2013). DNRM maps essential habitat (and essential regrowth habitat) in conjunction with remnant and regrowth vegetation.	Mapping was obtained for the preliminary investigation corridor and surrounding 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.	Essential habitat factors are determined by an expert panel as those basic factors that define essential habitat for a threatened species, and are used to ground truth essential habitat. Essential habitat layers for remnant and regrowth vegetation were investigated to map the location of essential habitat. Essential habitat factors were collected to assist in the understanding of the habitat requirements of threatened species for which these factors have been published.
Freshwater Fishes of North-Eastern Australia *Pusey* et al. *2004*	The text includes the fish species composition of all the rivers in north-eastern Australia. Species are listed for each river basin.	N/A - no search conducted - species lists and other information consulted.	Known distributions of species has been developed using historical through to relatively recent (2004 at time of publication) times, and so may be out-dated. Some species distributions may have been based on anecdotal evidence.	The specific fish communities of the Burdekin and Don River basins were used to determine potential fish communities within or near to the preliminary investigation corridor.

Source and name (alphabetical)	Description of information source	Database/mapping search extent (if applicable)	Limitations of use	Relevant information
Freshwater Fish of Burdekin Dry Tropics Natural Resource Management (NRM) Region *Carter and Tait (2008)*	This report documents the diversity and distribution of freshwater fish species within the Burdekin Dry Tropics NRM Region.	N/A	The sub-catchments covered in this report include many outside the preliminary investigation corridor and only those relevant to the preliminary investigation corridor have been consulted. Species distribution mapping in the report has been developed using pre-2008 data and so may not accurately represent current distribution patterns.	This report was used to assist in determining likely fish communities within the preliminary investigation corridor.
HERBRECS specimen database *Queensland Herbarium, Department of Science, Information Technology, Innovation and the Arts (DSITIA)*	The HERBRECS database catalogues the label and location information from all flora specimens held by the Queensland Herbarium collection.	Two rectangular search extents encompassing the preliminary investigation corridor was provided to the Queensland Herbarium for purposes of searching the HERBRECS database.	This database catalogues records of flora specimens held in the Queensland Herbarium collection – and so is subject to herbarium collection policies and decisions. This means the geographic spread of records may not be indicative of actual on-ground abundance/ occurrence. In some instances the age and lack of spatial precision of species records that pre-date GPS may limit their locational value.	The species list provides an indication of the diversity of flora species, and the previously recorded presence of conservation-significant species in the landscape encompassing the preliminary investigation corridor. Label notes from threatened species provide information and observations on the habitats and locations in which those species have been recorded by previous collectors.
Publically available EIS documents for projects in the region	EIS documents for projects in the region were sourced online: Abbot Point Coal Terminal 0 Project (Draft EIS) (CDM Smith 2013) Carmichael Coal Mine and Rail Project (EIS) (Adani Mining Pty Ltd 2012) Cumulative Impact Assessment (CIA) Migratory Shorebird and	N/A - no search conducted - species lists and other information consulted	The limitations of using these documents are various and are associated with the accuracy of the initial research reported in these reports, and the limitations declared in each document,	Data relating to survey methods and results, in particular the location of threatened species and their habitats, where it relates to the preliminary investigation corridor.

Source and name (alphabetical)	Description of information source	Database/mapping search extent (if applicable)	Limitations of use	Relevant information
	Waterbird Surveys (Biodiversity Assessment and Management (BAAM) Pty Ltd 2012) Caley Valley Wetlands – Baseline Report (BMT WBM 2012) Galilee Coal (Northern Export Facility) Project (Rail) EIS (Waratah Coal Pty Ltd 2011) Alpha Coal Project (Rail) EIS (Hancock Prospecting Pty Ltd 2010) Abbot Point Multi-Cargo Facility EIS (GHD 2010) Water for Bowen EIS (SunWater 2009)			
Queensland Museum data search *Queensland Museum (QM) (2013)*	The Queensland Museum catalogues vertebrate fauna specimen records obtained throughout Queensland.	Two rectangular search extents encompassing the preliminary investigation corridor was provided to Queensland Museum for purposes of search of internal Queensland Museum database.	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.	Results consolidated into single species list to provide an indication of vertebrate fauna species previously recorded in the landscape encompassing the preliminary investigation corridor.

Source and name (alphabetical)	Description of information source	Database/mapping search extent (if applicable)	Limitations of use	Relevant information
Regional ecosystem and regrowth mapping version 6.1 (including the Regional Ecosystem Description Database or REDD) *Queensland Herbarium (2013)*	Mapping of regional ecosystems (vegetation communities) prepared by the Queensland Herbarium, Department of Science, Information Technology, Innovation and the Arts, and held by the Department of Environment and Heritage Protection (DEHP). This includes remnant and regrowth vegetation. The REDD contains the descriptions of the RE units.	Mapping was obtained for the preliminary investigation corridor and surrounding landscape in an electronic data layer for GIS analysis.	Regional ecosystem mapping is primarily based on remote-sensing techniques and is not 100% ground truthed. It is produced at 1:100,000 scale and is not accurate at scales commonly utilised for the location of built infrastructure.	This mapping provides an indication of the potential diversity and location of vegetation communities in the preliminary investigation corridor. RE units as described in the REDD provide an outline of the vegetation communities present in the investigation corridor, their clearing extent and representation in the protection area, and some of the major values of these communities.
Wetland mapping *DEHP (2013)*	Various mapping layers produced by DEHP (including wetland protection areas and wetland management areas).	Mapping obtained for the preliminary investigation corridor and wider study area.	Wetlands are identified using the DEHP AquaBAMM (Clayton *et al.* 2006) which is primarily based on existing literature and expert opinion. Designation does not reveal the relative value of these systems for local flora and fauna. This mapping is most useful in identifying location of wetlands, not in assessing wetland values.	These layers are used to produce maps of the location of wetlands in the preliminary investigation corridor and wider study area.

Note: database searches were undertaken based on the preliminary investigation corridor provided to GHD by Adani. The buffers incorporated into the desktop database queries generally captured ecological information within a 10 km radius of the preliminary investigation corridor.

7.4.3 Field surveys

Field surveys were undertaken during May and June 2013 to provide current, site-specific information on the characteristics and values of the full diversity of terrestrial and aquatic habitats, including those relevant to MNES within the preliminary investigation corridor and wider study area. These surveys identified the characteristics and attributes of habitats, and the diversity and abundance of terrestrial and aquatic flora and fauna species present within the preliminary investigation corridor and wider study area. Based on the desktop assessment, RE mapping and aerial photography were used to provide a broad indication of the diversity and distribution of habitats across the landscape in which the preliminary investigation corridor occurs, and inform the selection of survey sites. Areas featuring remnant vegetation with the potential to support conservation significant species (particularly EPBC Act protected flora and fauna) or communities, and riparian habitats were preferentially targeted, as were those habitats that were more prevalent across the landscape (such as open eucalypt woodlands). Representative data collected for communities and habitats was then extrapolated to those areas not directly accessible during the survey.

In the four months (January 2013 to April 2013) leading up to the May/June field survey, the following rainfall totals were observed (long-term average totals in brackets):

- Bowen: 662 mm (593 mm (1987 to 2013))
- Collinsville: 522.4 mm (438.4 mm (1939 to 2013))
- Moranbah: 445.6 mm (296.3 mm (1972 to 2012)).

Rainfall totals were higher than their corresponding long-term averages due to an increased number of low pressure systems and rain depressions occurring across the region during early 2013. Weather conditions during the May/June field survey were typified by warm to hot temperatures, high humidity and mild to warm nights. Rainfall events occurred in the region prior to and during the May/June 2013 field survey. Average weather conditions during the survey period are summarised below:

- 7 to 11 May: average temperature range: 16.1 °C – 25.6 °C; rainfall: 12.2 mm (data sourced from Moranbah (Station ID 34035))
- 12 to 15 May: average temperature range: 16.3 °C – 27.5 °C; rainfall: 0.6 mm (data sourced from Collinsville (Station ID 33013))
- 16 to 17 May: average temperature range: 18.2 °C – 25.2 °C; rainfall: 26.4 mm (data sourced from Bowen (Station ID 033257))
- 13 to 14 June: average temperature range: 11.1 °C – 25.8 °C; rainfall: 0.2 mm (data sourced from Moranbah (Station ID 34035)).

Weather conditions both preceding and during field surveys were suitable for detecting the presence of targeted flora and fauna species during field surveys.

Field survey effort for threatened species, ecological communities and migratory birds is summarised in Table 7-20 and Table 7-21. Qualifications and experience of the EIS field teams are detailed in Volume 2 Appendix Q.

Field survey methodology is further detailed in Section 7.4.3.1 (terrestrial flora), Section 7.4.3.2 (terrestrial fauna), and Section 7.4.3.3 (aquatic flora and fauna).

Table 7-20 Survey effort for threatened species and ecological communities

MNES	Personnel	Survey locations	Survey technique employed and duration	DotE Recommended survey approach	Comments on suitability of survey approach	Details of future surveys
Brigalow (*Acacia harpophylla* dominant and co-dominant)	Simon Danielsen (BSc) Nick Willis (BEnvSci)	A total of 350 flora sites were assessed during the survey. Survey sites were selected to target mapped areas of TECs and / or the constituent REs and were distributed throughout preliminary investigation corridor.	Flora surveys were undertaken as 'quaternary' level survey sites using the CORVEG methodology developed by the Queensland Herbarium (Neldner *et al.* 2012). Quaternary sites involve recording the vegetation community structure and dominant species composition. Surveys were undertaken over 11 days (equivalent to 22 person days).	No survey guidelines have been developed by DotE for TECs.	Field surveys were consistent with the Queensland Herbarium's CORVEG methodology and are considered sufficient for this TEC.	A detailed vegetation mapping exercise is being undertaken for the purpose of lodging a Property Map of Assessable Vegetation application to DNRM.
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Simon Danielsen (BSc) Nick Willis (BEnvSci)	A total of 350 flora sites were assessed during the survey. Survey sites were selected to target mapped areas of TECs and / or the constituent REs and were distributed throughout preliminary investigation corridor.	Flora surveys were undertaken as 'quaternary' level survey sites using the CORVEG methodology developed by the Queensland Herbarium (Neldner *et al.* 2012). Quaternary sites involve recording the vegetation community structure and dominant species composition. Surveys were undertaken over 11 days (equivalent to 22 person days).	No survey guidelines have been developed by DotE for TECs. Field surveys were consistent with the Queensland Herbarium's CORVEG methodology (Neldner *et al.,* 2012).	Field surveys were consistent with the Queensland Herbarium's CORVEG methodology and are considered sufficient for this TEC.	A detailed vegetation mapping exercise is being undertaken for the purpose of lodging a Property Map of Assessable Vegetation application to DNRM.

MNES	Personnel	Survey locations	Survey technique employed and duration	DotE Recommended survey approach	Comments on suitability of survey approach	Details of future surveys
Black ironbox (*Eucalyptus raveretiana*)	Simon Danielsen (BSc) Nick Willis (BEnvSci)	A total of 350 flora sites were assessed during the survey, together with random meanders in suitable habitat for the target species. Sites and meanders were distributed throughout preliminary investigation corridor.	Targeted searches and random meanders were undertaken within watercourse vegetation. Surveys were undertaken over 11 days (equivalent to 22 person days).	Survey guidelines for this species require survey of permanent and semi-permanent streams (SEWPaC 2013a).	Surveys were consistent with DotE guidelines and are considered sufficient for this species.	Dry season flora survey
Squatter pigeon (southern) *Geophaps scripta scripta*	Shelley Wilkins (BEnvSci) Courtenay Mills (PhD, BSc (Hons) Craig Grabham (BAppSci) Richard Retallick (PhD, BSc) Glen Gaikhorst Neil Harwood (BA, MSc)	47 bird survey sites and 50 habitat assessment sites. Site locations were selected so as to encompass habitat variation across preliminary investigation corridor.	Slow traverses of tracks (by vehicle) were undertaken whilst driving on internal property roads, with details of any squatter pigeons (southern) observed during these traverses recorded. Standardised bird surveys undertaken at 47 sites equated to 27.5 person hours.	*Survey Guidelines for Australia's Threatened Birds* (DEWHA 2010) recommends area searches or transects in suitable habitat across 3 days for a total of 15 hours. Flushing surveys across 3 days for a total of 10 hours.	Survey technique was consistent with the guideline. Survey duration exceeded the recommended number of days and hours. Therefore, survey effort is considered sufficient for this species.	Dry season fauna survey

MNES	Personnel	Survey locations	Survey technique employed and duration	DotE Recommended survey approach	Comments on suitability of survey approach	Details of future surveys
Australian painted snipe *Rostratula australis*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	*Survey Guidelines for Australia's Threatened Birds* (DEWHA 2010) recommends area searches or transects through suitable wetlands; detection by sighting and flushing. Targeted stationary observations at dawn and dusk of suitable foraging locations within wetlands; detection by sighting. Also a brief spotlight search shortly after dusk may detect birds. The survey effort guide recommends targeted stationary observations across 5 days for a total of 10 hours, and/or land based area searches or line transects across 3 days for a total of 10 hours.	Survey does not meet recommended survey effort. However, data from previous surveys is available (BAAM 2012).	Dry season fauna survey

MNES	Personnel	Survey locations	Survey technique employed and duration	DotE Recommended survey approach	Comments on suitability of survey approach	Details of future surveys
Black-throated finch (southern) *Poephila cincta cincta*	Shelley Wilkins (BEnvSci) Courtenay Mills (PhD, BSc (Hons) Craig Grabham (BAppSci) Richard Retallick (PhD, BSc) Glen Gaikhorst Neil Harwood (BA, MSc)	Waterbody/riparian zone standardised bird surveys were undertaken at 19 locations within and near the preliminary investigation corridor. Habitat assessments were undertaken at 50 sites. Locations of black-throated finch (southern) survey sites are presented in Appendix A of the Nature Conservation technical report.	Watches were carried out at water bodies including farm dams, natural creeks and rivers, wetland fringes and stock troughs. A total of 11.45 person hours were invested in waterbody/riparian zone standardised bird surveys and watches for black-throated finches (southern) during the survey (time per survey ranged between 0.33 and 1.5 person hours). Habitat assessments undertaken to describe habitat attributes and context at 50 habitat assessment sites within and near preliminary investigation corridor.	*Survey Guidelines for Australia's Threatened Birds* (DEWHA 2010) recommends land-based area searches over five days for total of 10 hours, and targeted searches of water bodies and woodswallow nests over two days for total of six hours. *Significant Impact Guidelines for the Endangered Black-throated Finch (southern) (Poephila cincta cincta) Background Paper* (DEWHA 2009) recommends targeted searches of one hour per ha with maximum of 10 hours per search area (within 600 m of water source). Water source observations: minimum of six hours a day for two days for each water source. Habitat assessment surveys to determine the context of the site within the broader landscape.	Survey effort consistent with that recommended by DotE Survey Guidelines. Survey effort not fully compliant with DEWHA (2009) due to survey timeframes and linear nature of the project.	Dry season fauna survey

MNES	Personnel	Survey locations	Survey technique employed and duration	DotE Recommended survey approach	Comments on suitability of survey approach	Details of future surveys
Ornamental snake *Denisonia maculata*	Shelley Wilkins (BEnvSci) Courtenay Mills (PhD, BSc (Hons) Craig Grabham (BAppSci) Richard Retallick (PhD, BSc) Glen Gaikhorst Neil Harwood (BA, MSc)	Targeted searches undertaken at 10 sites that were selected based on habitat suitability. Habitat assessments at 50 sites. Locations of ornamental snake survey sites are presented in Appenidx A of the Nature Conservation technical report.	Targeted diurnal active searches of brigalow woodlands, brigalow regrowth and riparian habitats south of (approximately) Collinsville at 10 sites (10.5 person hours). Nocturnal searches over six nights on properties containing these sites (8.5 person hours). Habitat assessments undertaken to describe habitat attributes and context at 50 habitat assessment sites.	*Survey Guidelines for Australia's Threatened Reptiles* (SEWPaC 2011a) recommends driving on roads at night when frogs are active, and diurnal searches under sheltering sites (rocks, logs). Use of pitfall and funnel trap complexes recommended for trial. *Draft referral guidelines for the nationally listed Brigalow Belt reptiles* (SEWPaC 2011b) recommends diurnal searches (1.5 hours per ha for minimum of three days) and spotlighting (1.5 hours per ha for minimum of three days), and opportunistic survey of roads. Pitfall and funnel trap complexes (6 x 20 litre buckets under 30 m drift fence, with funnel trap at each end) – two replicates per habitat type, over four days of survey.	Methods are in accordance with DotE Guideline. Draft referral guidelines not met as requirement will be 370 survey hours. These guidelines also recommend use of pitfall and funnel trapping, although DotE Guidelines concede that trapping is likely to yield low returns.	Dry season fauna survey

MNES	Personnel	Survey locations	Survey technique employed and duration	DotE Recommended survey approach	Comments on suitability of survey approach	Details of future surveys
Koala *Phascolaractos cinereus*	Shelley Wilkins (BEnvSci) Courtenay Mills (PhD, BSc (Hons) Craig Grabham (BAppSci) Richard Retallick (PhD, BSc) Glen Gaikhorst Neil Harwood (BA, MSc)	Ten survey locations were selected based on habitat suitability. Locations of koala survey sites are presented in Appenidx A of the Nature Conservation technical report.	Targeted koala habitat assessments and faecal pellet surveys were undertaken at 10 locations within eucalypt woodland along the preliminary investigation corridor.	*Interim koala referral advice for proponents* (SEWPaC 2012) recommends collection of information on koala population and habitat information. Determine habitat critical to the survival of the koala including lists of primary and secondary food tree species. Undertake koala surveys using the techniques outlined in Policy 4 of the *Nature Conservation (koala) Conservation Plan 2006 and Management Program 2006-2016 (*Queensland Government). Undertake koala surveys for koala utilisation and frequency (faecal pellet surveys) using the spot assessment technique (Phillips & Callaghan 2011).	Survey consistent with DotE guidelines.	Dry season fauna survey

Table 7-21 Survey effort for migratory species

MNES	Personnel	Survey locations	Survey technique employed and duration	DotE Recommended survey approach	Comments on suitability of survey approach	Details of future surveys
Great egret *Ardea alba*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands, together with 47 bird survey sites and 50 habitat assessment sites. Site locations were selected so as to encompass habitat variation across preliminary investigation corridor.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day. Standardised bird surveys undertaken at 47 sites equated to 27.5 person hours.	Numbers may be counted or estimated by area search or by transect-point survey on foot or by aircraft.	Survey effort is considered appropriate for this species.	Dry season fauna survey
Caspian tern *Hydroprogne caspia*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	No relevant survey guidelines.	Survey effort is considered appropriate, together with data from previous surveys is available (BAAM 2012).	Dry season fauna survey
Glossy ibis *Plegadis falcinellus*	Shelley Wilkins (BEnvSci) Courtenay Mills (PhD, BSc (Hons) Craig Grabham (BAppSci) Richard Retallick (PhD, BSc) Glen Gaikhorst Neil Harwood (BA, MSc)	Caley Valley Wetlands, together with 47 bird survey sites and 50 habitat assessment sites. Site locations were selected so as to encompass habitat variation across preliminary investigation corridor.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day. Standardised bird surveys undertaken at 47 sites equated to 27.5 person hours.	No relevant survey guidelines.	Survey effort is considered appropriate for this species.	Dry season fauna survey

MNES	Personnel	Survey locations	Survey technique employed and duration	DotE Recommended survey approach	Comments on suitability of survey approach	Details of future surveys
Fork-tailed swift *Apus pacificus*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	No relevant survey guidelines. Present from October to April.	Survey was not within appropriate season. However, data from previous surveys is available (BAAM 2012).	Dry season fauna survey
Little tern *Sternula albifrons*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	Most surveys of the species are ground counts conducted by researchers moving on foot on the shoreline or from boats. No information is available on the preferred time(s) and/or conditions for surveys, or on the recommended survey effort.	Survey effort is considered appropriate, together with data from previous surveys is available (BAAM 2012; GHD 2010).	Dry season fauna survey
White-bellied sea-eagle *Haliaeetus leucogaster*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	Populations can be surveyed by performing systematic searches (area searches, line transects) for birds or nests. Searches can be conducted from the ground or air, or from a boat. No information is available on the preferred time(s) and/or conditions for surveys, or on the recommended survey effort.	Survey effort is considered appropriate, together with data from previous surveys is available (BAAM 2012).	Dry season fauna survey

MNES	Personnel	Survey locations	Survey technique employed and duration	DotE Recommended survey approach	Comments on suitability of survey approach	Details of future surveys
White-throated needletail *Hirundapus caudacutus*	Shelley Wilkins (BEnvSci) Courtenay Mills (PhD, BSc (Hons) Craig Grabham (BAppSci) Richard Retallick (PhD, BSc) Glen Gaikhorst Neil Harwood (BA, MSc)	47 bird survey sites and 50 habitat assessment sites. Site locations were selected so as to encompass habitat variation across preliminary investigation corridor.	Standardised bird surveys undertaken at 47 sites equated to 27.5 person hours.	It is difficult to conduct systematic surveys due to its mobility and ability to cover huge distances in a day. Any surveys must be conducted between October and April in northern and eastern Australia, and between December and March in south-eastern Australia, when numbers are highest.	Survey effort is considered appropriate for this species.	Dry season fauna survey
Barn swallow *Hirundo rustica*	Shelley Wilkins (BEnvSci) Courtenay Mills (PhD, BSc (Hons) Craig Grabham (BAppSci) Richard Retallick (PhD, BSc) Glen Gaikhorst Neil Harwood (BA, MSc)	47 bird survey sites and 50 habitat assessment sites. Site locations were selected so as to encompass habitat variation across preliminary investigation corridor.	Standardised bird surveys undertaken at 47 sites equated to 27.5 person hours.	No relevant survey guidelines.	Survey effort is considered appropriate for this species.	Dry season fauna survey

MNES	Personnel	Survey locations	Survey technique employed and duration	DotE Recommended survey approach	Comments on suitability of survey approach	Details of future surveys
Rainbow bee-eater *Merops ornatus*	Shelley Wilkins (BEnvSci) Courtenay Mills (PhD, BSc (Hons) Craig Grabham (BAppSci) Richard Retallick (PhD, BSc) Glen Gaikhorst Neil Harwood (BA, MSc)	47 bird survey sites and 50 habitat assessment sites. Site locations were selected so as to encompass habitat variation across preliminary investigation corridor.	Standardised bird surveys undertaken at 47 sites equated to 27.5 person hours.	No relevant survey guidelines.	Survey effort is considered appropriate for this species.	Dry season fauna survey
Black-faced monarch *Monarcha melanopsis*	Shelley Wilkins (BEnvSci) Courtenay Mills (PhD, BSc (Hons) Craig Grabham (BAppSci) Richard Retallick (PhD, BSc) Glen Gaikhorst Neil Harwood (BA, MSc)	47 bird survey sites and 50 habitat assessment sites. Site locations were selected so as to encompass habitat variation across preliminary investigation corridor.	Standardised bird surveys undertaken at 47 sites equated to 27.5 person hours.	Black-faced Monarchs have been surveyed using standard bird survey techniques, including fixed-width transect counts (e.g. 50 m width) and point counts (e.g. of one hour duration).	Survey effort is considered appropriate for this species.	Dry season fauna survey

MNES	Personnel	Survey locations	Survey technique employed and duration	DotE Recommended survey approach	Comments on suitability of survey approach	Details of future surveys
Spectacled monarch *Symposiarchus trivirgatus*	Shelley Wilkins (BEnvSci) Courtenay Mills (PhD, BSc (Hons) Craig Grabham (BAppSci) Richard Retallick (PhD, BSc) Glen Gaikhorst Neil Harwood (BA, MSc)	47 bird survey sites and 50 habitat assessment sites. Site locations were selected so as to encompass habitat variation across preliminary investigation corridor.	Standardised bird surveys undertaken at 47 sites equated to 27.5 person hours.	No relevant survey guidelines.	Survey effort is considered appropriate for this species.	Dry season fauna survey
Satin flycatcher *Myiagra cyanoleuca*	Shelley Wilkins (BEnvSci) Courtenay Mills (PhD, BSc (Hons) Craig Grabham (BAppSci) Richard Retallick (PhD, BSc) Glen Gaikhorst Neil Harwood (BA, MSc)	47 bird survey sites and 50 habitat assessment sites. Site locations were selected so as to encompass habitat variation across preliminary investigation corridor.	Standardised bird surveys undertaken at 47 sites equated to 27.5 person hours.	No relevant survey guidelines.	Survey effort is considered appropriate for this species.	Dry season fauna survey

MNES	Personnel	Survey locations	Survey technique employed and duration	DotE Recommended survey approach	Comments on suitability of survey approach	Details of future surveys
Rufous fantail *Rhipidura rufifrons*	Shelley Wilkins (BEnvSci) Courtenay Mills (PhD, BSc (Hons) Craig Grabham (BAppSci) Richard Retallick (PhD, BSc) Glen Gaikhorst Neil Harwood (BA, MSc)	47 bird survey sites and 50 habitat assessment sites. Site locations were selected so as to encompass habitat variation across preliminary investigation corridor.	Standardised bird surveys undertaken at 47 sites equated to 27.5 person hours.	No relevant survey guidelines.	Survey effort is considered appropriate for this species.	Dry season fauna survey
Common sandpiper *Actitis hypoleucos*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	No relevant survey guidelines. Present between August and March.	Survey was not within appropriate season. However, data from previous surveys is available (BAAM 2012; GHD 2010).	Dry season fauna survey
Cattle egret *Ardea ibis*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands, together with 47 bird survey sites and 50 habitat assessment sites. Site locations were selected so as to encompass habitat variation across preliminary investigation corridor.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day. Standardised bird surveys undertaken at 47 sites equated to 27.5 person hours.	No relevant survey guidelines.	Survey effort is considered appropriate for detection of this species.	Dry season fauna survey

MNES	Personnel	Survey locations	Survey technique employed and duration	DotE Recommended survey approach	Comments on suitability of survey approach	Details of future surveys
Sharp-tailed sandpiper *Calidris acuminata*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	No relevant survey guidelines. Present between August and March.	Survey was not within appropriate season. However, data from previous surveys is available (BAAM 2012).	Dry season fauna survey
Red-necked stint *Calidris ruficollis*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	No relevant survey guidelines. Birds arrive in Australia from August.	Survey was not within appropriate season. However, data from previous surveys is available (BAAM 2012).	Dry season fauna survey
Greater sand plover *Charafrius leschenaultii*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	Summer counts are the most useful, as they occur when the birds are present in Australia in their greatest numbers. Counts are usually conducted at high-tide, when the shorebirds are roosting.	Survey was not within appropriate season. However, data from previous surveys is available (BAAM 2012).	Dry season fauna survey
Lesser sand plover *Charadrius mongolus*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	Summer counts are the most useful, as they occur when the birds are present in Australia in their greatest numbers. Counts are usually conducted at high-tide, when the shorebirds are roosting.	Survey was not within appropriate season. However, data from previous surveys is available (BAAM 2012).	Dry season fauna survey

MNES	Personnel	Survey locations	Survey technique employed and duration	DotE Recommended survey approach	Comments on suitability of survey approach	Details of future surveys
Latham's snipe *Gallinago hardwickii*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	Populations can be surveyed by performing area searches or line transects in wetlands or other waterbodies and their surrounding vegetation. The surveys should be conducted on foot. In Australia, surveys should be conducted between October and February.	Survey was not within recommended season. However, data from previous surveys is available (BAAM 2012).	Dry season fauna survey
Grey-tailed tattler *Heteroscelus brevipes*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	No relevant survey guidelines. Species generally arrives in August and leaves mid-April.	Surveys were not within appropriate season. However, data from previous surveys is available (BAAM 2012).	Dry season fauna survey
Bar-tailed godwit *Limosa lapponica*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	No relevant survey guidelines. Many Bar-tailed Godwits remain in the non-breeding range all year.	Surveys were limited by time and not within ideal season. However, data from previous surveys is available (BAAM 2012).	Dry season fauna survey
Eastern curlew *Numenius madagascariensis*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	The Eastern Curlew is most often counted using ground-based surveys within Australia. Birds leave Australia by April.	Survey was not within appropriate season. However, data from previous surveys is available (BAAM 2012).	Dry season fauna survey

MNES	Personnel	Survey locations	Survey technique employed and duration	DotE Recommended survey approach	Comments on suitability of survey approach	Details of future surveys
Little curlew *Numenius minutus*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	No relevant survey guidelines. Birds leave Australia by April.	Survey was not within appropriate season. However, data from previous surveys is available (BAAM 2012).	Dry season fauna survey
Whimbrel *Numenius phaeopus*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	No relevant survey guidelines. Found in Australia from August to March.	Survey was not within appropriate season. However, data from previous surveys is available (BAAM 2012).	Dry season fauna survey
Grey plover *Pluvialis squatarola*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	No relevant survey guidelines. Found in Australia from August to March.	Survey was not within appropriate season. However, data from previous surveys is available (BAAM 2012).	Dry season fauna survey
Marsh sandpiper *Tringa stagnatilis*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	No relevant survey guidelines. Birds arrive in Australia from September.	Survey was not within appropriate season. However, data from previous surveys is available (BAAM 2012).	Dry season fauna survey
Terek sandpiper *Xenus cinereus*	Shelley Wilkins (BEnvSci) Richard Retallick (PhD, BSc)	Caley Valley Wetlands. Site selected based on habitat suitability.	A total of 3 person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley wetlands) across a period of one day.	No relevant survey guidelines. Found in Australia from August to March.	Survey was not within appropriate season. However, data from previous surveys is available (BAAM 2012).	Dry season fauna survey

7.4.3.1 Terrestrial flora surveys

Terrestrial survey sites were selected to target mapped areas of TECs and / or the constituent regional ecosystmes (REs). In particular, sites considered likely to provide habitat for listed threatened species were targeted, including mapped ‘endangered’ or ‘of concern’ remnant vegetation, mapped essential habitat and ecosystems that provide important function such as riparian vegetation and wetlands. In addition, the identity and location of declared weeds and other exotic species was also recorded. Weeds are often clustered in non-remnant areas or other heavily impacted locations, and these were noted where observed.

Assessment of TECs at each selected survey site involved recording the vegetation community structure and the dominant species composition of each stratum comprising the vegetation community. This is consistent with the ‘quaternary’ level of assessment of the CORVEG methodology developed by the Queensland Herbarium and outlined in *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (Neldner *et al.* 2012). Overall, flora surveys were undertaken at 350 ‘quaternary’ level survey sites over a total of 11 survey days y two ecologists. Quaternary surveys are faster and offer more discretion to the collector than the more detailed secondary surveys, and allow for greater land coverage. The greater coverage of habitat and increased ability to select multiple sites allowed more emphasis on targeted threatened species searches and random meanders.

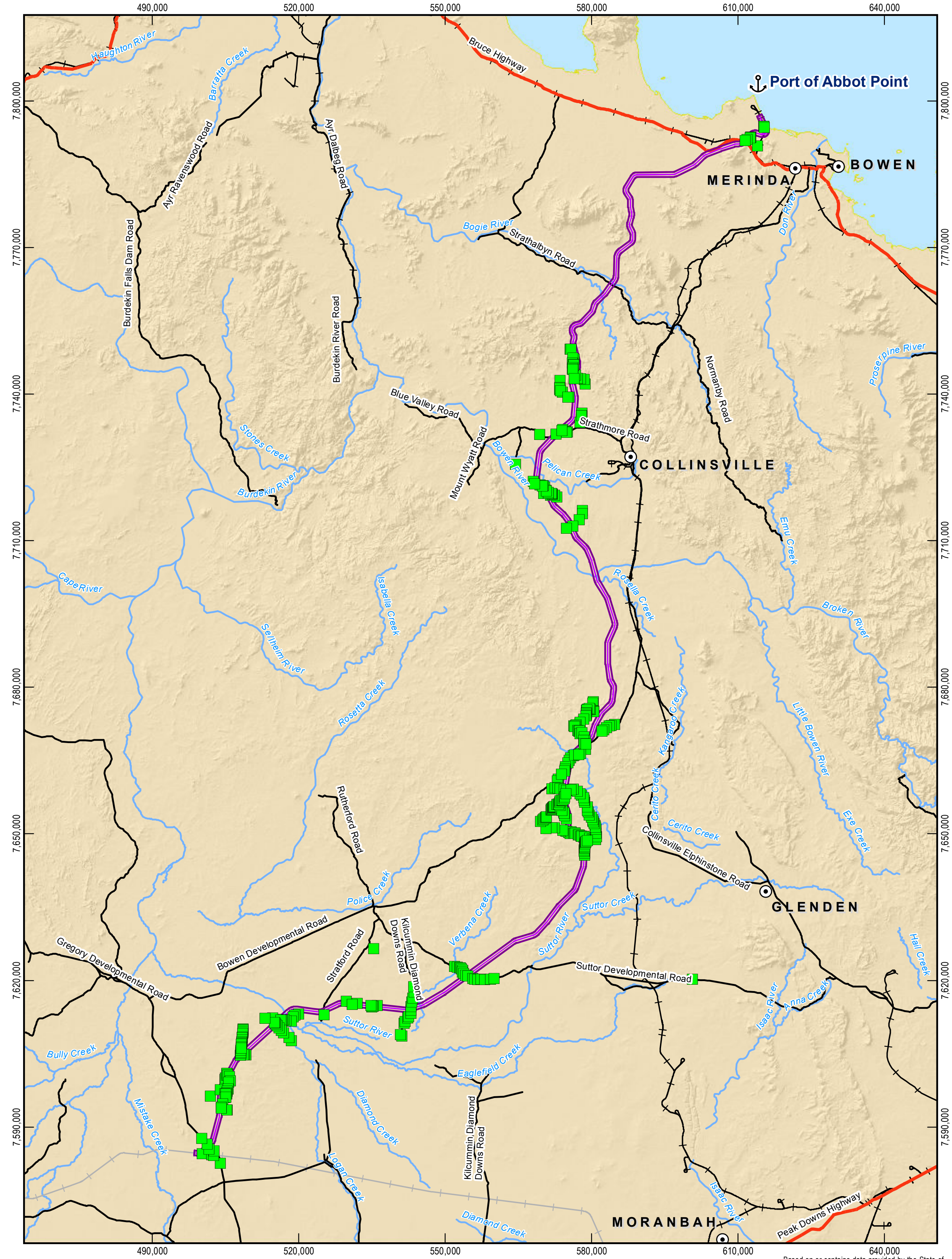
Targeted searches were undertaken opportunistically where suitable habitat for threatened flora species was observed within the study area. In such locations, two GHD ecologists undertook intensive searches, targeting locations and microhabitats known to be favoured by the threatened species being searched for. Random meanders (Cropper 1993) were also undertaken at many quaternary survey sites and involved random traverses of vegetation while searching for threatened species and other species of interest, such as species not yet observed in the study area, or thought to be unique to the area. Species considered unique or of particular interest included those not previously recorded in the study area during the survey, possible range extensions and species the ecologist collected samples of because it could not be readily identified (see Table 7-19). This technique is particularly suitable for locating species that typically occur at very low densities, or that may be grouped in isolated clumps, as is often the case with many plants listed as threatened.

The results of all targeted and random meander searches were recorded and incorporated into the quaternary survey data. Locations of terrestrial flora survey sites are presented in Figure 7-10 (overview), Figure 7-11 (northern section of preliminary investigation corridor), and Figure 7-12 (southern section of preliminary investigation corridor). Coordinates for each survey site are provided in Appendix A of Volume 2 Appendix F Nature conservation (page 187).

In addition to searches for species of interest (threatened or unique species), at each survey site RE units were ground-truthed using the CORVEG quaternary methodology, as outlined in Neldner *et al.* (2012). Information relating to the vegetation community, land zone, species composition and vegetation structure at each site was recorded. As a minimum, dominant species were recorded for the ecologically dominant layer (generally the tallest layer, with the exception of emergent layers). For RE ground-truthing, a CORVEG quaternary level of assessment is the recommended method (Neldner *et al.* 2012).

At representative sites within and near the preliminary investigation corridor, the condition of vegetation communities was assessed using the Vegetation Assets, States and Transitions (VAST) methodology (Thackway and Lesslie 2005). The VAST methodology is being utilised at a national level to assess condition in environments ranging from native woodlands to wasteland. For example, it can be used to assess the condition of non-remnant vegetation, and is particularly useful in assessing the impacts of land management on ecosystem services, among other things (Thackway and Lesslie 2005).

For this reason, it is considered to be a more appropriate tool than the BioCondition methodology (Eyre *et al.* 2011) for a rapid assessment of vegetation condition at quaternary sites during EIS investigations for linear infrastructure projects. BioCondition assessments involve the collection of a more detailed record of ecological condition, and typically require more time (in many cases, an hour or more). In addition, BioCondition results must be compared against benchmarks recorded by RE type (Eyre *et al.* 2011), making them impractical for use in non-remnant vegetation. However, VAST assessments are more suited to the rapid nature of exploratory investigations (as are quaternary surveys). In situations where the exact location of infrastructure footprints are not yet known, it is more practical to take a larger number of VAST assessments over a broader range of sites, than to take a much smaller number of detailed BioCondition surveys at locations that may ultimately be removed from any impact area.



LEGEND

- Population Centres
- Major Port
- Flora Survey Sites
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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GHD

adani

Adani Mining Pty Ltd
North Galilee Basin Rail Project

Flora survey sites
- overview

Job Number	41-26457
Revision	A
Date	26 Sep 2013

Figure 7-10

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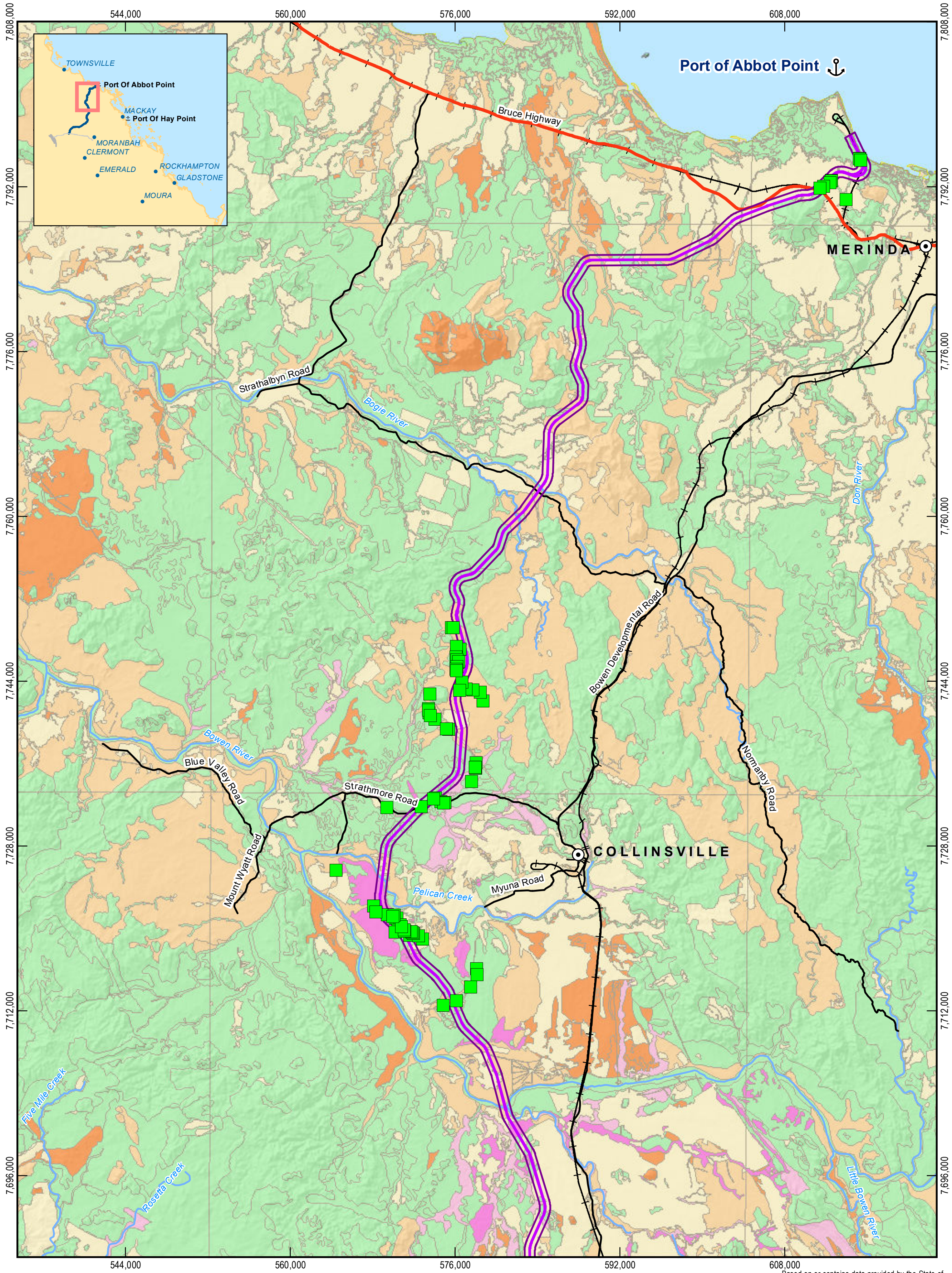
145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010; GHD: Flora Survey Sites. Created by:MS



LEGEND

- Population Centres
- Major Port
- Flora Survey Sites
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)

Regional Ecosystems v6.1

- Endangered - Dominant
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- Least Concern
- Non-remnant
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd
North Galilee Basin Rail Project

Flora survey sites - northern section

Job Number	41-26457
Revision	A
Date	26 Sep 2013

Figure 7-11

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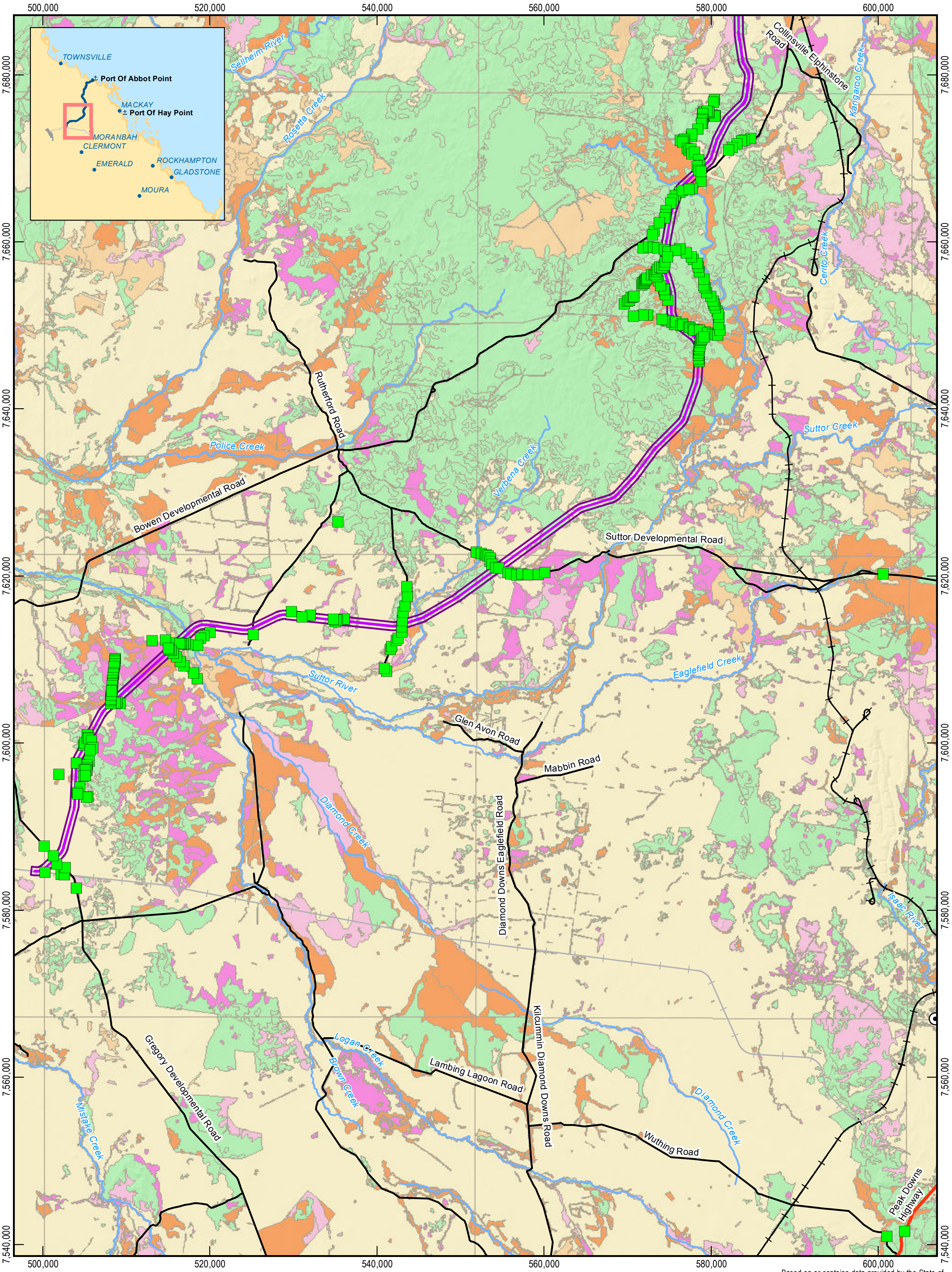
145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010, Regional Ecosystems/2011; GHD: Flora Survey Sites. Created by:MS



LEGEND

- Population Centres
- Flora Survey Sites
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)

Regional Ecosystems v6.1

- Endangered - Dominant
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- Least Concern
- Non-remnant
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:650,000 Paper Size A4

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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GHD

adani

Adani Mining Pty Ltd
North Galilee Basin Rail Project

Flora survey sites
- southern section

Job Number	41-26457
Revision	A
Date	26 Sep 2013

Figure 7-12

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Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010, Regional Ecosystems/2011; GHD: Flora Survey Sites. Created by:MS

7.4.3.2 Terrestrial fauna surveys

An integrated suite of field methods were employed to describe and assess the terrestrial fauna habitat values of the preliminary investigation corridor, in accordance with the *Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland* (Eyre *et al.* 2012). The assessment broadly involved two facets:

- Identification of the fauna habitat types occurring within and near the preliminary investigation corridor, including a description of the characteristics, condition and value of these habitats for fauna (common and conservation significant)
- Identification of fauna species in those habitats occurring within and near the preliminary investigation corridor through a suite of standard survey methods.

Survey sites sampled representative vegetation communities and fauna habitat types within and near the preliminary investigation corridor. RE mapping and aerial photography provided a broad indication of the diversity and distribution of habitats across the landscape in which the preliminary investigation corridor occurs, and inform the selection of survey sites. Areas featuring remnant vegetation that had the potential to support conservation significant species or communities and riparian habitats were preferentially targeted, as were those habitats that were more prevalent across the landscape (such as eucalypt woodlands).

In this study, an integrated suite of standard fauna detection methods formed the focus of the fieldwork, with no reliance upon a single methodology. This included habitat assessments (to include condition, species associations with specific vegetation communities and the presence or absence of key micro-habitat features), timed bird surveys, diurnal active searches, nocturnal surveys (spotlighting, call playback, nocturnal active searches, and microchiropteran bat call detection), threatened species surveys, waterbody watches and assessments of habitat values of the eastern fringe of the Caley Valley Wetland, which is adjacent to the preliminary investigation corridor.

A total of 50 terrestrial fauna habitat assessments were undertaken during field surveys. A summary of the terrestrial fauna survey effort is presented in Table 7-22.

Table 7-22 Summary of fauna survey effort

Survey method	Number of sites	Person hours
Terrestrial fauna habitat assessment	50	25
Standardised bird survey	47	28
Diurnal active search	34	37
Nocturnal survey (walking and vehicle transects)	26	21
Nocturnal anabat sites	13	48
Nocturnal call playback	6	3
Bird surveys on eastern fringe of Caley Valley Wetland	3	3
Total number of person hours for fauna surveys		*165*

Locations of terrestrial fauna assessment sites are presented in Figure 7-13 (overview), Figure 7-14 (northern section of preliminary investigation corridor), and Figure 7-15 (southern section of preliminary investigation corridor). Coordinates for each survey site are provided in Appendix A of Volume 2 Appendix F Nature conservation (page 187).

The following parameters were recorded on proforma site sheets during terrestrial habitat assessments:

- Landscape context (size, shape, connectivity or relative isolation of habitat remnants)
- Structural and floristic complexity of vegetation
- Structural complexity and relative heterogeneity of ground-level microhabitats (for example substrate type, vegetation cover, leaf litter, woody debris, presence of rocks, logs or boulders)
- Habitat features (for example hollows, fallen logs, rock outcrops, nests, burrows, waterways)
- Sources of disturbance (for example adjacent land uses, feral animals, predation, weed infestation)
- Potential habitat features for threatened species.

These assessments informed the description of the existing fauna habitat values of the landscape in which the preliminary investigation corridor occurs. This included the *in situ* values of habitats, as well as the inferred value of sites as part of broader (i.e. landscape scale) movement corridors. Fauna species information collected at habitat assessment sites allowed for broad patterns of association between habitats and species to be described.

Survey guidelines for threatened species prepared by the Commonwealth Government were reviewed for those threatened species (Commonwealth listed) considered likely to occur from the desktop assessments, or confirmed present in the landscape in which the preliminary investigation corridor occurs. The Commonwealth prescribed threatened species survey effort applied for these species is summarised in Section 7.4.3 and the location of the threatened species surveys is shown in Figure 7-19.

Standardised diurnal bird surveys using the method outlined in Eyre *et al.* (2012) were undertaken at 47 sites. This involved a timed 20 minute survey of a two hectare (ha) search area, recording the number of birds seen or heard calling.

A total of 34 diurnal active searches were undertaken for reptiles and amphibians in a variety of habitat types. Sites selected included a representative suite of the habitats (and various associated microhabitats) identified as occurring within the preliminary investigation corridor and wider study area. Searches involved looking beneath rocks, logs, bark and among soil and leaf litter. Diurnal active searches were timed in accordance with Eyre *et al.* (2012); with each diurnal active search event lasting for a minimum of 30 person-minutes at each survey site (active searches generally averaged around one person-hour per site). During diurnal active searches, opportunistic records of wildlife traces (for example bones, hair traces, tracks, scats, diggings, burrows, nests, skins) were also made.

Nocturnal spotlighting surveys were undertaken within the preliminary investigation corridor and wider study area over eight nights at 26 sites. Figure 7-16 provides an overview, and the northern and southern sections of the preliminary investigation corridor are mapped in Figure 7-17 and Figure 7-18 respectively. Coordinates and details of each survey site are provided in Appendix A of Volume 2 Appendix F Nature conservation (page 187). A minimum of two person-hours was invested in nocturnal surveys each night using a combination of high-powered spotlights and head torches on walking transects and vehicular transects as outlined in Eyre *et al.* (2012). Visual surveys were undertaken in a minimum 100 m x 100 m search area, searching trees, shrubs and understorey habitats for arboreal mammals, ground mammals, reptiles, frogs and nocturnal birds. In addition, spotlighting was undertaken from vehicles traversing internal property tracks when moving between sites, and when leaving sites.

Call playback surveys were undertaken to detect nocturnal birds at open woodland and grassland habitats. Call playback surveys involved broadcasting the call of individual target species for three minutes. This was followed by a listening period of two minutes as outlined in Eyre *et al.* (2012). Species targeted for call playback surveys were selected based on desktop information of their known ranges, previous sightings, individual habitat requirements and onsite assessment of the likelihood of being present.

Anabat bat detectors were used to survey for microchiropteran (insectivorous) bats by recording their echolocation calls. A combination of overnight detection, timed *in situ* detection (up to three hours) and walking transects (lasting up to three hours) was undertaken. All bat species were targeted, with a subsequent focus on identifying any EPBC Act-listed bat species that may have occurred, or were likely to occur, within the Project area via comparison with published characteristic call signatures.

Bat call detection focused on habitat types of likely value to bats, such as eucalypt woodlands, acacia woodland and riverine areas. Echolocation call recordings were sent to a qualified bat-call analyst for identification. All species echolocation call recordings have been included in the results analysis and are identified as either positively identified calls or species potentially present, but not reliably identified from call analysis.

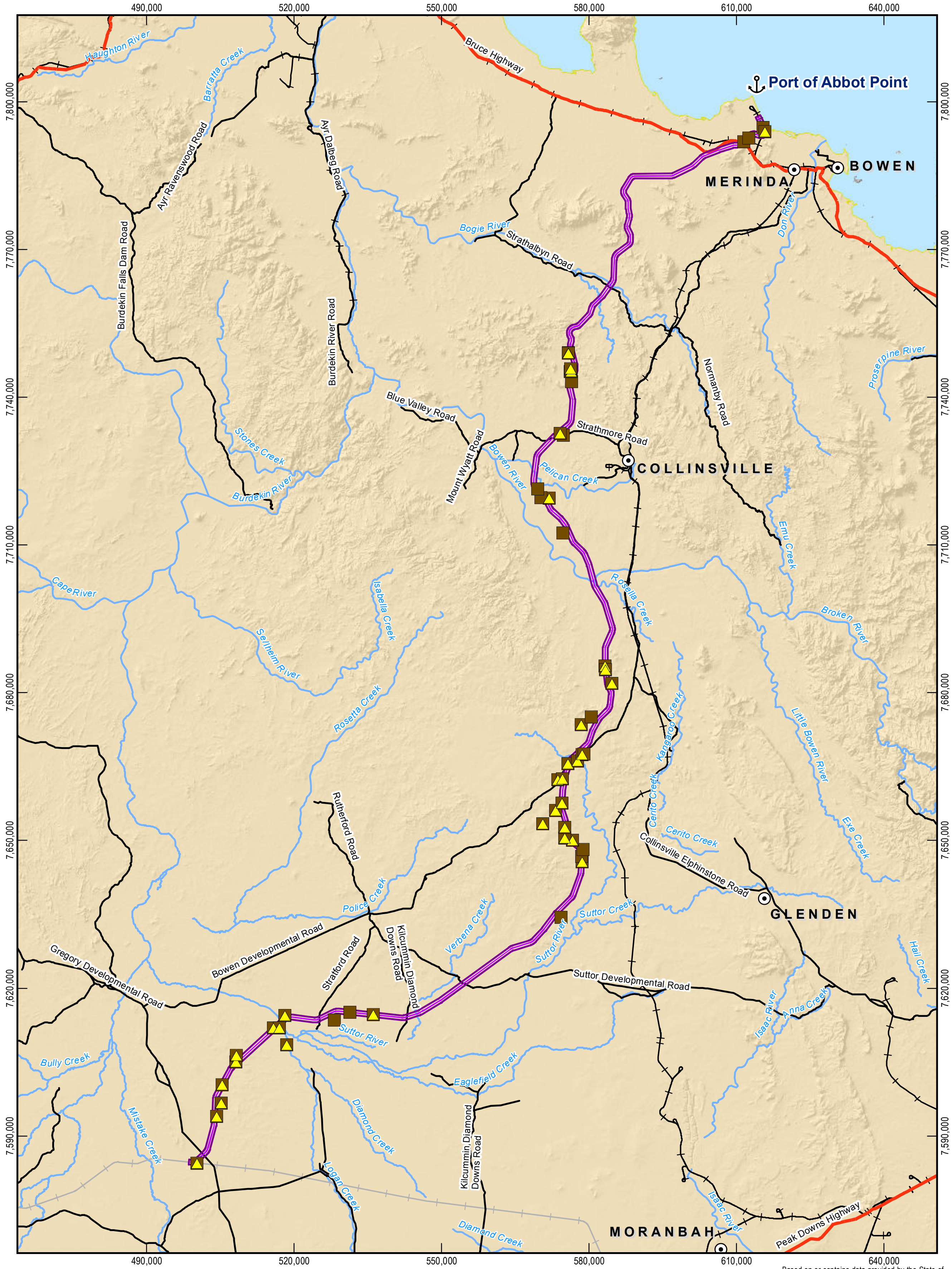
An assessment of the habitat values of the eastern fringe of the Caley Valley Wetland was also undertaken. The objective of this survey was to supplement existing information on the characteristics and values of this area for water birds, including migratory species. The survey involved a combination of habitat assessments and timed point observations (one person hour) at three locations where the preliminary investigation corridor occurs adjacent to the wetland. Bird species diversity (and total counts) was recorded at each observation point, while opportunistic records were noted when navigating between sites.

The field survey methodology employed during the field surveys did not involve trapping for small ground-dwelling fauna. The rationale for this approach was based upon a number of drivers, as follows:

- As many sites as possible were assessed to develop a greater level of understanding of the types of habitats within and near the preliminary investigation corridor, including the characteristics and attributes of these habitats, the condition of habitats, species diversity within these habitats, and the likely value of habitats for conservation significant species. This involved increased sampling effort in those habitats that are most widespread (such as open woodland, fringing woodland and non-remnant vegetation), as opposed to focusing on a small number of detailed and localised (trapping) assessment sites.
- More time was invested in alternative fauna survey techniques that have been found to be effective means of detecting fauna including cryptic ground-dwelling species in recent project experiences in the Brigalow Belt bioregion (SEWPaC 2011a; SEWPaC 2013g; Porter 1998).

- More time was invested in targeted surveys for species of conservation significance, especially in consideration of extremely low success rates of trapping for threatened reptiles (Kutt *et al.* 2003; Kutt *et al.* 2012; Kutt and Fisher 2011; SEWPaC 2011a).
- Broad patterns of association between habitats and fauna species in the landscape in which the preliminary investigation corridor occurs were deciphered, through a combination of greater level of sampling effort (via accessing numerous survey sites) and an integrated suite of fauna detection methods. As a major impact of the NGBR Project could be habitat fragmentation at the landscape scale, identifying these patterns of association was considered to be an important component of the impact assessment and mitigation process.

Recent project experience and a review of relevant literature will suggest that trapping typically results in the capture of locally-abundant species whose presence could otherwise be detected using alternative survey techniques, such as spotlighting or active searching, or (at least) expected via a habitat suitability or likelihood of occurrence approach underpinned by a review of desktop information.



LEGEND

- Population Centres
- Major Port
- Fauna Habitat Assessment Site
- Diurnal Active Search Site
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Adani Mining Pty Ltd
North Galilee Basin Rail Project
Fauna habitat assessment sites and diurnal active search locations – overview

Job Number	41-26457
Revision	A
Date	26 Sep 2013

Figure 7-13

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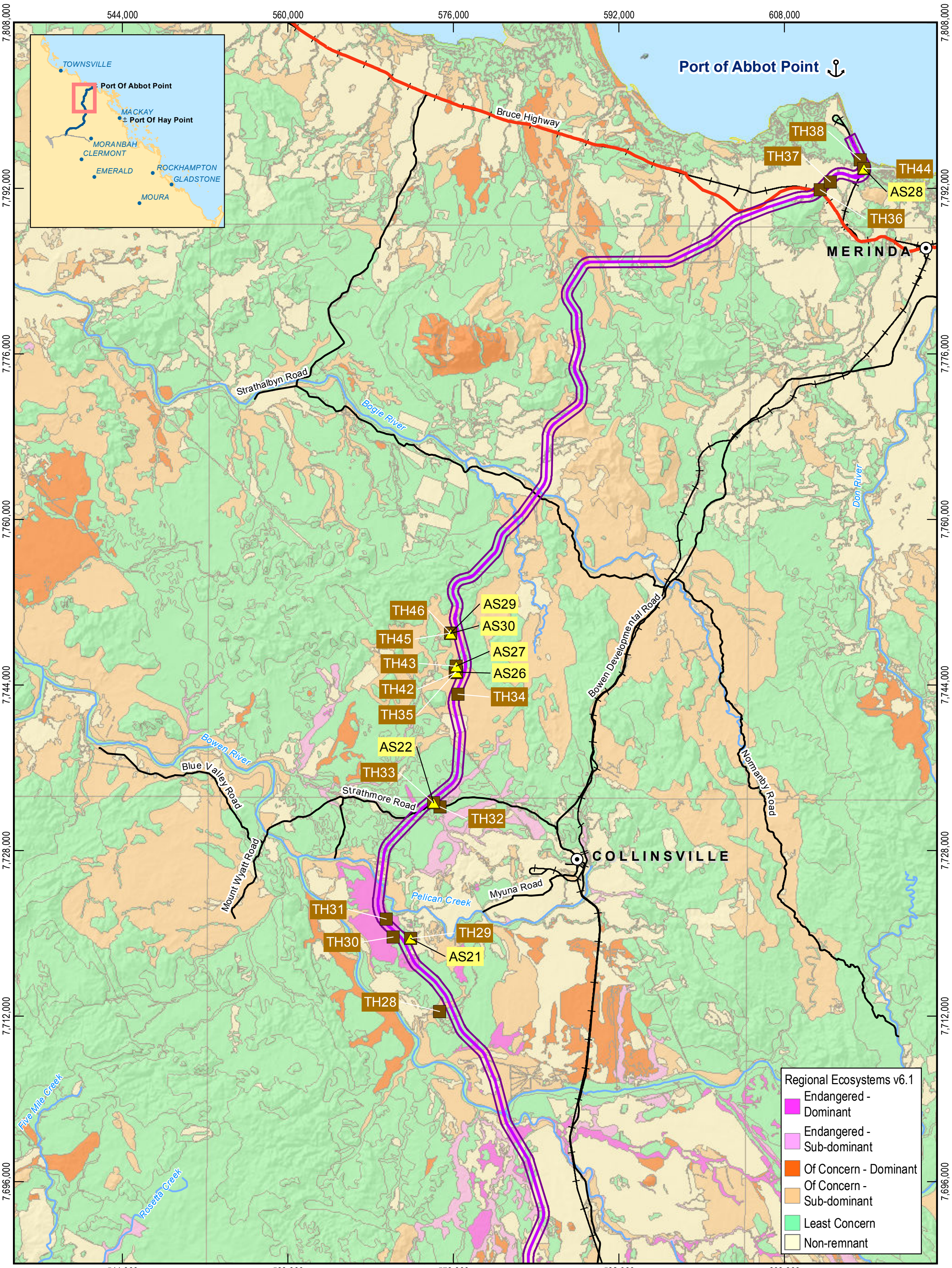
145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Carmichael Rail Project/2012; DNRM: Roads/2010; GHD: Fauna Survey Sites/2013. Created by:MS



LEGEND

- Population Centres
- Major Port
- Fauna Terrestrial Habitat Assessment (TH) Site
- Diurnal Active Search (AS) Site
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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GHD adani

Adani Mining Pty Ltd
North Galilee Basin Rail Project
Fauna habitat assessment sites and diurnal active search locations – northern section

Job Number	41-26457
Revision	A
Date	26 Sep 2013

Figure 7-14

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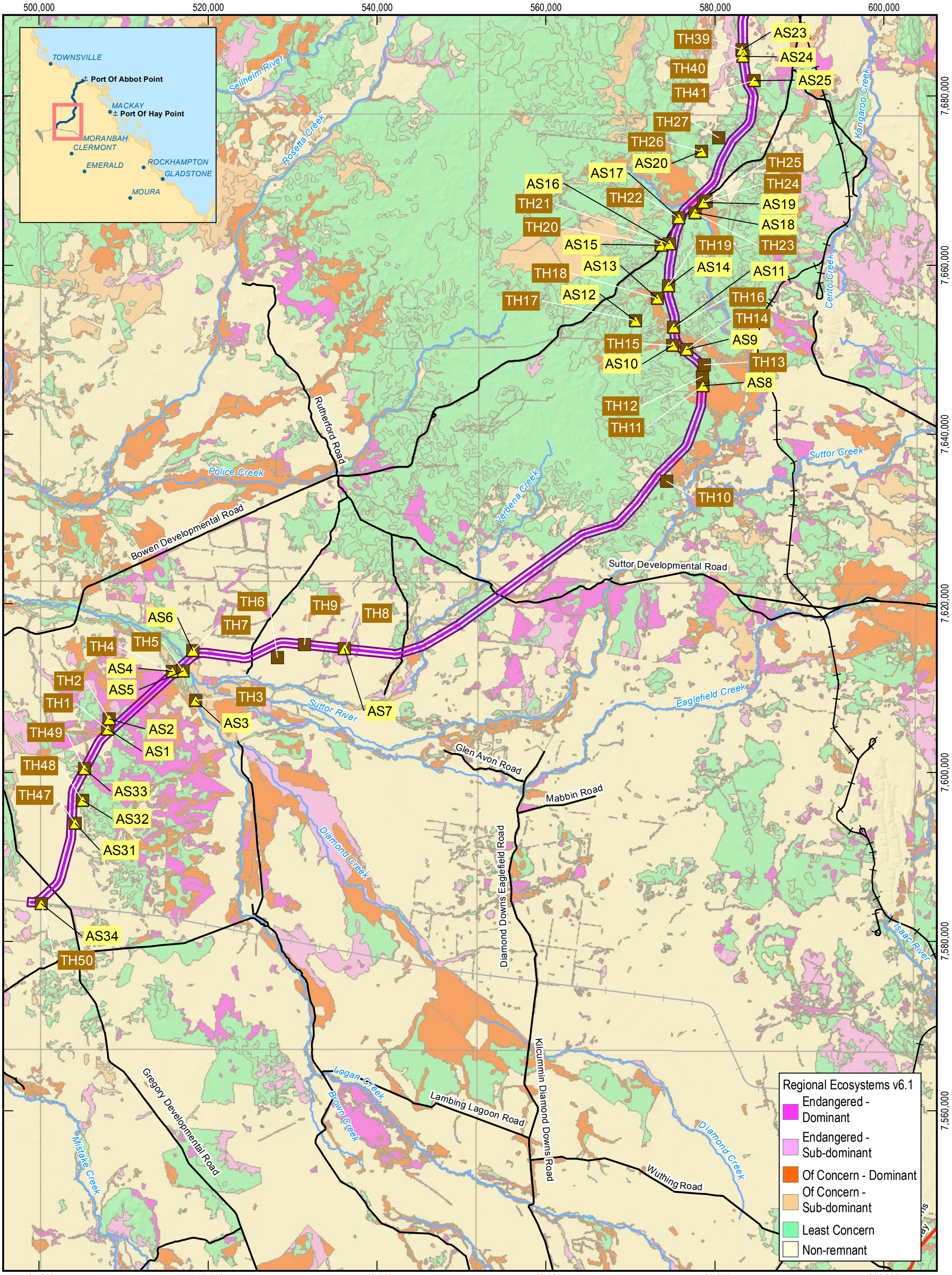

LEGEND

- Population Centres
- Fauna Terrestrial Habitat Assessment (TH) Site
- Diurnal Active Search (AS) Site
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd
North Galilee Basin Rail Project
Fauna habitat assessment sites and diurnal active search locations – southern section

Job Number 41-26457
Revision A
Date 26 Sep 2013

Figure 7-15

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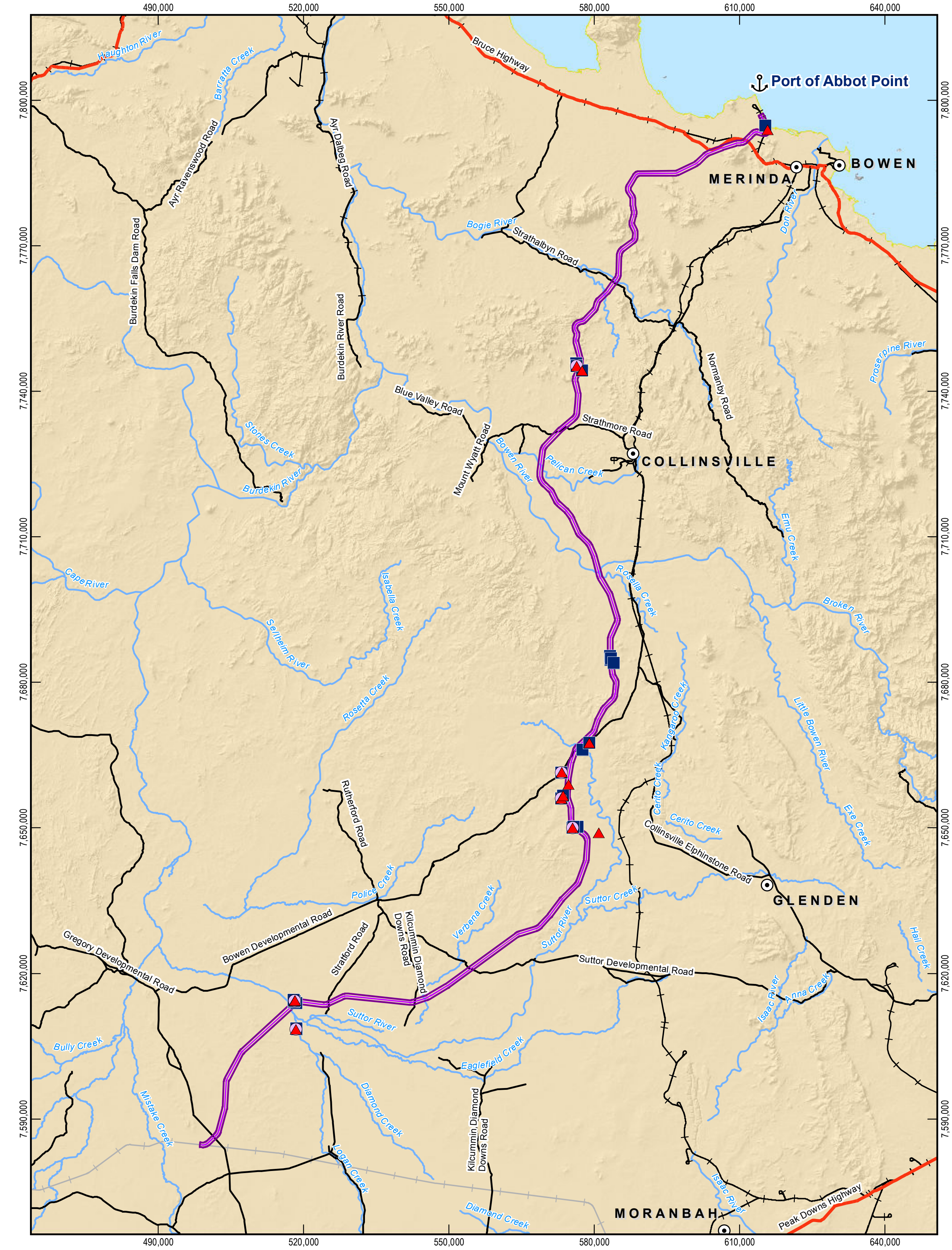

LEGEND

- Population Centres
- Major Port
- Anabat Location
- Call Playback Location
- Nocturnal Active Search Site
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd
North Galilee Basin Rail Project
Fauna nocturnal survey sites, anabat and call playback locations – overview

Job Number	41-26457
Revision	A
Date	26 Sep 2013

Figure 7-16

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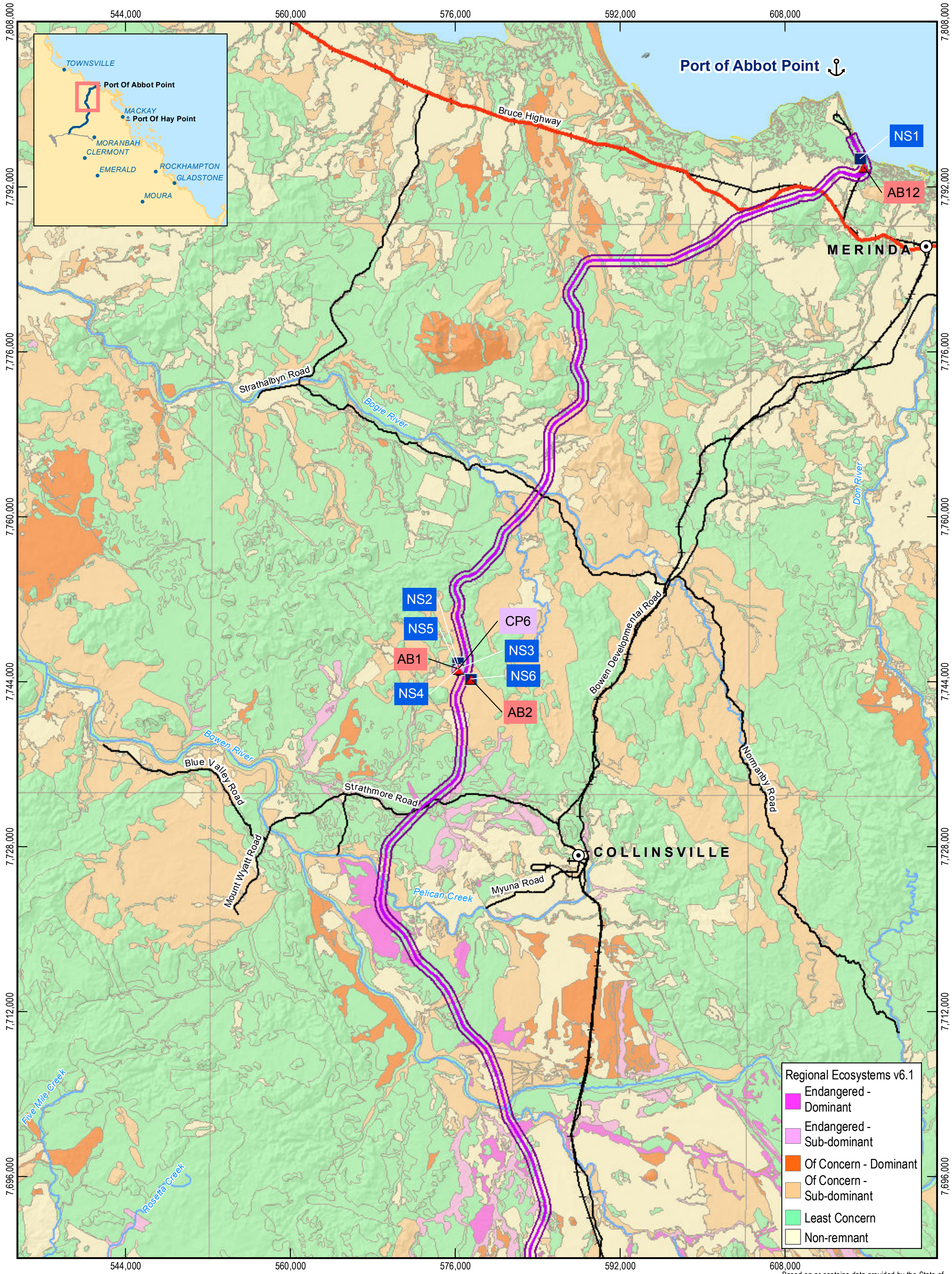
Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010; GHD: Noturnal Survey Sites/2013. Created by:MS



LEGEND

- Population Centres
- Major Port
- Anabat (AB) Location
- Call Playback (CP) Location
- Nocturnal Active Search (NS) Site
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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GHD adani

Adani Mining Pty Ltd
North Galilee Basin Rail Project
Fauna nocturnal survey sites, anabat and call playback locations – northern section

Job Number	41-26457
Revision	A
Date	26 Sep 2013

Figure 7-17

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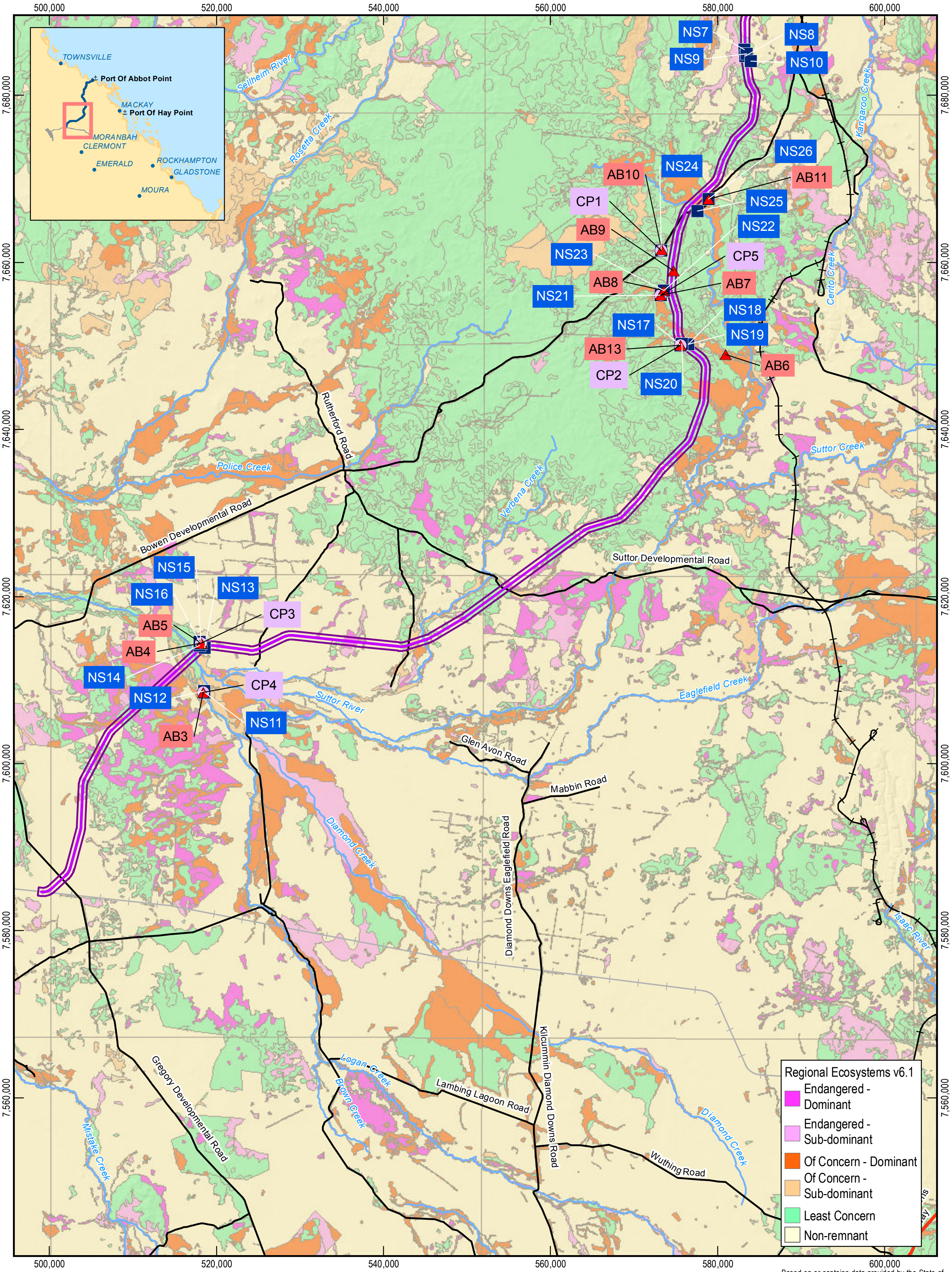
Data source: Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010, Regional Ecosystems/2011; GHD: Nocturnal Survey Sites/2013. Created by:MS



LEGEND

- Population Centres
- Anabat (AB) Location
- Call Playback (CP) Location
- Nocturnal Active Search (NS) Site
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd
North Galilee Basin Rail Project
Fauna nocturnal survey sites, anabat and call playback locations – southern section

Job Number	41-26457
Revision	A
Date	26 Sep 2013

Figure 7-18

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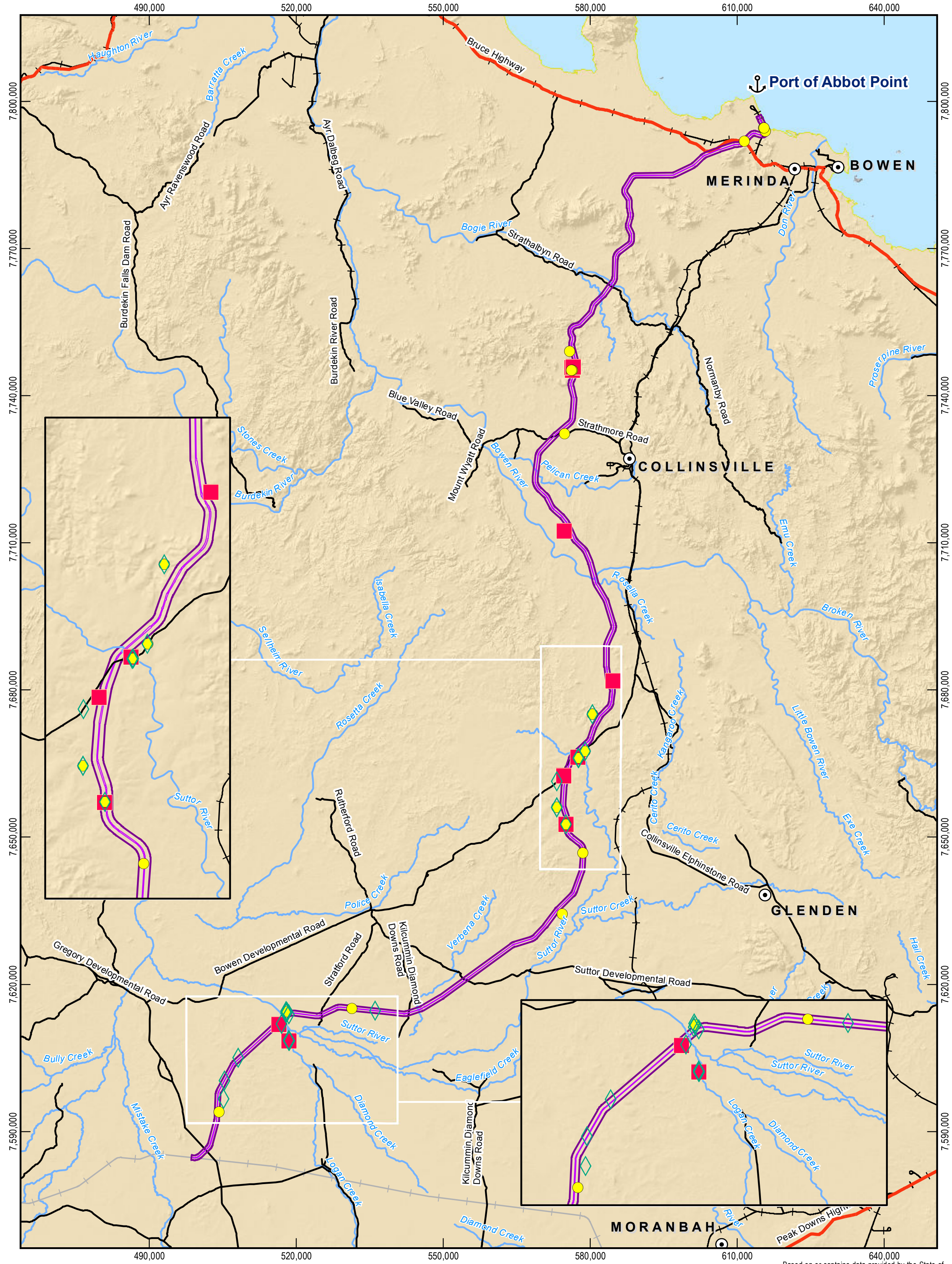
145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010, Regional Ecosystems/2011; GHD: Nocturnal Survey Sites/2013. Created by:MS



LEGEND

- Population Centres
- Major Port
- Ornamental snake
- Black-throated finch
- Koala
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Kilometres

Horizontal Datum: WGS 1984
Grid: GCS WGS 1984

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North Galilee Basin Rail Project

Threatened species survey locations

Job Number	41-26457
Revision	B
Date	26 Sep 2013

Figure 7-19

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145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010; GHD: Targeted Species Survey Sites/2013. Created by:MS

7.4.3.3 Aquatic flora and fauna assessment

The preliminary investigation corridor mainly traverses the Burdekin River Basin and Don River Basin. The Burdekin River Basin can be divided into three dominant catchments (namely the Suttor River, Bowen River and lower Burdekin River) (Figure 7-20). Aquatic survey sites were selected to provide data that represented the diverse range of aquatic habitats in the preliminary investigation corridor – such sites included artificial dams, wetlands, drainage lines, small streams and rivers. A site assessment of waterways took place between 7 and 9 May 2013. The watercourses listed in Table 7-23 were assessed (note that watercourses may have been assessed in a number of places, and that this table does not include isolated waterbodies (e.g. farm dams and gilgais)). Locations of aquatic habitat assessment sites are presented in Figure 7-21 (overview), Figure 7-22 (northern section of preliminary investigation corridor), and Figure 7-23 (southern section of preliminary investigation corridor). Coordinates for each survey site are provided in Appendix A of Volume 2 Appendix F Nature conservation (page 187).

Table 7-23 Aquatic ecology watercourse survey sites

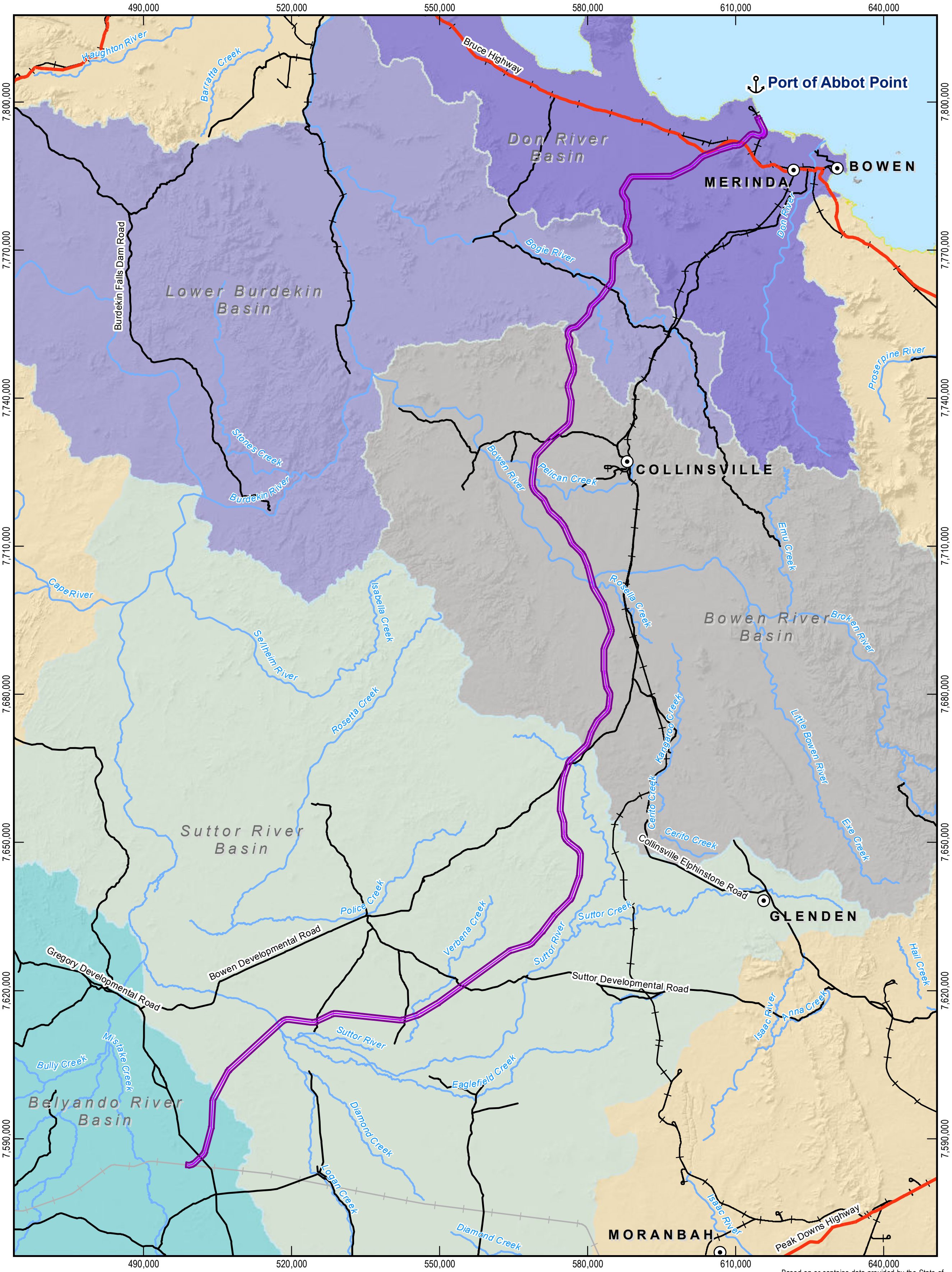
River Basin	Catchment	Watercourse
Burdekin River Basin	Suttor River	Suttor River Gunn Creek Rockingham Creek Lily Creek
	Bowen River	Bowen River Pelican Creek Five Mile Creek Strathmore Creek Oaky Creek
	Lower Burdekin River	Sandy Creek Bogie River
Don River Basin	-	Splitter's Creek Tabletop Creek Maria Creek Six Mile Creek Saltwater Creek

A field survey was conducted to identify aquatic flora, fauna and habitat characteristics specific to the preliminary investigation corridor and wider study area. For the purposes of the aquatic ecology assessment, aquatic fauna species were defined to include fish, freshwater turtles, crocodiles and freshwater macroinvertebrates. Aquatic habitat assessments were undertaken to describe the aquatic ecosystems in terms of habitat diversity and extent, suitability for aquatic fauna groups, sensitivity to change, existing disturbances/modifications or barriers, riparian condition and flow characteristics. Assessments were made regardless of whether surface water was present. Where the site was a dam or small lake, an assessment was made of the entire waterbody, where possible. For large lakes and wetlands, an assessment was made of a

100 m section of the margin of the area. All sites were assessed using Queensland River Assessment System protocols. Recorded key features included:

- Aquatic flora and fauna observations
- Substrate type and composition
- Surface water depth
- Type and availability of habitat structure (e.g. woody debris)
- Riparian zone characteristics
- Pest flora and fauna
- Habitat attributes (e.g. macrophytes, substrate anoxia, trailing bank vegetation)
- Odour and turbidity
- Deposition, scouring and erosion
- Existing disturbances.

This information provided a characterisation of the aquatic ecology values for each site. Information gathered from desktop and field assessments was collated to determine and describe the existing aquatic ecological environment and the presence of conservation significant values. This information allowed for an understanding of the dynamics of the aquatic ecosystems present within the preliminary investigation corridor.



LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)

River Basins
- Belyando River
- Suttor River
- Bowen River
- Don River
- Lower Burdekin River

- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd
North Galilee Basin Rail Project

Job Number 41-26457
Revision A
Date 26 Sep 2013

Watercourse of relevance to the preliminary investigation corridor

Figure 7-20

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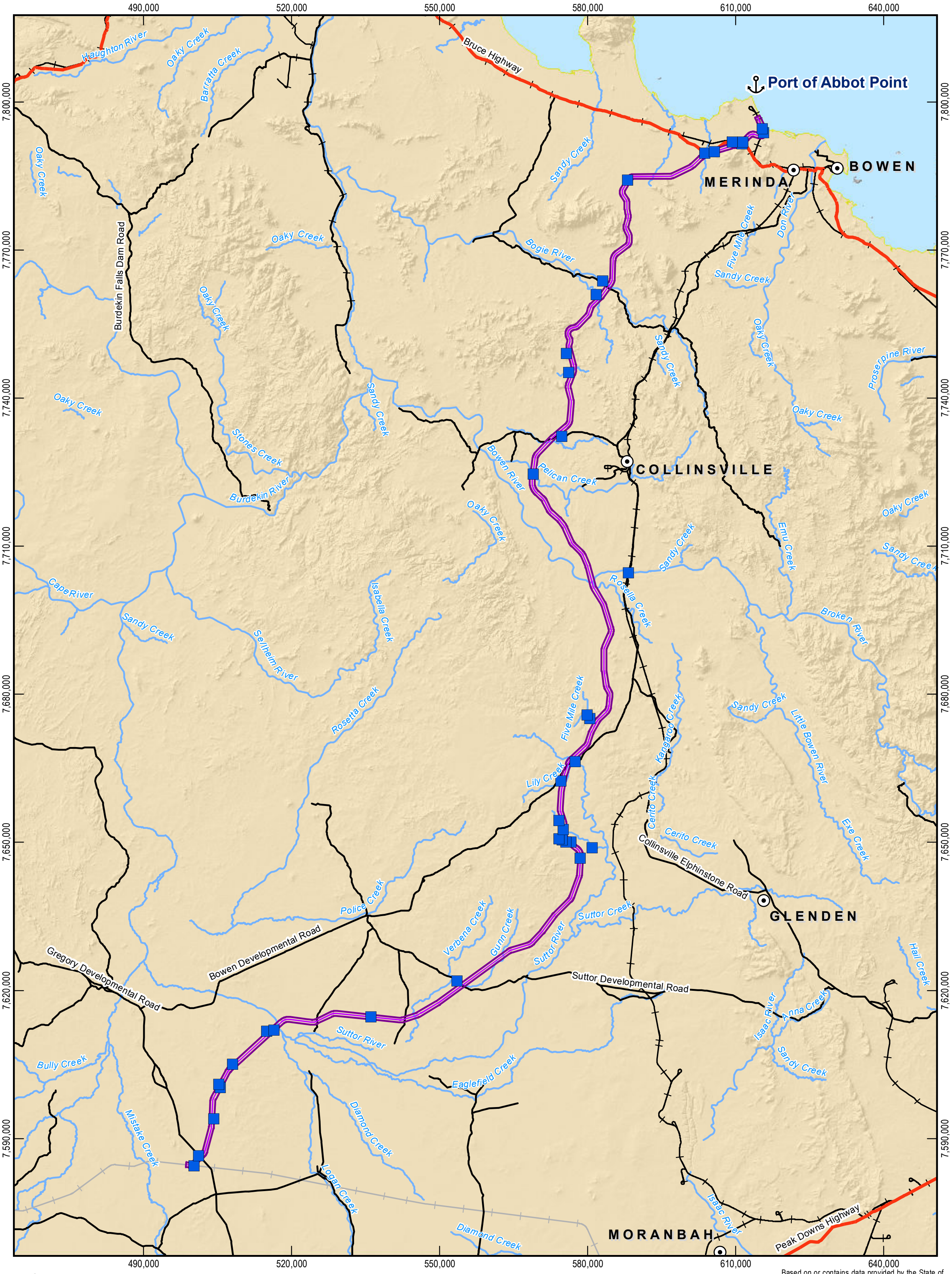
145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: River Basin (2010), Roads/2010. Created by:MS



LEGEND

- Population Centres
- Major Port
- Aquatic Habitat Assessment Sites
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses of Relevance
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd

North Galilee Basin Rail Project

Job Number	41-26457
Revision	A
Date	26 Sep 2013

Aquatic habitat assessment sites – overview

Figure 7-21

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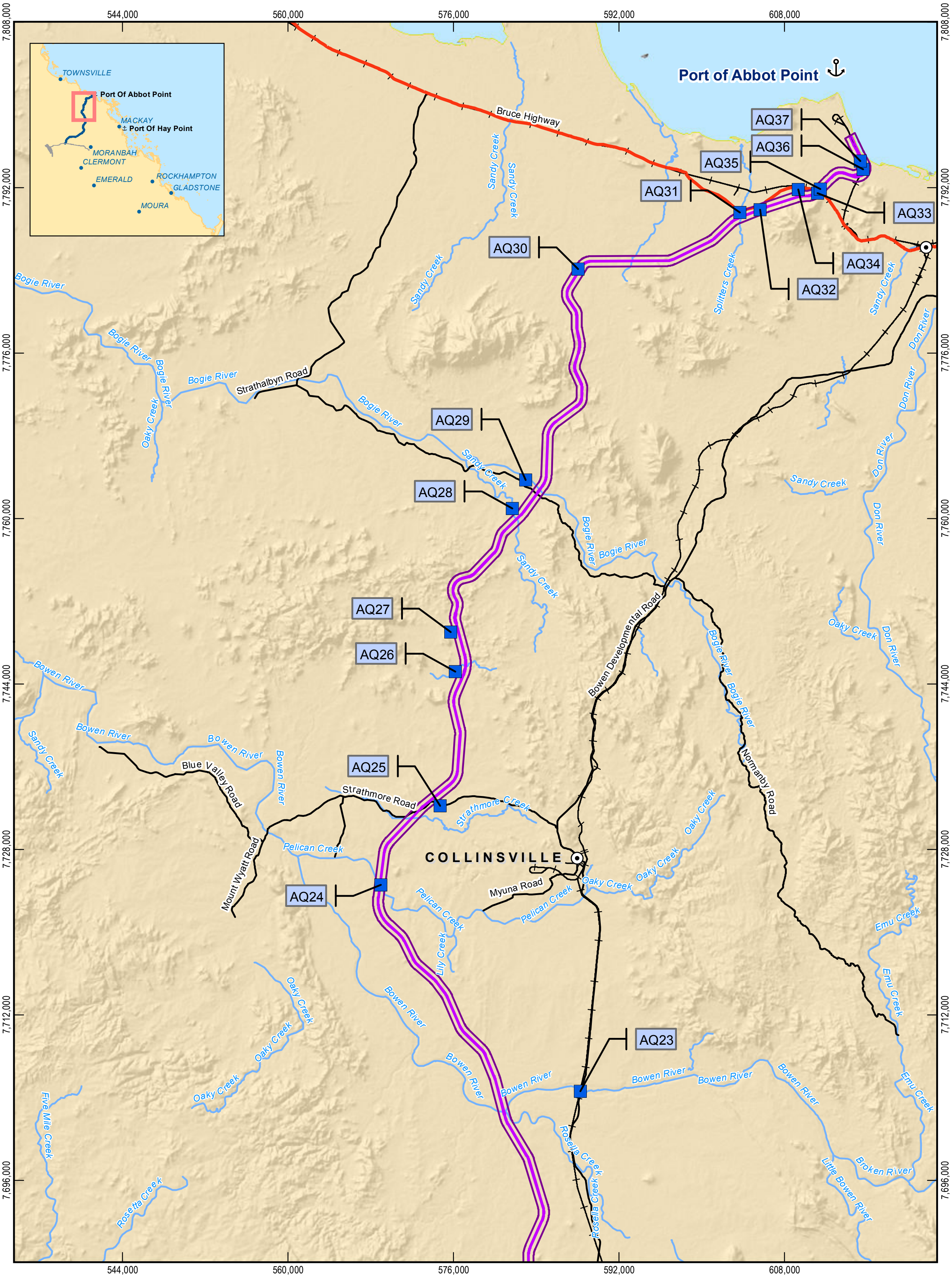
145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010; GHD: Aquatic Survey Sites/2013. Created by:MS



LEGEND

- Population Centres
- Major Port
- Aquatic Habitat Assessment (AQ) Sites
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses of Relevance
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd
North Galilee Basin Rail Project

Job Number	41-26457
Revision	B
Date	26 Sep 2013

Aquatic habitat assessment sites – northern section

Figure 7-22

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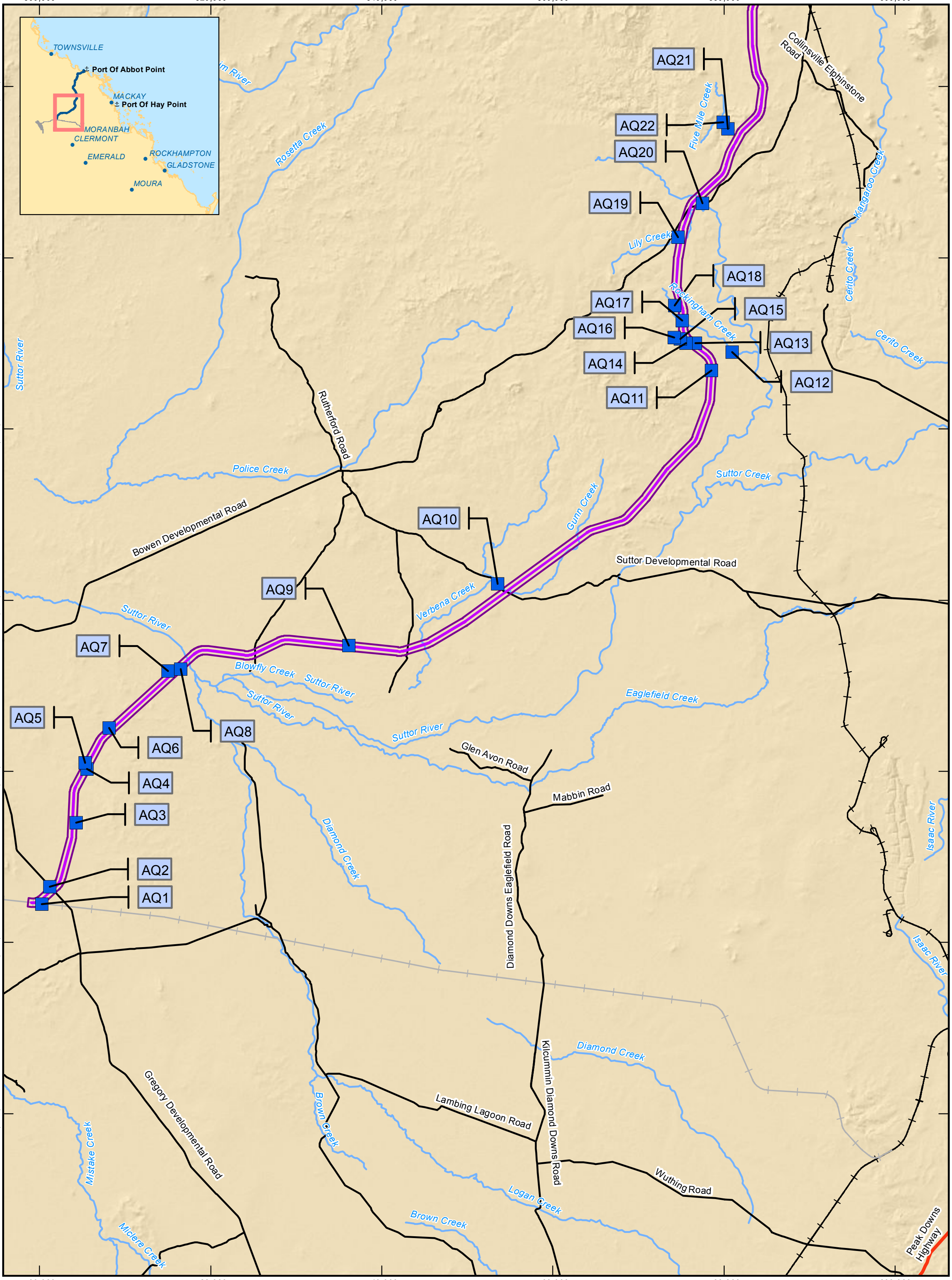
145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010;
GHD: Aquatic Survey Sites/2013. Created by:MS



LEGEND

- Population Centres
- Aquatic Habitat Assessment Sites
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses of Relevance
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:650,000 Paper Size A4

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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GHD adani

Adani Mining Pty Ltd
North Galilee Basin Rail Project

Job Number 41-26457
Revision B
Date 26 Sep 2013

Aquatic habitat assessment sites – southern section

Figure 7-23

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145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010; GHD: Aquatic Survey Sites/2013. Created by:MS

7.4.4 Likelihood of occurrence assessment

The ecological values identified during the desktop and field surveys were in turn used to develop a likelihood of occurrence assessment for conservation significant terrestrial flora and fauna species and communities, and for aquatic vertebrate species (i.e. for fish and aquatic reptiles), potentially present. The likelihood of occurrence assessments incorporated the following considerations for each given species and community:

- Known distribution
- Habitat preferences
- The presence and availability of suitable habitat in the preliminary investigation corridor
- Relative abundance
- Previous records from desktop sources
- Observations of the species in the preliminary investigation corridor.

For each given species, the likelihood of occurrence was assessed using the following categories:

- **Unlikely to occur:** species has not been recorded in the region (no records from desktop searches) AND/OR current known distribution does not encompass preliminary investigation corridor AND/OR suitable habitat is generally lacking within the preliminary investigation corridor
- **May occur:** species either has or has not been recorded in the region (desktop searches) although species' distribution incorporates preliminary investigation corridor AND potentially suitable habitat occurs in the preliminary investigation corridor
- **Likely to occur:** species has been recorded in the region (desktop searches) AND suitable habitat is present in the preliminary investigation corridor except where the species has a known highly restricted distribution and based on this distribution and knowledge of the project area, it is not considered to be likely to occur
- **Confirmed present:** species recorded during field surveys in the preliminary investigation corridor. Includes species recorded during field surveys carried out by others.

An additional likelihood of occurrence was assessed for threatened migratory marine species listed under the EPBC Act to determine whether these species were likely to occur in the wider study area using the following categories:

- **Unlikely to occur:** species has not been recorded in the region (no records from desktop searches) AND/OR current known distribution does not encompass wider study area AND/OR suitable habitat is generally lacking from the wider study area
- **May occur:** species either has or has not been recorded in the wider study area (desktop searches) although species' distribution incorporates wider study area AND potentially suitable habitat occurs in the wider study area (but may not be particularly abundant or optimal habitat)
- **Likely to occur:** species has been recorded in the region (desktop searches) AND suitable habitat is present in the wider study area (species determined to be 'likely to occur' are otherwise known to occur within the wider study area, and has suitable habitat present).

Species considered 'unlikely to occur' or 'may occur' have not been assessed further in this EIS, as significant impacts to these species are unlikely and the objective of the assessment is to focus on key issues that need to be taken into account during development of the NGBR Project (EIANZ, 2010).

7.4.5 Potential habitat mapping for threatened species

Predictive modelling of potential habitat for threatened species was undertaken due to the extensive size of the preliminary investigation corridor. Predictive modelling was completed for EPBC Act listed species that were confirmed present or considered likely to occur within the preliminary investigation corridor. For each threatened species, habitat attributes and data were identified based on known information about species' habitat, microhabitat preferences and their tolerance of disturbance. As a result of the predictive modelling, maps were created displaying the distribution of potential habitat for EPBC Act listed species. Where possible, potential habitat mapping was validated using field observations and publicly available sighting data.

Species mapping took into consideration the length of the preliminary investigation corridor and its context as a narrow corridor in a wider regional landscape.

As it was not possible to survey all habitats in the entire preliminary investigation corridor, potential habitat mapping was therefore based on observations made in representative habitats, in conjunction with predictive modelling. Consequently, potential habitat mapping should be considered to be indicative only and may not be verified in some areas.

The habitat modelling and mapping involved:

- Determining those EPBC Act listed flora and fauna species that were confirmed present during field surveys (or during the desktop assessment if evidence of presence was found) or assessed as likely to occur in the preliminary investigation corridor from the likelihood of occurrence assessment
- Identifying habitat attributes for listed species confirmed present or considered likely to occur within the preliminary investigation corridor, based on known information about species' habitat and microhabitat preferences and their tolerance of disturbance
- Acquiring data characterising habitat types which could be input into a predictive model, to allow for the mapping of the distribution of potential habitat for listed species. Available data included:
  - Certified RE mapping (i.e. approved by DEHP)
  - Altitude, slope and terrain data
  - Soil type data
  - Waterways and wetlands, including characteristics such as wetland type, whether or not these are artificial, extent of inundation
- Using a multi-criteria analysis to determine relative importance of various habitat characteristics such that a model of likely suitable habitat could be constructed using a GIS platform
- Where possible, validating the model output (for example potential habitat mapping) using appropriate point data such as field observations and publicly available sighting data.

7.4.6 Assessment of potential impacts

Environmental impact assessment is the process undertaken to identify, evaluate and mitigate potential environmental impacts of a proposed development. The approach employed for the NGBR Project involved:

- Defining the sensitivity of MNES
- Defining the potential impacts caused by the NGBR Project and their magnitude
- Identifying appropriate avoidance, mitigation and management measures to minimise the potential impacts
- Evaluating the significance of residual impacts in accordance with the Significance Impact Guidelines.

The MNES potentially impacted by the NGBR Project were defined through desktop based research, field surveys and preliminary consultation with state agencies, local councils, regional stakeholders and local communities.

To determine the magnitude of potential impacts from the NGBR Project, the scale of the impact, its geographic extent, duration, reversibility, additive or cumulative effects and likelihood of occurrence were considered. The significance of the impact was determined in accordance with the Significant Impact Guidelines.

In instances where limited baseline data was available, a conservative approach was taken by assuming the highest likely significance of impact. Any gaps in information and assumptions made in determining the worst impact have been clearly stated in the reporting, and mitigation measures have included recommendations for further studies, reassessment once further information becomes available or a robust monitoring program.

The development of mitigation and management aimed to:

- Be appropriate in terms of the effort and expense in relation to the scale and nature of the impact
- Target the protection and/or restoration of the systems/resources affected
- Respond to the impact following a mitigation hierarchy (i.e. avoid, minimise, rehabilitate, manage, offset /compensate).

Impacts that were considered significant (but not grounds for a fundamental re-design of the NGBR Project) have been addressed with a high level of mitigation that avoids, eliminates or makes provisions for full offsetting or compensation in advance and ensures that measures are demonstrably effective.

Conversely, for impacts that were not considered significant, mitigation by control of impacts through day to day management has been proposed with only occasional monitoring required as validation.

Once mitigation measures were identified, residual impacts were assessed. This was achieved through assessing and describing the effects of mitigation and subsequently, how the proposed measures will reduce the significance of the impact.

7.4.6.1 Threatened species

The assessment is based on the key concepts applied under the EPBC Act and defined in accordance with the Significance Impact Guidelines (DEWHA 2009c).

Endangered species

In determining the significance of the final rail corridor to an EPBC Act-listed endangered species, a ‘population’ is defined as an occurrence of the species in a particular area and can include:

- A geographically distinct regional population, or collection of local populations
- A population, or collection of local populations, that occurs within a particular region.

An invasive species is defined as an introduced species, native or exotic, which out-competes local native species for space and resources or which is a predator of native species.

Habitat critical to the survival of the species (or ecological community) refers to areas that are necessary:

- For activities such as foraging, breeding, roosting or dispersal
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- To maintain genetic diversity and long term evolutionary development
- For the reintroduction of populations or recovery of the species or ecological community.

Such habitat can include, but is not limited to habitat identified within recovery plans for species or ecological communities as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act.

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:

- Lead to a long term decrease in the size of a population
- Reduce the area of occupancy of the species
- Fragment an existing population into two or more populations
- Adversely affect habitat critical to the survival of a species
- Disrupt the breeding cycle of a population
- Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- Result in invasive species that are harmful to an endangered species becoming established in the endangered species’ habitat
- Introduce disease that may cause the species to decline
- Interfere with the recovery of the species.

Vulnerable species

For vulnerable listed species under the EPBC Act, an ‘important population’ is defined as a population that is necessary for species’ long term survival and recovery. This may include:

- Populations identified within recovery plans
- 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.

An action is likely to have a significant impact on a vulnerable species under the EPBC Act if there is a real chance or possibility that it will:

- Lead to a long term decrease in the size of an important population of a species
- Reduce the area of occupancy of an important population
- Fragment an existing population into two or more populations
- Adversely affect habitat critical to the survival of the species
- Disrupt the breeding cycle of an important population
- Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat
- Introduce disease that may cause the species to decline
- Interfere substantially with the recovery of the species.

7.4.6.2 Threatened ecological communities

Significance of impacts to threatened ecological communities were defined in accordance with the Significance Impact Guidelines.

An action is likely to have a significant impact on an endangered ecological community if there is a real chance or possibility that it will:

- Reduce the extent of an ecological community
- Fragment or increase fragmentation of an ecological community
- Adversely affect habitat critical to the survival of an ecological community
- Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns
- Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species
- Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:
  - Assisting invasive species, that are harmful to the listed ecological community, to become established, or
  - Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or
- Interfere with the recovery of an ecological community.

The following assessments are based on an understanding of the potential impacts to TECs as a result of the NGBR Project and proposed management and mitigation measures. These assessments are undertaken using the Significant Impact Guidelines criteria outlined above.

7.4.6.3 Migratory birds

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species
- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

7.5 Existing environment

The section provides a general overview of the existing environment along the NGBR Project final rail corridor and the surrounding region. Detailed existing environment information relevant to each controlling provision of the NGBR Project is provided in the following sections:

- World Heritage Properties and National Heritage Places (refer Section 7.6.2)
- Great Barrier Reef Marine Park (refer Section 7.7.2)
- Listed threatened species and communities (refer Section 7.8)
- Threatened ecological communities (refer Section 7.9)
- Listed migratory species (refer Section 7.10)
- Commonwealth marine areas (refer Section 7.12)

7.5.1.1 Regional overview

The NGBR Project preliminary investigation corridor traverses the Brigalow Belt bioregion and two river basins.

Brigalow Belt bioregion

The Brigalow Belt bioregion is a large, complex area covering approximately 365,326 km^2 of central Queensland, extending south from Townsville to Narrabri in New South Wales (Sattler and Williams 1999). The Brigalow Belt bioregion is characterised by brigalow (Acacia harpophylla) dominated forests and woodlands on clay soils (Sattler and Williams 1999). In addition to brigalow, other communities that characterise the bioregion are eucalypt forests and woodlands, grasslands, dry rainforests, cypress pine woodland and riparian communities (Sattler and Williams 1999).

The NGBR Project is located in the far north of the Brigalow Belt bioregion, traversing five subregions of the Brigalow Belt North bioregion (Townsville Plains, Bogie River Hills, Northern Bowen Basin, Wyarra Hills and Belyando Downs).

Burdekin River Basin

The Burdekin River Basin is the second largest river basin on the Queensland coast (NWC 2013) and covers approximately 130,109 km^2 (DEHP 2013b). The preliminary investigation corridor runs through the east of the basin, to the west of the Bowen Developmental Road and past Collinsville, ending 7.2 km from Mistake Creek. Cattle grazing is the dominant land use in the area and covers approximately 96 per cent of the basin (Dight 2009). Aquatic habitats in the area are diverse, and include ephemeral creeks and drainage lines, rivers, lakes and swamps, floodplains, wetlands and mangrove forests (DEHP 2013b).

The Burdekin River Basin is subject to strong seasonality with mean annual rainfall varying between 600 to 2,500 mm, falling predominantly during the wet season (Dight 2009; NWC 2013). Severe flooding occasionally occurs within the Burdekin River Basin as a result of severe storms, cyclones and tropical low pressure systems. However, prolonged dry conditions and drought are also characteristic of the basin.

Mean annual discharge from the basin (taken from the Clare Weir in the lower Burdekin River Basin) is approximately 9.4 million ML. This accounts for approximately one third of all coastal mean annual discharge into the Great Barrier Reef along the north Queensland coast (NWC 2013). The Burdekin River Basin can be divided into three dominant catchments of relevance to the preliminary investigation corridor, namely the Suttor River, Bowen River and Lower Burdekin River.

Don River Basin

The Don River Basin is located along the central coast of Queensland and is bounded by the Clarke Range. It covers an area of approximately 3,736 km^2 from Bowen to Home Hill, south of Ayr (DEHP 2013a). The preliminary investigation corridor runs through the centre of the basin to the north of the Don River catchment, finishing at the Port of Abbot Point where it connects with supporting infrastructure (rail loop/s and port infrastructure). Although the Don River catchment forms part of the Don River Basin, it is not traversed by the preliminary investigation corridor. The preliminary investigation corridor traverses the catchment parallel to the Don River catchment, and intersects many minor tributaries and flow paths within this basin.

Land use within the basin includes cattle grazing, horticulture and commercial fishing (DEHP 2013a). In addition, the Port of Abbot Point is an important industrial centre in the basin (NQBP 2013). The Don River Basin experiences relatively high rainfall with mean annual rainfall ranging from 1,000 to 1,600 mm (DEHP 2013a).

The basin supports a range of aquatic habitats, including coastal and sub-coastal floodplains, tree swamps, grass-sedge wetlands, mangroves and saltmarshes (DEHP 2013a). The major waterway within the basin relevant to the preliminary investigation corridor is the Elliot River (DEHP 2013a). Minor waterways of importance to the preliminary investigation corridor include Splitters Creek and Saltwater Creek.

7.5.1.2 Preliminary investigation corridor

Landuse

The majority of the preliminary investigation corridor occurs within the Whitsunday Regional Council Local Government Area (LGA), with the southern portion occurring within the Isaac Regional Council LGA, and the northern portion occurring in the Abbot Point State Development Area. The main residential areas occur in the towns of Moranbah, Collinsville and Bowen, which are over 18 km from the NGBR Project final rail corridor. Properties traversed by the final rail corridor include leasehold lots, freehold lots and one lot deemed to be ‘Unallocated State Land’, totalling 64 properties (individual lots). Land use is predominantly for the purposes of cattle breeding and fattening. Towards the Port of Abbot Point, the NGBR Project traverses land designated for industrial use including port handling activities and environmental buffers.

The NGBR Project traverses tenements comprising exploration permits for coal, minerals and petroleum however does not cross any existing mining lease or mineral development licence areas. The NGBR Project final rail corridor intersects a State-controlled road or local road at 15 locations, and intersects 54 occupational (private) tracks. Rail transport networks also exist in the vicinity of the NGBR Project, namely the North Coast Line and Newlands rail system. The final rail corridor is situated to the west of the Newlands rail system, primarily interacting with this rail service and the North Coast Line via grade-separated crossings towards Abbot Point.

The study area has little existing anthropogenic lighting influences, with the exception of areas in the vicinity of existing roads, mines, rail lines and port infrastructure. Twenty-three potential sensitive receptors (homesteads) are located within six kilometres of the preliminary investigation corridor. The nearest sensitive receptor to the centreline of the NGBR Project final rail corridor is approximately 1.1 kilometres away.

Topography

A range of landscape features will be intersected by the final rail corridor. Distinctive topographical features from north to south include the coastal floodplain, Clarke Range, Bowen River Valley, Leichhardt Range and the Suttor River floodplain. Geology is varied in the study area and is closely related to topography and soil type.

Water resources

Four major catchment areas traversed by the NGBR Project, namely the Suttor River, Bowen River and Lower Burdekin River catchments (all within the Burdekin Basin), and the Don River Basin. Waterway hydrology is mainly influenced by the pattern of rainfall in the catchment areas. While there are more flow events in the wet season, periods of zero flow can occur in any month of the year. Large, short duration flood events, which can occur anytime from November to May, dominate the discharge regime and long-term flow averages. Waterways along the preliminary investigation corridor are predominately set within rural or semi-rural/bushland settings and have been substantially modified over time by land clearance and other agricultural practices. Catchment changes due to land clearance include increased runoff, increased drainage density, and increased erosion and sediment yields within the catchment.

Groundwater use in these areas ranges from domestic supply, irrigation and agriculture and mining, to applications in the local sugar industry. Assessment of surface water quality identified land use as a primary factor of influence on water quality parameters at a local scale, in particular cattle in waterholes and riparian vegetation known to be particularly degrading to water quality.

In total, 16 major and moderate waterways and approximately 120 minor waterways are intersected by the preliminary investigation corridor. Disturbance from cattle and pigs is common within aquatic habitats along the preliminary investigation corridor, particularly around farm dams.

The preliminary investigation corridor, due to its 1,000 m width, crosses the western part of the DIWA listed Abbot Point – Caley Valley Wetland however, the final rail corridor is not expected to enter any part of this wetland.

No other DIWA listed wetlands occur within the preliminary investigation corridor; however, the Southern Upstart Bay wetland and Bowen River: Birralee – Pelican Creek wetland are within 4.5 km and 2.6 km respectively. All other DIWA listed wetlands are more than 20 km from the preliminary investigation corridor.

The Caley Valley Wetland is also identifed as a wetland of high ecological significance in Great Barrier Reef catchments under SPP 4/11 and is identified as wetland protection area. The SPP 4/11 outlines a code for assessing prospective developments that are planned in wetlands of high ecological significance and is discussed further in Volume 1 Chapters 6 Nature conservation.

The Caley Valley Wetland was modified from its natural state using the strategic placement of bunds to retain surface water and increase ponding. A number of creeks drain directly into the Caley Valley Wetland, including Spring Creek, Tabletop Creek, Main Creek, Mount Stuart Creek, Saltwater Creek, Goodbye Creek and Six Mile Creek. The wetland drains into Abbot Bay and the Great Barrier Reef. A narrow band of coastal dunes create a barrier between the beach and the wetland. The wetland itself is vast, with the total catchment approximately 76,750 ha (GHD 2009).

Climate

Existing climatic conditions relevant to NGBR Project based on Bureau of Meteorology (BOM) climatic stations indicate long-term monthly mean temperatures observed at the inland sites show that daytime summer temperatures mostly range between 29 and 38 °C, with winter overnight temperatures dropping ranging between 3 and 16 °C. Temperatures in the inland region vary between -3.2 °C and 44.4 °C.

Long-term rainfall records indicate annual rainfall decreases with distance inland from the coast, with potential for short duration flood events between September and May. The mean annual rainfall at all sites is dominated by the wet season (December to March). The prevailing trade winds in this geographical location are south-east.

Cultural heritage

A contextual study of environment, land use, historic data and archaeological evidence indicates that Indigenous cultural heritage places are likely to occur within the study area, with particularly high concentrations expected upon raised terraces overlooking the many permanent fresh water sources that are traversed by the final rail corridor. However, the NGBR Project does not cross any known non-Indigenous cultural heritage sites.

Existing threatening processes

The landscape in which the preliminary investigation corridor occurs has been historically, and continues to be, exposed to a diverse array of threatening processes. Sattler and Williams (1999) identified continued vegetation clearing, high total grazing pressure and exotic species as the major threats to biodiversity in the Brigalow Belt bioregion. Other threatening processes impacting upon biodiversity include baiting, disease, vehicle collisions with wildlife, inappropriate fire regimes, linear infrastructure development, mining and urban development.

These threatening processes are mostly related to the land use in the Brigalow Belt bioregion. Historical vegetation clearing has occurred in parts of the landscape to facilitate agricultural and mining industries, and associated infrastructure (such as roads and railways). Vegetation clearing has resulted in direct mortality of flora and fauna, habitat loss, habitat fragmentation and the erosion and sedimentation of watercourses. The introduction of non-indigenous grazing animals (mainly cattle) has resulted in terrestrial and aquatic habitat degradation throughout the preliminary investigation corridor. The presence and abundance of feral animals and exotic plants is reflected in the management practices of properties throughout the preliminary investigation corridor. In general, riparian areas throughout the landscape are particularly susceptible to weed invasion, with a number of weed infestations noted. Introduced fauna or evidence of introduced fauna is common, particularly in riparian areas surrounding watercourses.

7.6 World Heritage properties and National Heritage places

7.6.1 Overview

7.6.1.1 World Heritage properties

A ‘declared World Heritage property’ (WHP) is an area that has been included in the World Heritage list or declared by the minister to be a WHP (DEWHA 2009). WHPs are places with natural or cultural heritage values which are recognised to have outstanding universal value (OUV).

In order for a site to be included on the World Heritage list, sites must be of outstanding universal value (OUV) and the World Heritage Committee (of the United Nations Educational, Scientific and Cultural Organization – UNESCO) must find that it meets one or more of the following criteria (SEWPaC 2008):

Criteria 7. to represent a masterpiece of human creative genius

Criteria 8. to exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design

Criteria 9. to bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared

Criteria 10. to be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history

Criteria 11. to be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change

Criteria 12. to be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance. (The Committee considers that this criterion should preferably be used in conjunction with other criteria)

Criteria 13. to contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance

Criteria 14. to be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features

Criteria 15. to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals

Criteria 16. to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation

7.6.1.2 National Heritage places

For a place to be considered a National Heritage Place (NHP) and included in the National Heritage List the place must meet one or more of the National Heritage criteria; the National Heritage criteria for a place include any or all of the following (AHC 2009):

a. the place has outstanding heritage value to the nation because of the place's importance in the course, or pattern, of Australia's natural or cultural history

b. the place has outstanding heritage value to the nation because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history

c. the place has outstanding heritage value to the nation because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history

d. the place has outstanding heritage value to the nation because of the place's importance in demonstrating the principal characteristics of:

    (i) a class of Australia's natural or cultural places; or

    (ii) a class of Australia's natural or cultural environments;

e. the place has outstanding heritage value to the nation because of the place's importance in exhibiting particular aesthetic characteristics valued by a community or cultural group

f. the place has outstanding heritage value to the nation because of the place's importance in demonstrating a high degree of creative or technical achievement at a particular period

g. the place has outstanding heritage value to the nation because of the place's strong or special association with a particular community or cultural group for social, cultural or spiritual reasons

h. the place has outstanding heritage value to the nation because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history

i. the place has outstanding heritage value to the nation because of the place's importance as part of Indigenous tradition.

7.6.2 Existing environmental values

There are no WHPs or NHPs directly intersected by the final rail corridor. Despite this, there is the potential that the NGBR Project may indirectly impact on WHPs or NHPs due to hydraulic connectivity with watercourses intersected by the final rail corridor. Two WHPs and one NHP have been identified as of potential relevance to the NGBR Project, these include:

- The Wet Tropics World Heritage Area (WTWHA)
- The Great Barrier Reef World Heritage Area (GBRWHA) and National Heritage Place (GBRNHP).

The location of these sites in relation to the NGBR Project is shown on Figure 7-24; the existing environmental values of each are discussed further below.

7.6.2.1 Wet Tropics World Heritage Area

The WTWHA is located over 300 km north of the final rail corridor and is outside the Burdekin River Basin and the Brigalow Belt Bioregion, with no direct or indirect terrestrial, aquatic or biodiversity links to the final rail corridor (refer to Figure 7-24). The WTWHA is, therefore, not hydrologically or regionally connected to the final rail corridor and, as such, there is no ecological connection between the final rail corridor and the WTWHA. No influences from the NGBR Project are predicted to occur on the WTWHA and this site has not been considered further within this assessment.

7.6.2.2 Great Barrier Reef World Heritage Area and National Heritage place

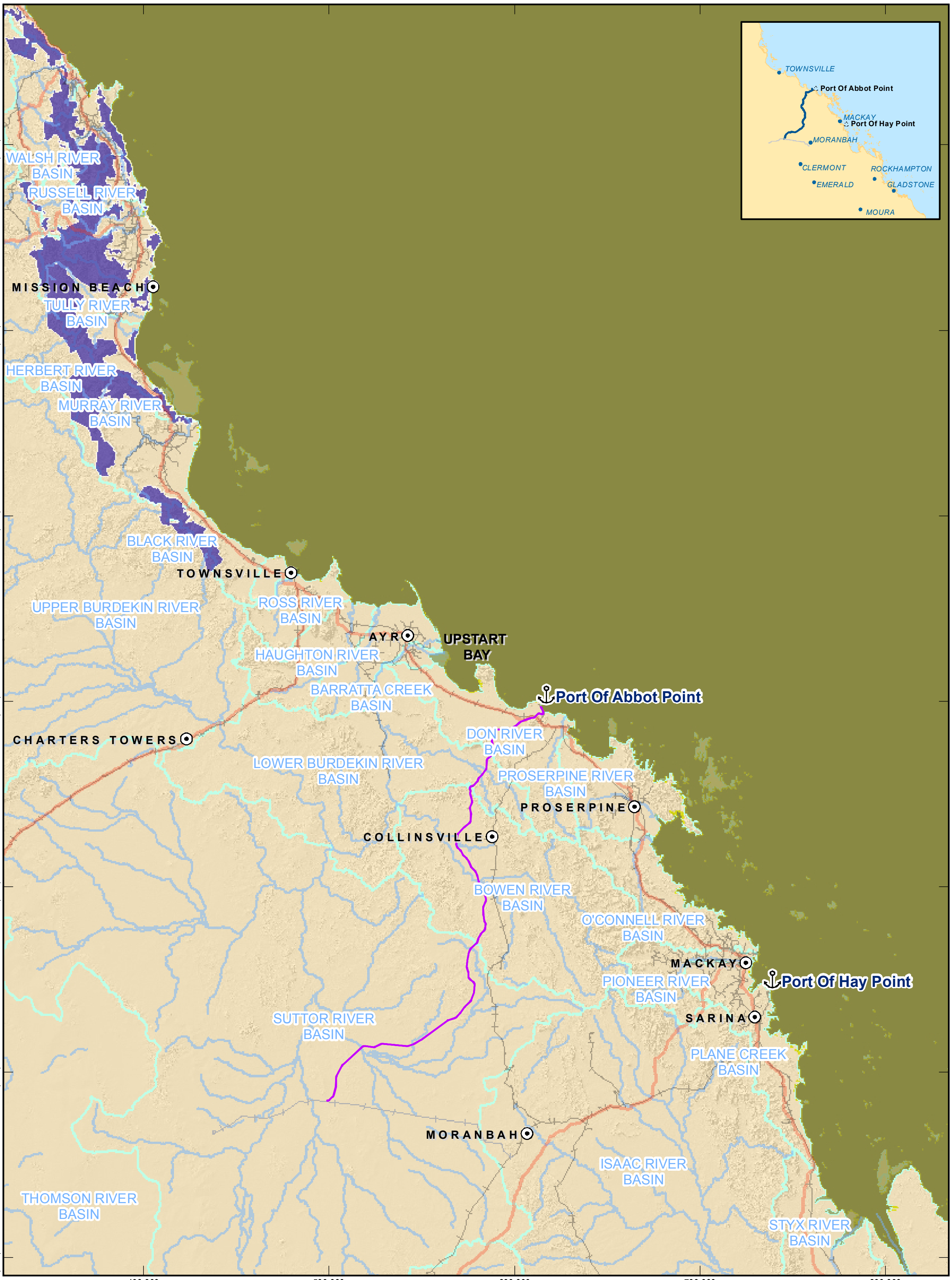
The GBRWHA has been identified as being of relevance to the study area. The GBRWHA is not directly intersected by the final rail corridor, however may be subject to indirect impacts due to the hydrological connection of the watercourses crossed by the final rail corridor.

The GBRWHA lies within 500 m of the northern-most part of the final rail corridor near the Port of Abbot Point (refer to Figure 7-25). The final rail corridor crosses watercourses (including the Bowen River, Bogie River and Suttor River) which discharge indirectly into the GBRWHA via the Lower Burdekin River. The majority of the final rail corridor is within the Burdekin River Basin, which discharges directly to the GBRWHA near the town of Ayr, into Upstart Bay (refer to Figure 7-24).

The final rail corridor also intersects a number of perennial and ephemeral streams (Elliot River, Saltwater Creek and Splitters Creek, among others) within the Don River Basin, which flow directly into Abbot Bay or into the Caley Valley Wetland, which subsequently discharges into Abbot Bay and the GBRWHA.

This section outlines the existing environmental values associated with the GBRWHA with the potential to be impacted by the NGBR Project; these have been characterised into the following components:

- The outstanding universal values of the GBRWHA
- The existing World Heritage values at Abbot Point
- The National Heritage criteria of the GBRNHP
- The existing marine environment at Abbot Point.



LEGEND

- Population Centres
- Major Port
- North Galilee Basin Rail 100m Corridor
- Highway
- Carmichael Mine Project Rail
- Railway
- Watercourse (Major)
- Great Barrier Reef World Heritage Area
- Wet Tropics World Heritage Area
- River Basin
- islands

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Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd
North Galilee Basin Rail Project

World Heritage Properites

Job Number	41-26457
Revision	A
Date	12 Nov 2013

Figure 7-24

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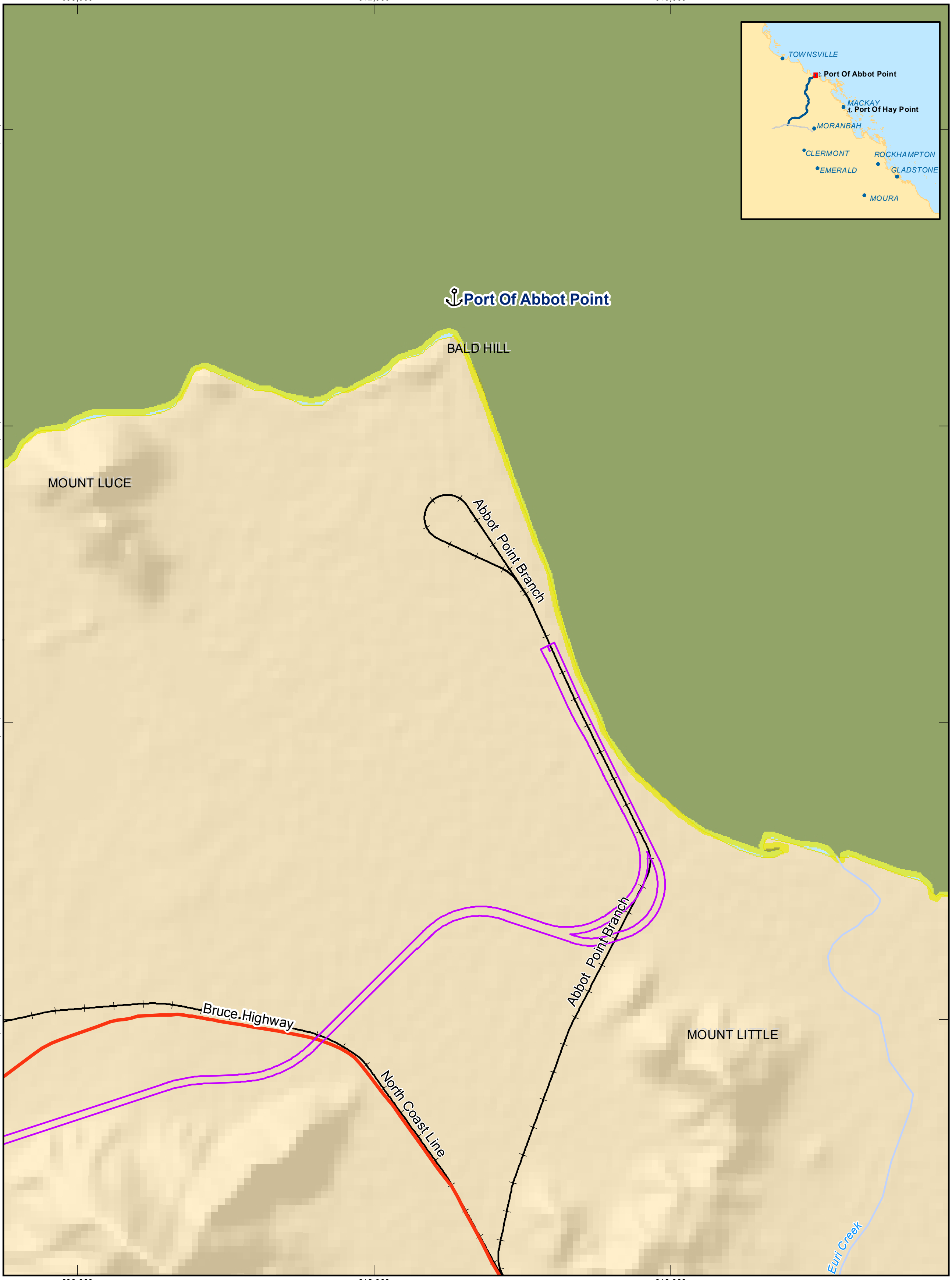
Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010, World Heritage Area/2010, River Basins/2010. Created by:MS



LEGEND

Population Centres
Major Port
Highway
Main Road
Carmichael Mine Project Rail
Railway
Watercourse (Major)
Watercourse (Minor)
Great Barrier Reef World Heritage Area
North Galilee Basin Rail 100m Corridor

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Great Barrier Reef
World Heritage Area

Job Number	41-26457
Revision	A
Date	12 Nov 2013

Figure 7-25

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Level 9, 145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010, World Heritage Areas/2010. Created by:MS

Outstanding universal values - GBRWHA

The Great Barrier Reef (GBR) is 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 (SEWPaC 2012b). The GBRWHA was designated in 1981 in recognition of containing the following OUVs:

Criteria vii Contains superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.

Criteria viii Outstanding example representing major stages of the earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features.

Criteria ix Outstanding example representing significant on-going ecological and biological processes in the evolution and development of terrestrial, freshwater, coastal and marine ecosystems and communities of plants and animals.

Criteria x Contains the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

The full official 'Statement of Outstanding Universal Value' for the GBRWHA can be accessed in its entirety online at http://www.environment.gov.au/node/19766 (DotE 2013). Table 7-24 identifies examples of attributes relevant to each of these OUVs. These attributes are representative examples of each OUV and are not considered to be exhaustive.

Table 7-24 Key examples of World Heritage attributes for the GBR (GBRMPA, 2013)

World Heritage Criteria	Example attributes
Criterion vii Contain unique, rare or superlative natural phenomena	- Vast mosaic patterns of reefs providing an unparalleled aerial panorama of seascapes and landscapes for example, Whitehaven Beach, Whitsunday islands, Hinchinbrook Island - One of the few living structures visible from space - Beneath the ocean surface, there is an abundance of shapes, sizes and colours, including spectacular coral assemblages (hard and soft corals) and >1,500 species of fish - Globally important breeding colonies of seabirds and marine turtles, including Raine Island, the world's largest green turtle breeding area - Superlative natural phenomena include the annual coral spawning, migrating whales, and significant spawning aggregations of many fish species
Criterion viii Outstanding example representing major stages of the earth's history	- Forms the world's largest coral reef ecosystem, extending over 14 degrees of latitude - Globally outstanding example of an ecosystem that has evolved over millennia - Environmental history recorded in the reef structure; for example, climatic conditions over many hundreds of years can be seen in old massive coral cores - Comprises about 3000 separate coral reefs, ranging from inshore fringing reefs to mid shelf reefs and shoals, exposed outer reefs and deep water reefs, including

World Heritage Criteria	Example attributes
	examples of all stages of reef development - Deep water features of the adjoining continental shelf includes canyons, channels, plateaux and abyssal plains
Criterion ix Outstanding example representing significant on-going ecological and biological processes	- Globally significant diversity of reef and island morphologies reflecting on-going geomorphic, oceanographic and environmental processes - Complex cross-shelf, longshore and vertical connectivity influenced by dynamic oceanic currents and ongoing ecological processes such as upwellings, larval dispersal and migration - Over 900 islands and cays; around 600 are continental (high) islands, 300 are coral cays in various stages of geomorphic development, with the remaining islands comprising mangrove islands that provide important ecological services - An ecosystem that has evolved over millennia with evidence of the evolution of hard corals and other fauna - Globally significant marine faunal groups include over 4000 species of molluscs; over 1500 species of fish; plus a great diversity of sponges, anemones, marine worms, crustaceans, and many others - Man's interaction with the natural environment illustrated by strong ongoing links between Aboriginal and Torres Strait Islanders and their sea country, including numerous shell deposits (middens) and fish traps, plus the application of story places and marine totems
Criterion x Contains the most important and significant natural habitats for in-situ conservation of biological diversity	- One of the richest and most complex natural ecosystems on earth, and one of the most significant for biodiversity conservation - Amazing diversity supports tens of thousands of marine and terrestrial species, many of which are of global conservation significance - Some 39 species of mangroves comprising 54 per cent of the world's mangrove diversity - ~ 43,000 km^2 of seagrass meadows in both shallow and deep water areas, including 23 per cent of known global species diversity - Habitat for one of the world's most important dugong populations and six of the world's seven species of marine turtle - A breeding area for humpback whales, with at least 30 other species of whales and dolphins also identified - 70 bioregions (broad-scale habitats) identified comprising 30 reef bioregions and 40 non-reefal bioregions; including algal and sponge gardens, sandy and muddy bottom communities, continental slopes and deep ocean troughs - The reef bioregions contain one third of the world's soft coral and sea pen species (80 species) - 2000 species of sponges equalling 30 per cent of Australia's diversity in sponges - 630 species of echinoderms (for example sea stars) equalling 13 per cent of the known global diversity

For the purpose of this assessment, the relevance of each GBRWHA attribute to the NGBR Project has been assessed to determine whether the NGBR Project will have a significant impact on the OUVs of the GBRWHA; this is discussed in Section 7.6.3. It is noted that the components of the GBR within the GBRWHA are also within the boundaries of the Great Barrier Reef Marine Park (GBRMP); subsequently the areas of sensitive marine habitat managed under the provisions of the GBRMP are also considered to be an OUV. An assessment of the impacts of the NGBR Project on the existing marine environment and the GBRMP is provided in Section 7.7.3.

World Heritage Values at Abbot Point

A total of 29 natural heritage attributes were identified as contributing to the OUV of the GBRWHA (Lucas *et al*. 1997), three of which have been identified as relevant to Abbot Point (Eco Logical Australia (ELA) and OpenLines 2012).

These attributes are discussed in more detail below and include:

- Aesthetic attributes
- Migratory birds
- Marine mammals.

These are discussed in more detail below.

Other natural heritage attributes are present in the vicinity of Abbot Point however it was considered that these attributes were not present at a scale or value that was relevant to the GBRWHA as a whole (ELA and OpenLines 2012).

Aesthetic Attributes

The aesthetic attributes and values of Abbot Point were assessed as part of the Abbot Point Cumulative Impact Assessment (CIA) undertaken in 2012 (ELA and OpenLines 2012). The assessment determined that Abbot Point contains an existing industrial port and evidence of historical agricultural development. Subsequently, it was determined that Abbot Point did not encompass an ‘area of exceptional beauty’ in accordance with criterion 7 of the World Heritage Convention.

Migratory Birds

The Caley Valley wetland provides habitat aggregations of migratory shorebirds and other waterbirds including threatened and migratory species. The wetland is not located within the boundaries of the GBRWHA however, due to its proximity, there is a high likelihood of hydrological connectivity between the two areas. Additionally, it has been suggested that the bird species which utilise the Caley Valley wetland are likely to use the beach and intertidal habitat within the adjacent GBRWHA for foraging (ELA and OpenLines 2012). As shown in Figure 7-25, the final rail corridor intersects the south-eastern extent of the Caley Valley wetland and therefore has the potential to impact the ecological functions of the area (refer to Section 7.6.3).

Further detail regarding the existing diversity of migratory birds potentially impacted by the NGBR Project is provided in Section 7.10.

Marine Mammals

The Coral Sea adjacent to Abbot Point provides foraging habitat and acts as a transitory area for a number of marine mammals. Abbot Point is deemed to contain habitat for inshore dolphin species including the Indo-Pacific humpback and Australian snubfin dolphin, as well as habitat for dugongs (ELA and OpenLines 2012). The Coral Sea adjacent to Abbot Point also provides a transitory area for humpback whales undertaking annual migrations.

Further detail regarding the existing diversity of migratory mammals potentially impacted by the NGBR Project is provided in Section 7.10.

7.6.2.3 National Heritage criteria – GBRNHP

The GBR is 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 (SEWPaC 2012b). 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.

In accordance with Ministerial Determination S99 (21 May 2007), the GBR has both World Heritage Values and corresponding National Heritage Criteria. The National Heritage Criteria ascribed to the GBRWHA are (from Ministerial Determination S99):

- The place has outstanding heritage value to the nation because of the place's importance in the course, or pattern, of Australia's natural or cultural history
- The place has outstanding heritage value to the nation because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history
- The place has outstanding heritage value to the nation because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history
- The place has outstanding heritage value to the nation because of the place's importance in demonstrating the principal characteristics of:
  - A class of Australia's natural or cultural places
  - A class of Australia's natural or cultural environments
- The place has outstanding heritage value to the nation because of the place's importance in exhibiting particular aesthetic characteristics valued by a community at a particular period.

For the purpose of this assessment, the relevance of each National Heritage criteria has been assessed to determine whether the NGBR Project will have a significant impact on the National Heritage values of the GBRNHP; this is discussed in Section 7.6.3.

Existing marine environment at Abbot Point

Within the GBRWHA, GBRNHP and the wider study area (i.e. outside of the 1,000 m preliminary investigation corridor), the marine environment between Upstart Bay and Abbot Bay is characterised by a heterogeneous habitat matrix of soft-sediment, rocky reef, coral, seagrass and algae (GHD 2012). Previous studies have identified that the benthic communities within the marine environment between Upstart Bay and Abbot Bay are of low diversity and the patchiness of these communities occurs at a scale of tens of metres (GHD 2010, CDM Smith 2012, ELA and OpenLines 2012).

Seagrasses at Abbot Point are generally low density and highly dynamic, with changes in density and distribution being influenced by seasonality and major weather events. The direct value of seagrass habitat for fisheries production in the Abbot Point region is reported to be significantly less than other areas in central and northern Queensland (GHD 2010, GHD 2012, CDM Smith 2012, ELA and OpenLines 2012).

The marine environment adjacent to the coastline is shallow and punctuated by creek mouths, mud flats and mangrove habitats. Despite the variable (and occasionally relatively high) turbidity and sediment loads, seagrass occurs throughout most of the marine environment between Upstart and Abbot Bays at densities that vary seasonally and temporally, from very low to medium density meadows (McKenna *et al*. 2008). Algal communities are more common but also in very low prevalence (GHD 2010). In a regional context, the benthic communities found within the wider study area are not unique.

The low density seagrass beds found in the area are expansive and provide a direct and indirect foraging habitat for numerous key marine fauna species. The waters within Upstart and Abbot Bays provide a habitat that has been observed to support a resident marine turtle population and dugong and dolphin species on a semi-permanent basis (GHD 2010).

The existing landscape at Upstart Bay and Abbot Bay comprises open beach to partially sheltered beaches with sand overlying rock to the west of Abbot Point, to sandy beaches that are part of a large estuary west of Mount Luce. Mangroves are present in Upstart Bay at the mouth of the Burdekin River and Nobbies Inlet. Mangroves are also present along the Elliot River and Mount Stuart Creek, which discharge into Abbot Bay (GHD 2010).

The near-shore coastal environments exhibit a high degree of temporal variability and to a lesser degree, spatial variability in water quality parameters; this is primarily a result of the marked influence of waves, currents and local discharges from rivers and creeks within shallow coastal environments (De'ath 2007, De'ath and Fabricius 2008).

Previous studies at Abbot Point have determined that the high degree of seasonality in rainfall in the region influences fluctuations in turbidity, total suspended solids (TSS) and salinity, whereby increased runoff and freshwater inputs result in increased suspended solids in the water column and reduced salinity and pH (GHD 2010, ELA and OpenLines 2012). A number of the parameters recorded showed results exceeding Australian and New Zealand Environment Conservation Council (ANZECC), Great Barrier Reef Marine Park (GBRMP) and/or Queensland water quality (QWQ) guidelines. These exceedances primarily comprised TSS, nutrients and dissolved oxygen (DO) and, at a lesser frequency, chlorophyll *a* and pH during the wet season.

Previous surveys at Abbot Point have identified a number of marine migratory species protected under the EPBC Act, including species of birds, turtles, whales and dolphins (GHD 2010); these are discussed further in Section7.10. Marine megafauna studies have identified at least 14 different species in the Abbot Point area (GHD 2009). Previous bird surveys have identified 59 EPBC Act listed migratory and marine bird species primarily associated with the Caley Valley wetland, many of which occur outside the World Heritage Area (GHD 2010, BAAM 2012); this is discussed further in Section 7.10.

7.6.3 Potential impacts and mitigation

7.6.3.1 Overview

This section discusses the outcomes of the assessment undertaken to determine the significance of the potential impacts of the NGBR Project on the values of the GBRWHA and GBRNHP. The assessment has been undertaken in accordance with the criteria outlined in the Significant Impact Guidelines. This section addresses the potential direct and indirect impacts of the NGBR Project only; cumulative and consequential impacts (e.g. in relation to shipping) are discussed in Section 7.13.

These criteria state that an action is likely to have a significant impact on the World Heritage values / National Heritage values of a declared WHA / NHP if there is a real chance or possibility that it will cause:

- One or more of the World Heritage / National Heritage values to be lost
- One or more of the World Heritage / National Heritage values to be degraded or damaged, or
- One or more of the World Heritage / National Heritage values to be notably altered, modified, obscured or diminished.

The impact assessment has assessed the potential impacts of the NGBR Project during the construction and operations phases on the following values of the GBRWHA and GBRNHP:

- The outstanding universal values of the GBRWHA (as outlined in Table 7-24)
- The National Heritage criteria of the GBRNHP
- The existing marine environment at Abbot Point
- The existing World Heritage values at Abbot Point.

A desktop analysis coupled with conceptual modelling of potential direct and indirect impacts was undertaken to understand the potential of the NGBR Project to adversely affect the relevant values and attributes of the GBRWHA and GBRNHP. The analysis assessed the direct impacts of the final rail corridor on the upstream catchments and the subsequent indirect impacts to downstream catchments, including coastal waters within the GBRWHA and GBRNHP. The outcomes of the assessment are discussed below.

The likelihood of indirect impacts on water quality and subsequently habitats and individual species within the GBRWHA and GBRNHP is very remote, given the geographical separation between the marine environment and the majority of watercourses crossed by the final rail corridor. It is noted that the impacts discussed in this section comprise a conservative worst-case scenario where no mitigation or management measures have been implemented. Management plans will be developed prior to the commencement of construction activities and will be implemented throughout the life of the NGBR Project.

In general, the mitigation measures will be developed to manage erosion and sediment runoff and the introduction of weeds into the waterways crossed by the final rail corridor as well as minimising any contamination of the waterways as a result of construction or operational activities. These management plans are discussed in detail at the end of this section. An assessment of the residual impacts (i.e. the anticipated impacts of the NGBR Project once the management plans have been implemented) is provided in Section 7.6.4. The proposed monitoring and reporting protocols to be undertaken during the construction and operations phases are provided in Section 7.14.

7.6.3.2 Construction phase – Potential impacts

Construction activities associated within the final rail corridor (i.e. vegetation clearing, cut and fill activities etc.) will not directly affect the GBRWHA or GBRNHP, however indirect impacts such as increased sediment load of runoff into watercourses or accidental spillages of contaminants have the potential to degrade downstream water quality and subsequently affect the relevant World Heritage / National Heritage values.

Construction works have the potential to directly affect watercourses that are hydrologically connected to coastal habitats. The NGBR Project traverses 567 waterways and overland flow paths, as well as their catchments and flood plains. Activities during the construction phase that have relevance to the GBRWHA and GBRNHP are those that have potential to influence the quality of water entering the downstream catchment system as a result of:

- Changes in water quality
- Changes to freshwater inflows
- Introduction of weeds and pests.

Potential impacts - Changes in water quality

Construction activities including vegetation clearing, bridge construction and chemical spills have the potential to impact on the water quality of local waterways and, theoretically, downstream on the GBRWHA and GBRNHP. Physical changes in water quality, including increased sediment and nutrient loads and the disturbance of acid sulphate soils have the potential to reduce the suitability of the aquatic environment for some aquatic and marine flora and fauna species. However, the likelihood of the NGBR Project causing a significant impact in this regard is considered very remote, particularly within the context of the broader catchment. The final rail corridor crosses a number of major rivers in the Burdekin Basin at varying (straight-line) distances from the coastline including the Bogie (approximately 125 km), Bowen (approximately 165 km) and Suttor Rivers (approximately 280 km).

Vegetation clearing associated with the NGBR Project will result in an increase in the amount of exposed earth surfaces. The mobilisation of soils through surface runoff, stream bank erosion and dust are the source of most suspended particulates, nutrients and other contaminants attached to particulates in waterways (ANZECC and ARMCANZ, 2000). Construction activities within or adjacent to watercourses at the proposed crossings will disturb bed and bank substrates and may lead to localised erosion and sediment transport to downstream aquatic and marine habitats. Sediment load is also likely to increase in the vicinity of hardstand areas such as roads and other impermeable developed areas.

Excess sediment in coastal waters can result in reduced light penetration, decreased water temperatures and a reduced level of dissolved oxygen in the water column (Pawert *et al*. 1998; Allan 2004; Camargo and Martinez 2007). There is also the potential for physical impacts of sediments on aquatic flora and fauna including the clogging and damaging of fish and invertebrate gills, or smothering / obstructing photosynthesis in aquatic flora.

The movement of sediment downstream has the ability to mobilise nutrients and pollutants into aquatic habitats. Soils from the exposed earth surfaces (exposed during vegetation clearing etc.), and potential pollutants, could be readily mobilised into water bodies after rainfall events and during high winds. Nutrient pollution has the potential to impact upon a system via the stimulation of growth of nuisance plants and cyanobacteria (ANZECC and ARMCANZ 2000) which may result in:

- Changes in the biological community composition
- Changes to water quality such as dissolved oxygen concentration which can impact upon aquatic fauna communities.

Excess nutrients reaching the GBRWHA and GBRNHP can promote increased algal blooms resulting in changes to water quality, habitats and the diversity of flora and fauna present in the region. Unnaturally high levels of algae and plankton can restrict the passage of light through the water column which impact on flora and fauna populations. Additionally, high algae and plankton loads can smother benthic flora and fauna (including corals) (Kelley *et al.* 2006).

Acid sulfate soils (ASS) have the potential to be present between chainages 3.4 km to 12.7 km, and between chainage 19.1 km and chainage 22.7 km within the Don River Basin. The disturbance of ASS has the potential to alter the pH of a water body and cause the release of metals bound within sediments. Changes in water quality as a result of elevated levels of acidity could impact aquatic communities within the Don River Basin and subsequently, the marine environment of the GBRWHA and GBRNHP. Construction activities in this area will involve in-filling of greater than 500 m^3 which has the potential to disturb in-situ ASS through the creation of heaves and mud waves. ASS may also be disturbed by the excavation of piers for three bridge structures: over Splitters Creek; a bridge over the Bruce Highway and North Coast rail line between and over Saltwater Creek; and minor excavation to place bed culverts.

Potential impacts - Changes to freshwater inflow

Marine and estuarine habitats have evolved in response to freshwater inflows from inland catchments, however human influence and development within catchments have resulted in changes to these inflows which have subsequently disrupted biological balances and processes that rely on consistent and adequate freshwater inflows and associated nutrients (Kelley *et al*. 2006).

Natural surfaces allow runoff to infiltrate into the soil and natural groundcover (i.e. vegetation) which slows the flow of runoff into waterways. The construction of hardstand areas at construction camps and laydown areas will increase the impervious area in the landscape adjacent to the watercourses which flow into the GBRWHA and GBRNHP. The replacement of natural surfaces with levelled, impervious material may result in an increase in runoff velocities and limited infiltration in hardstand areas. However, the likelihood of the NGBR Project causing a significant impact in this regard is considered very remote, given the rainwater harvesting, sediment collection ponds and re-use of water for landscape irrigation proposed at these ancillary infrastructure areas.

The alteration of topography during construction and the construction of temporary barriers in waterways has the potential to change the extent and depth of peak flood levels by changing flow paths and connectivity. This could increase the flood risk to construction works and surrounding lands, as well as change the frequency and duration of inundation. This alteration to the hydrological regime will impact the inflow rates of freshwater into waterways and subsequently into the GBRWHA and GBRNHP. However, as identified in Volume 2 Appendix H2 Hydrology and hydraulics (page 30), the risk of potential flooding at cross drainage structures due to temporary waterway barriers will be low due to the temporary nature of the structures (i.e. only for the duration of works at that waterway) and barrier structures will be designed to provide sufficient capacity to ensure minimal impact on natural waterway flows. Construction within waterways will be limited to the dry-season wherever practicable to minimise potential flood-related impacts during construction.

Potential impacts – Introduction of weeds and pests

Consutction activities at proposed watercourse crossings and subsequent increased access to areas during construction activities including vegetation clearing and soil disturbance can facilitate the introduction and spread of weed species into waterways and, theoretically, downstream on the GBRWHA and GBRNHP. Weed species may have adverse impacts on the flora and fauna diversity of a region and disrupt ecosystems by outcompeting and replacing native species, thereby altering species diversity and potentially disrupting ecosystem function. However, the likelihood of the NGBR Project causing a significant impact in this regard is considered very remote, particularly within the context of the broader catchment and given the distance of proposed major river crossings from the coastline.

Aquatic weeds may be transported during construction of water crossings. Machinery and vehicles working within waterways have the potential to disperse aquatic weeds between waterways and catchments if not managed in the appropriate manner. Twenty-four introduced aquatic dependent flora species were identified as occurring in riverine and/or non-riverine wetlands within the Burdekin and Don River Basins (Inglis and Howell 2009a; Inglis and Howell 2009a). These species and aquatic weeds from other catchments could be transported to waterways where weeds are not currently present. Subsequent weed infestations can affect waterways by disrupting natural flood regimes, changing aquatic habitats, reducing visual amenity and degrading water quality (DERM, 2011).

In order to reduce the dispersal and potential introduction of new weed species, active weed management will be implemented during construction of the NGBR Project.Additionally, there is the potential for the introduction of marine pests into the GBRWHA and GBRNHP through the increase of shipping associated with the operations of the NGBR Project.

7.6.3.3 Construction phase – Mitigation measures

As discussed previously, the construction of the NGBR Project has the potential to increase sediment and nutrient loads if stormwater, the introduction of weeds, waste and other pollutant sources are not appropriately managed. Environmental control measures proposed for the NGBR Project, including stormwater and weed management measures, will aim to appropriately manage this risk.

These measures will mitigate potential impacts to aquatic environmental values that could affect the downstream reefal environment of the GBRWHA and GBRNHP. Stormwater, wastewater and waste management for the NGBR Project will be designed to minimise any potential for the release of potential contaminants and the introduction of weeds into surrounding waters from the NGBR Project footprint.

During the early design phase of the NGBR Project, the number, width and extent of waterway crossings was reduced to the absolute minimum required. Where waterway crossings are unavoidable, potential impacts on aquatic habitats as a result of land based activities such as clearing, can be largely avoided or mitigated through the implementation of construction specific management measures.

To limit the degradation of downstream water quality and the introduction of weeds during construction activities, mitigation and management will focus on reducing the potential mobilisation of sediments or pollutants, and limiting sediment transport from exposed areas.

This will be achieved through the implementation of the following management plans:

- Erosion and Sediment Control Plan (ESCP)
- Acid Sulfate Soils Management Plan (ASS Management Plan)
- Water Quality Management Plan
- Weed and Pest Management Plan.

These are discussed in more detail below:

Erosion and sediment control plan

An ESCP will be developed prior to the commencement of construction activities and will be implemented throughout the life of the NGBR Project. The ESCP will aim to minimise any impacts associated with increased erosion as a result of the NGBR Project and to limit the potential for contamination of waterways.

The ESCP will be developed in accordance with following guidelines:

- Best Practice Erosion and Sediment Control. International Erosion Control Association (Australasia) (IECA 2008)
- Urban Stormwater Quality Planning Guidelines 2010 (DEHP 2010)
- Manual for Erosion and Sediment Control Version 1.2. Sunshine Coast Regional Council, November 2008 (SRSC, 2008)

The key objectives of the ESCP will be to:

- Control surface water movement through construction sites
- Minimise the extent and duration of soil disturbance
- Minimise soil erosion
- Minimise sediment laden water leaving construction sites
- Promptly stabilising disturbed areas
- Maximising sediment retention on site
- Maintaining ESC measures in proper working order

The ESCP will also include the following:

- Site analysis - site characteristics and constraints (locality, topography, geology, groundwater, soils, vegetation, sensitive receptors), rainfall distribution and amounts relevant to the study area, staging of construction, details of proposed land disturbance activities and timeframe for construction implementation
- Appropriate management and monitoring strategies to minimise erosion and sedimentation with respect to specific soil types
- Design and construction details of drainage, sediment control measures and sediment basins

Plans and figures for erosion and sediment control including:

- Explanatory notes and installation sequences
- Contingency plans – in the case of rainfall events or unforseen situations
- Soil management – location of stockpiles, management of dispersive soils, potential acid sulfate soils, high erosion risk areas, soils with extreme pH, required amelioration
- Site access – and associated temporary sediment controls
- Vegetation Management Plan – vegetation clearing, site stabilisation, rehabilitation
- Monitoring program –for drainage, erosion and sediment controls, water quality
- Maintenance program
- Water discharge

A monitoring program will be incorporated into the ESCP; this is discussed in more detail in Section 7.14.4.

Acid sulfate soils management plan

ASS will be managed in accordance with the requirements of *State Planning Policy (SPP) 2/02* and the soil management guidelines (Dear *et al.* 2002). Construction in accordance with the SPP 2/02 limits the potential for cumulative impacts as these soils must be managed according to defined management guidelines and in accordance with an approved ASS Management Plan.

An ASS Management Plan will be developed and implemented prior to the commencement of construction activities on the NGBR Project. Where the final rail corridor has the potential to disturb areas of ASS, a detailed survey will be undertaken in the areas of proposed disturbance.

The survey for ASS will be consistent with:

- State Planning Policy 2/02 Guideline: Acid Sulfate Soils
- Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils in Queensland 1998 (CR Ahern, MR Ahern, and B Powell 1998)
- Acid Sulfate Soils Laboratory Methods Guidelines (CR Ahern, AE McElnea and LA Sullivan 2004).

An ASS Management Plan will be developed for any construction activities proposed to occur below 5 mAHD that will:

- Disturb >100 m^3 (bulked volume) of ASS material
- Place hard fill material of >500 m^3, with an average thickness >0.5 m and/or
- Disturb existing groundwater or surface water regimes.

Where disturbance of ASS is not avoidable, soils will be managed in accordance with the State Planning Policy 2/02 (SPP 2/02). Applicable management techniques include:

- Chemical neutralisation (use of pure fine agricultural lime, Aglime) through mechanical mixing by plough or excavator, to provide adequate homogeneity of the sediment-lime mix
- The less preferred, risky method of anoxic storage or placement below the water table and beneath clean non-ASS fill
- Disposal of neutralised material upon acceptance of relevant permits.

Water quality management plan

A water quality management plan will be developed and implemented prior to construction commencing on the NGBR Project. The plan will be developed in conjunction with the ESCP outlined previously, and will incorporate the following strategies:

- Fuels, chemicals, wastes and other potentially environmentally hazardous substances will be appropriately stored in bunded or otherwise contained areas away from watercourses.
- Refuelling will be undertaken in areas away from watercourses.
- Vehicles and equipment will be regularly inspected for oil / transmission leaks.

- Appropriate dewatering procedures will be developed and implemented for the management of construction groundwater inflow or on-site stormwater collection including appropriate capture, treatment and disposal measures.
- Emergency response protocols and procedures will be developed and subsequently implemented in the event of a contaminant spill or leak including the provision of spill response equipment.
- Waterway profiles at temporary construction access roads and temporary construction facility areas will be reinstated and disturbed areas will be promptly stabilised following completion of construction works.
- Existing disturbed areas will be utilised to access waterways.
- The construction of waterway crossings will be scheduled during dry or low flow periods.
- The construction of waterway crossings will be completed in a timely manner to minimise the potential impacts.
- All construction camp stormwater captured on site will be reused for irrigation, dust suppression or stored within sediment basins before being appropriately treated and discharged.
- The route used by machinery in and out of the work sites on waterways will be controlled and the need for access of heavy machinery to the bed of the waterways will be avoided. Works will be undertaken from the top of waterway banks.
- Wastewater from concrete batching plants will be captured, stored and either reused in concrete batching or treated and disposed appropriately.

It is noted that the construction of waterway crossings poses the largest risk to degradation of water quality in the waterways to be crossed and hence the water quality of the GBRWHA and GBRNHP. Subsequently, the construction of waterway crossings will be appropriately managed to minimise the risk of increased erosion, sedimentation and contamination of waterways. The following strategies will be implemented:

- Staged installation of culverts within the permanent infrastructure (where required) will maintain connectivity and reduce the likely impact of infrastructure on flows and afflux during the wet season.
- Perimeter bunds will be established around construction areas to divert surface runoff and prevent flooding of the area during construction works.

A monitoring program will be incorporated into the ESCP; this is discussed in more detail in Section 7.14.

Weed and pest management plan

A weed and pest management plan will be developed prior to construction commencing and implemented during the construction phase of the NGBR Project. The weed and pest management plan will include details relating to the monitoring, management and, eradication of weeds, disposal of green waste, and vehicle/plant weed wash down protocols.

These management strategies will be implemented at proposed watercourse crossings which flow into the GBRWHA and GBRNHP to minimise the likelihood of weeds being introduced into the marine environment. It is anticipated that through appropariate management of weeds at upstream watercourse crossings the likelihood of any adverse impacts to the values of the GBRWHA and GBRNHP will be negligible. It is anticipated that industry standard marine pest management guidelines will be implemented as required by North Queensland Bulk Ports (NQBP) in all operational activities of the Port of Abbot Point; these measures pertain to the discharge of ballast water and monitoring of biofouling on vessels to minimise the introduction of pests into the marine environment.

7.6.3.4 Operations phase – Potential impacts

The potential impacts during the operations phase of the NGBR Project on the GBRWHA and GBRNHP are expected to be similar in nature (albeit of a reduced magnitude) to those experienced during the construction phase. In this regard, the operations of the final rail corridor are not expected to directly impact the values of the GBRWHA and GBRNHP however there is the potential for contamination of the watercourses crossed by the final rail corridor. The contamination of these watercourses may subsequently affect the water quality of the GBRWHA and GBRNHP and could hence detract from the World Heritage and National Heritage values.

During the operations phase of the NGBR Project, no further changes to the existing topography or surface cover are expected and it is not anticipated that any further hardstand areas will be developed. It is therefore unlikely that there will be any change to the inflow of freshwater (i.e. stormwater) into waterways and subsequently, the GBRWHA and GBRNHP.

Activities during the operations phase which have relevance to the GBRWHA and GBRNHP are those that have potential to influence quality of water entering the downstream catchment system.

Potential impacts - Changes in water quality

During the operations phase of the NGBR Project it is not anticipated that levels of erosion and sedimentation will increase as a result of operational activities. The most likely source of contamination of waterways during the operations of the NGBR Project will result from accidental spillages of hazardous materials or in sensitive areas i.e. in close proximity to waterways or within significant overland flow paths. Additionally, there is the potential for increased erosion and scouring around waterway crossings in times of heavy flow.

7.6.3.5 Operations phase – Mitigation measures

Water quality management during the operations phase of the NGBR Project primarily comprise of an operational water quality monitoring program which will be developed prior to commencement of operations of the NGBR Project; this is discussed in more detail in Section 7.14.3.

7.6.4 Significance of residual impacts

This section describes the significance of the residual impacts of the NGBR Project to values of the GBRWHA and GBRNHP. For the purpose of this assessment, residual impacts refer to the expected impacts of the NGBR Project on the values of the GBRWHA and GBRNHP once all relevant management and mitigation measures have been implemented.

As outlined in Section 7.6.3, an action is likely to have a significant impact on the World Heritage values / National Heritage values of a declared WHA / NHP if there is a real chance or possibility that it will cause:

- One or more of the World Heritage / National Heritage values to be lost
- One or more of the World Heritage / National Heritage values to be degraded or damaged, or

- One or more of the World Heritage / National Heritage values to be notably altered, modified, obscured or diminished.

Sections 7.6.4.1 to 7.6.4.4 outline the residual impact significance of the NGBR Project on the following values of the GBRWHA and GBRNHP:

- Outstanding universal values of the GBRWHA
- World Heritage values at Abbot Point
- The National Heritage criteria of the GBRNHP
- Existing marine environment at Abbot Point.

The assessment describes the significance of the impacts associated with each value and provides a conlucsion of whether the NGBR Project is likely to have a significant impact in accordance with the Significant Impact Guidelines 1.1.

7.6.4.1 Residual impact significance – GBRWHA Outstanding universal values

Table 7-25 outlines the significance of the residual impacts of the NGBR Project on the values of the relevant OUV criteria of the GBRWHA. The assessment identifies that while there is the potential for increased turbidity and sedimentation within the waterways crossed by the final rail corridor, these impacts are likely to occur only during the construction phase and will generally be temporary and infrequent. The benthic habitat of the area of the GBRWHA potentially impacted by the NGBR Project comprises primarily patchy low density seagrass beds with a generally low coral cover.

Additionally, there is a very low likelihood of sediments reaching the GBRWHA and GBRNHP due primarily to the distance from the proposed crossings to the mouth of the river. The sediments are likely to be deposited within the waterways or trapped by an existing dam / weir structure (e.g. the Suttor River catchment flows into the Burdekin Falls Dam) prior to discharge into the GBRWHA / GBRNHP.

Seagrasses at Abbot Point are considered to be generally low density and highly dynamic, with changes in density and distribution being influenced by seasonality and major weather events. The benthic habitat in the area is acclimatised to the influx of high turbidity runoff and upon cessation of the impacts, the seagrasses generally recolonise the area. The direct value of seagrass habitat for fisheries production in the Abbot Point region is reported to be significantly less than other areas in central and northern Queensland (GHD 2010, GHD 2012, CDM Smith 2012, ELA and OpenLines 2012). The significance of the impact on seagrasses as a result of the NGBR Project is therefore considered minimal.

Based on the assessment it is not anticipated that the NGBR Project will result in any OUVs of the GBRHWA being lost, degraded or damaged, or notably altered as a direct or indirect result of project activities. The NGBR Project is therefore not expected to have a significant impact on the GBRHWA.

Table 7-25 Residual impact significance - GBRWHA values

World Heritage Criteria	Example attributes	Residual impact significance
Criterion 7 Contain unique, rare or superlative natural phenomena	Vast mosaic patterns of reefs providing an unparalleled aerial panorama of seascapes and landscapes for example, Whitehaven Beach, Whitsunday islands, Hinchinbrook Island	The potential impacts of the NGBR Project will not affect the aerial panorama of seascapes / landscapes associated with the GBR.
	One of the few living structures visible from space	The potential impacts of the NGBR Project will not affect the aerial panorama of seascapes / landscapes associated with the GBR.
	Beneath the ocean surface, there is an abundance of shapes, sizes and colours, including spectacular coral assemblages (hard and soft corals) and >1,500 species of fish	The implementation of appropriate management plans is expected to mitigate the impacts of water quality degradation in waterways which discharge into the GBRWHA. During construction there is the potential for increased sediment loads to be deposited into waterways and subsequently the very low risk of water quality degradation in the GBRWHA. These events have the potential to impact seagrass habitat located in the vicinity of Abbot Point, however the events are expected to be temporary and infrequent. Additionally, once the event has subsided, recolonisation of habitat is expected to occur.
	Globally important breeding colonies of seabirds and marine turtles, including Raine Island, the world's largest green turtle breeding area	The final rail corridor does not intersect any areas used as marine turtle nesting areas and therefore is not considered likely to impact breeding turtle populations. The impacts of the NGBR Project on migratory seabirds are discussed in Section 7.10.
	Superlative natural phenomena include the annual coral spawning, migrating whales, and significant spawning aggregations of many fish species	The implementation of appropriate management plans is expected to mitigate the impacts of water quality degradation in waterways which discharge into the GBRWHA. During construction there is the potential for increased sediment loads into waterways during high intensity rainfall events with subsequent low risk of discharge into the GBRWHA; these events have the potential to impact coral and fish spawning cycles in the vicinity of Abbot Point. These impacts however, are expected to be temporary and infrequent. The construction and operation of the NGBR Project is not expected to have a significant impact on migrating whales. Consequential impacts, such as the effect of increased shipping traffic to the Port of Abbot Point are discussed in Section 7.13

World Heritage Criteria	Example attributes	Residual impact significance
Criterion 8 Outstanding example representing major stages of the earth's history	Forms the world's largest coral reef ecosystem, extending over 14 degrees of latitude	The potential impacts of the NGBR Project will not affect the extent of the GBR ecosystem.
	Globally outstanding example of an ecosystem that has evolved over millennia	The potential impacts of the NGBR Project will not affect the long term evolution of the GBRWHA.
	Environmental history recorded in the reef structure; for example, climatic conditions over many hundreds of years can be seen in old massive coral cores	The potential impacts associated with the NGBR Project will not affect significant areas of mature hard coral. The wider study area of the GBRWHA potenitally impacted by the NGBR Project (i.e. between Upstart Bay and Abbot Bay) is characterised by a heterogeneous habitat matrix of soft-sediment, rocky reef, coral, seagrass and algae. The benthic habitat in the Abbot Point area comprises primarily patchy low density seagrass beds; coral cover is generally low.
	Comprises about 3,000 separate coral reefs, ranging from inshore fringing reefs to mid shelf reefs and shoals, exposed outer reefs and deep water reefs, including examples of all stages of reef development	The implementation of appropriate management plans is expected to mitigate the impacts of water quality degradation in waterways which discharge into the GBRWHA. During construction there is the potential for increased sediment loads into waterways during high intensity rainfall events with subsequent discharge into the GBRWHA. These impacts however, are expected to be temporary and infrequent. Additionally, the benthic habitat in the Abbot Point area comprises primarily patchy low density seagrass beds with a generally low coral cover; it is therefore unlikely that any impacts of the NGBR Project will affect inshore fringing reef systems. Outer reef systems are considered too far away to be directly affected by the NGBR Project.
	Deep water features of the adjoining continental shelf includes canyons, channels, plateaux and abyssal plains	The potential impacts of the NGBR Project will not affect any deep water features of the GBR.
Criterion 9 Outstanding example representing significant on-going ecological and	Globally significant diversity of reef and island morphologies reflecting on-going geomorphic, oceanographic and environmental processes	The potential impacts of the NGBR Project are not considered to be significant at a global scale. There is the potential during the construction phase for minor increases in sedimentation during high intensity rainfall events which may impact on the biological functions of flora and fauna species in the immediate vicinity of the discharge areas, however these impacts are expected to temporary and infrequent.

World Heritage Criteria	Example attributes	Residual impact significance
biological processes	Complex cross-shelf, longshore and vertical connectivity influenced by dynamic oceanic currents and ongoing ecological processes such as upwellings, larval dispersal and migration	The potential impacts of the NGBR Project are not expected to be at a scale to significantly impact the existing oceanographic currents and upwellings associated with the GBR.
	Over 900 islands and cays; around 600 are continental (high) islands, 300 are coral cays in various stages of geomorphic development, with the remaining islands comprising mangrove islands that provide important ecological services	The potential impacts of the NGBR Project will not affect any island formations associated with the GBR.
	An ecosystem that has evolved over millennia with evidence of the evolution of hard corals and other fauna	The potential impacts of the NGBR Project will not affect the long term evolution of the GBRWHA.
	Globally significant marine faunal groups include over 4,000 species of molluscs; over 1,500 species of fish; plus a great diversity of sponges, anemones, marine worms, crustaceans, and many others	The potential impacts of the NGBR Project are not considered to be of a scale which will significantly impact the diversity and distribution of marine faunal groups within the GBRWHA. There is the potential during the construction phase for increased sedimentation during high intensity rainfall events which may impact on the biological functions of flora and fauna species in the immediate vicinity of the discharge areas, however these impacts are expected to be temporary and infrequent with recolonisation of habitat areas occurring upon cessation of the impact.
	Man's interaction with the natural environment illustrated by strong ongoing links between Aboriginal and Torres Strait Islanders and their sea country, including numerous shell deposits (middens) and fish traps, plus the application of story places and marine totems	The potential impacts of the NGBR Project will not affect the cultural connections between Aboriginal and Torres Strait Islanders and the GBRWHA. The impacts will not be at a scale which will impact areas of cultural significance.
Criterion 10 Contains the most important and significant natural habitats for in-situ conservation of biological diversity	One of the richest and most complex natural ecosystems on earth, and one of the most significant for biodiversity conservation	The impacts of the NGBR Project on the GBR ecological functions will be minimal and restricted primarily to areas in immediate proximity to Abbot Point. It is not expected that the NGBR Project will result in any impact to conservation or marine park areas of the GBRMPA.
	Amazing diversity supports tens of thousands of marine and terrestrial species, many of which are of global conservation significance	The potential impacts of the NGBR Project are not considered to be of a scale which will significantly impact the diversity of marine or terrestrial species within the GBRWHA. The implementation of species management plans particularly during the construction phase of the NGBR Project will aim to minimise any impact to flora and faunal communities.

World Heritage Criteria	Example attributes	Residual impact significance
	Some 39 species of mangroves comprising 54 per cent of the world's mangrove diversity	The design of the final rail corridor will seek to minimise the vegetation clearing requirements of the NGBR Project. Where relevant and required, rehabilitation of cleared vegetation will be undertaken in accordance with a rehabilitation plan; additionally, offsetting of cleared areas will be undertaken as required. Offset requirements under the EPBC Act are discussed in Section 7.15.
	Approximately 43,000 km^2 of seagrass meadows in both shallow and deep water areas, including 23 per cent of known global species diversity	There is the potential during the construction phase for minor increases in sedimentation during high intensity rainfall events which may impact on the biological functions of seagrass beds in the immediate vicinity of Abbot Point. Seagrasses at Abbot Point are considered to be generally low density and highly dynamic, with changes in density and distribution being influenced by seasonality and major weather events. The direct value of seagrass habitat for fisheries production in the Abbot Point region is reported to be significantly less than other areas in central and northern Queensland (GHD 2010, GHD 2012, CDM Smith 2012, ELA and OpenLines 2012). The significance of the impact on seagrasses as a result of the NGBR Project is therefore considered minimal.
	Habitat for one of the world's most important dugong populations and six of the world's seven species of marine turtle	The potential impacts of the NGBR Project on dugong and marine turtle species are discussed in Section 7.10.
	A breeding area for humpback whales, with at least 30 other species of whales and dolphins also identified	The potential impacts of the NGBR Project on whale and dolphin species are discussed in Section 7.10.
	70 bioregions (broad-scale habitats) identified comprising 30 reef bioregions and 40 non-reefal bioregions; including algal and sponge gardens, sandy and muddy bottom communities, continental slopes and deep ocean troughs	The potential impacts of the NGBR Project are not considered to be of a scale which will significantly impact the diversity of bioregions within the GBRWHA. There is the potential during the construction phase for minor increases in sedimentation during high intensity rainfall events which may impact on the biological functions of flora and fauna species in the immediate vicinity of the discharge areas, however these impacts are expected to be temporary and infrequent with recolonisation of habitat areas occurring upon cessation of the impact.
	The reef bioregions contain one third of the world's soft coral and sea pen species (80 species)	The benthic habitat in the vicinity of Abbot Point comprises primarily low density seagrass beds; the potential impacts of the NGBR Project are not considered to be of a scale which will significantly impact the diversity of soft coral and sea pen bioregions within the GBRWHA.

World Heritage Criteria	Example attributes	Residual impact significance
	2,000 species of sponges equalling 30 per cent of Australia's diversity in sponges	The benthic habitat in the vicinity of Abbot Point comprises primarily low density seagrass beds; the potential impacts of the NGBR Project are not considered to be of a scale which will significantly impact the diversity of sponge species within the GBRWHA.
	630 species of echinoderms (for example sea stars) equalling 13 per cent of the known global diversity	While there is the potential during the construction phase for a minor increase in sedimentation as a result of high intensity rainfall events, these impacts are expected to temporary and infrequent and will not have a significant impact on the species diversity of echinoderms in the GBRWHA.

7.6.4.2 Residual impact significance – World Heritage values at Abbot Point

The World Heritage values identified as being significant at Abbot Point include:

- Aesthetic attributes
- Migratory birds
- Marine mammals

The residual impacts of the NGBR Project on each are discussed below.

Aesthetic attributes

The Abbot Point area contains an existing coal terminal and thus portrays a degraded aesthetic environment. The NGBR Project comprises a nominal 100 m final rail corridor (and ancillary infrastructure facilities) which will enter the Abbot Point area from the southeast. During construction, the proposed vegetation clearing and movement of construction machinery will result in a temporary loss of aesthetic value however, the proposed rehabilitation of temporary construction areas will mitigate this impact resulting in a minor impact to the area.

The NGBR Project will not have a significant impact on the aesthetic values of Abbot Point.

Migratory birds

The residual impacts of the NGBR Project on migratory bird species is discussed in Section 7.10.

Marine mammals

The residual impacts of the NGBR Project on marine mammals are discussed in Section 7.10.

7.6.4.3 Residual impact significance – National Heritage criteria

Table 7-26 outlines the significance of the residual impacts of the NGBR Project on the National Heritage values of the GBRNHP. The implementation of the mitigation measures proposed in Section 7.6.3 will minimise the impacts to the GBRNHP. The residual impacts associated with the construction and operations of the NGBR Project are unlikely to have a significant impact on the natural history and environmental values of the GBRNHP. Additionally, due to the nature of the residual impacts anticipated, it is considered unlikely that the NGBR Project will impact on any cultural values of the GBRNHP.

Table 7-26 Residual impact significance - GBRNHP

National Heritage criteria	Residual impact significance
The place has outstanding heritage value to the nation because of the place's importance in the course, or pattern, of Australia's natural or cultural history	The potential impacts of the NGBR Project will not affect the long term evolution of the GBRNHP. Due to the nature of the residual impacts anticipated, it is considered unlikely that the NGBR Project will impact on any cultural values of the GBRNHP.
The place has outstanding heritage value to the nation because of the place’s possession of uncommon, rare or endangered aspects of Australia’s natural or cultural history	The marine environment adjacent to the coastline is shallow and punctuated by creek mouths, mud flats and mangrove habitats. The wider study area of the GBRWHA potentially impacted by the NGBR Project (i.e. between Upstart Bay and Abbot Bay) is characterised by a heterogeneous habitat matrix of soft-sediment, rocky reef, coral, seagrass and algae. The

National Heritage criteria	Residual impact significance
	benthic habitat in the Abbot Point area comprises primarily patchy low density seagrass beds; coral cover is generally low. In a regional context, the benthic communities found within the wider study area are not considered to be uncommon, rare or endangered. Due to the nature of the residual impacts anticipated, it is considered unlikely that the NGBR Project will impact on any cultural values of the GBRNHP.
The place has outstanding heritage value to the nation because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history	The potential residual impacts of the NGBR Project on the GBRNHP will not significantly affect the potential to yield information on the historical development of the reef. Due to the nature of the residual impacts anticipated, it is considered unlikely that the NGBR Project will impact on any cultural values of the GBRNHP.
The place has outstanding heritage value to the nation because of the place's importance in demonstrating the principal characteristics of: • A class of Australia's natural or cultural places • A class of Australia's natural or cultural environments	Due to the nature of the residual impacts anticipated, it is considered unlikely that the NGBR Project will impact on any natural or cultural places or environments within the GBRNHP.
The place has outstanding heritage value to the nation because of the place's importance in exhibiting particular aesthetic characteristics valued by a community at a particular period.	The area of the GBRNHP with the potential to be impacted by the residual impacts of the NGBR Project comprises primarily patchy low density seagrass beds; coral cover is generally low. It is not expected that the residual impacts of the NGBR Project will significantly affect the aesthetic values of the GBR.

Based on the assessment it is not anticipated that the NGBR Project will result in any national Heritage values of the GBRHNP being lost, degraded or damaged, or notably altered as a direct or indirect result of project activities. The NGBR Project is therefore not expected to have a significant impact on the GBRNHP.

7.6.4.4 Residual impact significance – Existing marine environment at Abbot Point

Where impacts to seagrass and other benthic communities are observed such as increased turbidity and sedimentation at the mouth of the river, these impacts are expected to be temporary. It is expected that recolonisation of the soft sediment systems will occur once the impact has subsided. This conclusion is supported by recent surveys which indicate that disposal of dredged material at the existing Abbot Point relocation area has not had any long-term impacts on resident communities (BMT WBM 2012b).

The implementation of the proposed mitigation measures as well as the distance from the Great Barrier Reef will significantly reduce the potential water quality and flow impacts of the NGBR Project on the GBRWHA and GBRNHP.

No impacts associated with the NGBR Project will result in a substantial or measurable change in the hydrological regime of the GBRWHA waters and therefore, no significant impacts on the World Heritage values are anticipated.

7.7 Great Barrier Reef Marine Park

7.7.1 Overview

The Great Barrier Reef Marine Park (GBRMP) is not directly intersected by the final rail corridor however it may be subject to indirect impacts due to the hydrological connection of the watercourses intersected by the final rail corridor.

The GBRMP lies adjacent to the coastline between Upstart Bay and Abbot Bay; the port area at Abbot Point is excluded from the marine park and the northern-most part of the final rail corridor is adjacent to the GBRMP (refer to Figure 7-26).

Prior to being listed on either the World Heritage or National Heritage registers, the Great Barrier Reef was recognised as an environment requiring coordinated management in order to provide sustainable use for stakeholders while ensuring appropriate protection. In 1975, the GBRMP was designated and the Great Barrier Reef Marine Park Authority was established as a management agency chartered with the responsibility of management of activities within the park boundaries. The marine park covers more than 344,400 km^2 of the GBRWHA and extends 2,300 km along the Queensland coast. The values of the Great Barrier Reef recognised in the GBRWHA (ie the OUVs) are discussed in Section 7.6.

7.7.2 Existing environmental values

For the purpose of the impact assessment, the existing environmental values associated with the GBRMP were taken to include:

- The existing marine environment at Abbot Point and Upstart Bay
- The GBRMP zoning in the vicinity of Abbot Point and Upstart Bay.

These are discussed further below. It is noted that the sensitive marine habitat areas within the GBRMP are also within the GBRWHA; an assessment of the impacts of the NGBR Project on the OUVs of the GBRWHA is provided in Section 7.6.3

7.7.2.1 Existing marine environment

The Significant Impact Guidelines (DEWHA 2009) specifies that an action will require approval under the EPBC Act where:

- The action is taken in the GBRMP and the action has, will have, or is likely to have a significant impact on the environment, or
- The action is taken outside the Great Barrier Reef Marine Park and the action has, will have, or is likely to have a significant impact on the environment in the GBRMP.

  The ‘environment’ of the GBRMP is broadly defined under the EPBC Act as:

- Ecosystems and their constituent parts including people and communities
- Natural and physical resources
- Qualities and characteristics of locations, place and areas
- Heritage values of places
- The social, economic and cultural aspects of the components mentioned above.

As discussed in Section 7.7.1, the NGBR Project final rail corridor does not intersect the GBRMP area and therefore will not have a direct impact on the relevant environmental values.

However, due to the hydraulic connectivity between the watercourses intersected upstream by the NGBR Project and the GBRMP, it is considered relevant to assess the indirect impacts of this interaction. The impacts of the NGBR Project on the environmental values of the GBRMP will be confined to the area in the vicinity of Abbot Point and Upstart Bay; a description of the existing marine environment in this area is provided in Section 7.6.2.

7.7.2.2 Existing marine park zoning

The NGBR Project final corridor traverses entirely terrestrial areas and therefore does not directly intersect any GBRMP zones. Within the wider study area however, there are several areas zoned for protection and management under the GBRMP (refer to Figure 7-26). These zones are listed in Table 7-27 below along with a brief description of the intent of the zoned area.

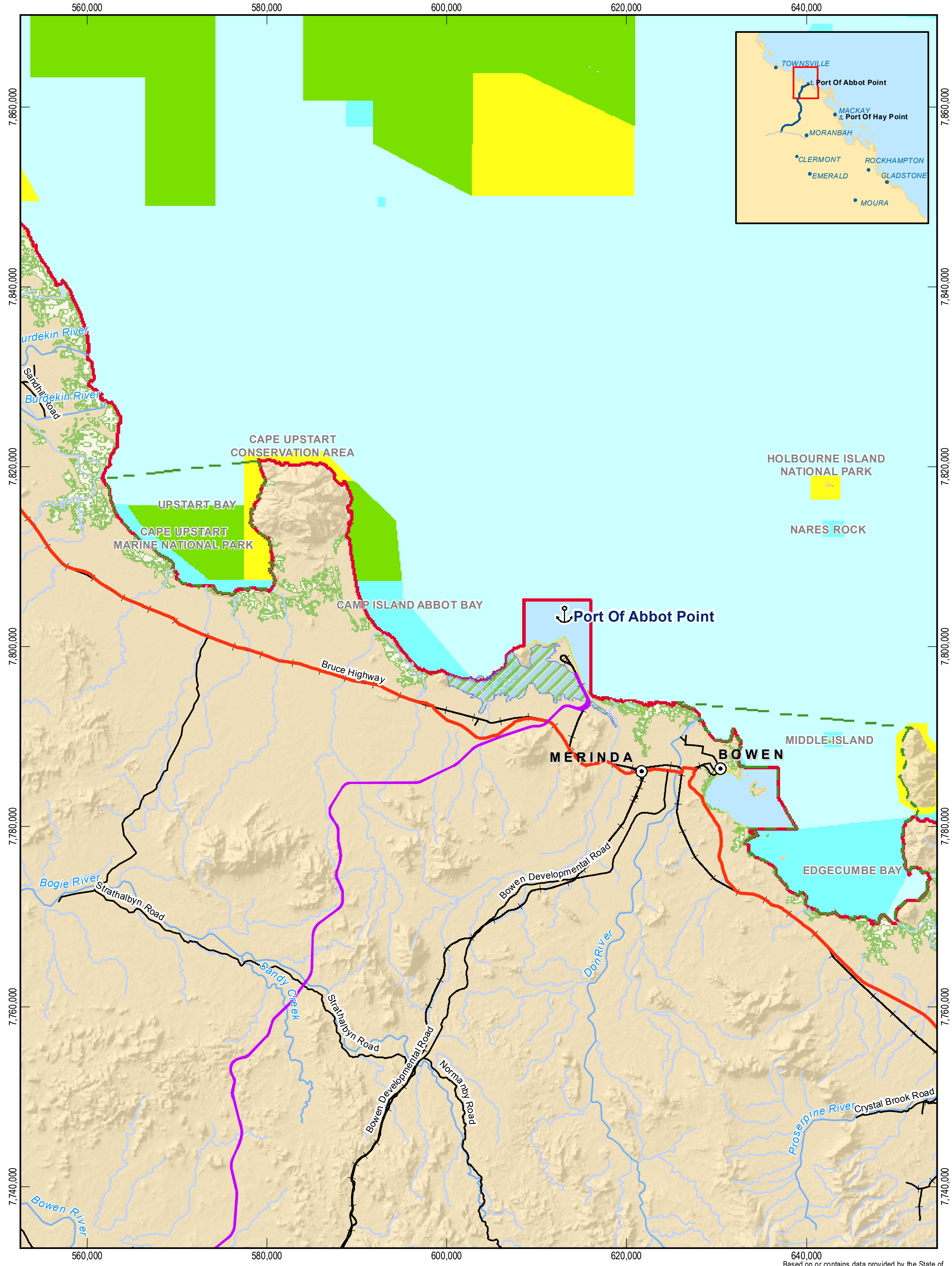
Table 7-27 GBRMP zones - Abbot Point

GBRMP zone	Objective of zone
General use zone	To provide for the conservation of areas of the marine park, while providing opportunities for reasonable use; most activities within this zone do not require permits / permission.
Habitat protection zone	To provide for the conservation of areas of the marine park through the protection and management of sensitive habitats, generally free from potentially damaging activities.
Conservation park zone	To provide for the conservation of areas of the marine park and to provide opportunities for reasonable use and enjoyment, including limited extractive use.
Marine national park zone	To provide for the protection of the natural integrity and values of areas of the Marine Park, generally free from extractive activities and to provide opportunities for certain activities, including the presentation of the values of the marine park, to be undertaken in relatively undisturbed areas.

Source: (GBRMPA 2003)

There are a number of inshore sensitive marine habitats to the east and west of Abbot Point including Holbourne Island National Park, Camp Island, Middle Island, Nares Rock, Upstart Bay and Edgecumbe Bay (refer to Figure 7-26). Within Upstart Bay there are General Use, Habitat Protection, Conservation Park (Cape Upstart Conservation Area) and Marine National Park (Cape Upstart Marine NP) zones. The Burdekin fish habitat area, which includes Upstart Bay, and the Upstart Bay Dugong Protection Area provide foraging habitat for a number of fauna species, including a marine turtle population and dugong and dolphin species. The area within Abbot Bay is covered by General Use, Habitat Protection and Marine National Park zones (refer to Figure 7-26).

The marine environment adjacent to Abbot Point provides a direct and indirect foraging habitat for numerous key marine fauna species. The waters within Upstart Bay and Abbot Bay provide a habitat that has been observed to support a resident marine turtle population and dugong and dolphin species on a semi-permanent basis (GHD, 2010). Recent surveys in the inshore and offshore marine environment of Abbot Point recorded fifteen species of marine megafauna including four species of dolphin, five species of marine turtle, two species of shark, dugong (*Dugong dugon*), humpback whale (*Megaptera novaeangliae*), olive headed sea snake (*Disteira major*) and manta ray (*Manta birostris*) (Bell 2003, GHD 2009). Migratory marine fauna are discussed in Section 7.10.



LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Carmichael Mine Project Rail
- Railway
- Watercourse (Major)
- Watercourse (Minor)
- Caley Valley Wetlands
- Mangroves
- Great Barrier Reef Marine Park boundary
- GBRMP Zoning (2003)
- General Use
- Habitat Protection
- Conservation Park
- Marine National Park
- Dugong Protection Area
- North Galilee Basin Rail 100m Corridor

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:600,000 Paper Size A4

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd
North Galilee Basin Rail Project

Job Number 41-26457
Revision A
Date 12 Nov 2013

Great Barrier Reef
Marine Park areas

Figure 7-26

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Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012;
DNRM: Roads/2010, GBR World Heritage Area/2011, Mangroves/2011, Caley Valley Wetlands/2010; GBRMPA: Zoning, Dugong Proection Area, Boundary/2011. Created by:MS

7.7.3 Potential impacts and mitigation

7.7.3.1 Overview

This section discusses the outcomes of the assessment undertaken to determine the significance of the potential impacts of the NGBR Project on the environmental values of the GBRMP. The assessment has been undertaken in accordance with the criteria outlined in the Significant Impact Guidelines.

These criteria state that an action is likely to have a significant impact on the environment of the GBRMP if there is a real chance or possibility that the action will:

- Modify, destroy, fragment, isolate or disturb an important, substantial, sensitive or vulnerable area of habitat or ecosystem component such that an adverse impact on marine ecosystem health, functioning or integrity in the GBRMP results
- Have a substantial adverse effect on a population of a species or cetacean including its life cycle and spatial distribution
- Result in a substantial change in air quality or water quality (including temperature) which may adversely impact on biodiversity, ecological health or integrity or social amenity or human health
- Result in a known or potential pest species being introduced or becoming established in the GBRMP
- Result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, or social amenity or human health may be adversely affected, or
- Have a substantial adverse impact on heritage values of the GBRMP, including damage or destruction of an historic shipwreck.

A desktop analysis coupled with conceptual modelling of potential direct and indirect impacts was undertaken to understand the potential of the NGBR Project to adversely affect the relevant existing environmental values of the GBRMP. The analysis assessed the direct impacts of the final rail corridor on the upstream catchments and the subsequent impacts to downstream catchments, including coastal waters within the GBRMP area. Additionally, the assessment analysed the influence of the NGBR Project on coastal habitats and water quality within the GBR which may subsequently affect sensitive marine environments including protected conservation areas within the GBRMP. The outcomes of the assessment are discussed below.

It is noted that the impacts discussed in this section comprise a conservative worst-case scenario where no mitigation or management measures have been implemented. Management plans will be developed prior to the commencement of construction activities and will be implemented throughout the life of the NGBR Project. These management plans will aim to minimise the direct and indirect impacts of the NGBR Project on the existing environmental values associated within the study area.

In general, the mitigation measures will be developed to manage erosion and sediment runoff into the waterways crossed by the final rail corridor as well as minimising any contamination of the waterways as a result of construction or operational activities. These management plans are discussed in detail at the end of this section. An assessment of the residual impacts (i.e. the anticipated impacts of the NGBR Project once the mitigation and management plans have been implemented) is provided in Section 7.7.4. The proposed monitoring and reporting protocols to be undertaken during the construction and operations phases are provided in Section 7.14.

7.7.3.2 Construction phase – potential impacts

As shown in Figure 7-26, the final rail corridor does not directly traverse the GBRMP; thus, the construction activities associated with the NGBR Project (i.e. vegetation clearing, cut and fill activities etc.) will not directly affect the existing environmental values of the GBRMP. However, there is the potential for indirect impacts such as increased sediment load in runoff or accidental spillages of contaminants at watercourse crossings in upstream catchments, to have the potential to degrade downstream water quality and subsequently affect the quality of the marine environment within the GBRMP.

The NGBR Project traverses 567 waterways and overland flow paths, as well as their catchments and flood plains. Activities during the construction phase that have relevance to the GBRMP are those that have the potential to influence the quality of water entering the downstream catchment system as a result of:

- Changes in water quality
- Changes to freshwater inflows.

These impacts are discussed in further detail in Section 7.6.3 and are summarised below. In general, it is highly unlikely that the NGBR Project will result in a significant impact to the values of the marine environment within the GBRMP; this is primarily due to the geographical separation between the GBRMP and the waterways crossed by the final rail corridor. Additionally, the magnitude of any sedimentation likely to occur within the waterways is not expected to result in a significant impact to water quality within the context of the broader catchment.

Potential impacts - changes in water quality

In general, changes to water quality in upstream catchments have the potential to adversely affect the marine environments where the relevant waterways discharge into the GBRMP. The GBRMP aims to protect areas of conservation significance including sensitive ecosystems and other high value marine habitat. Degraded water quality within the GBRMP may adversely impact these sensitive ecosystems and subsequently affect the conservation significance of the area.

Changes in water quality may arise due to the following:

- Vegetation clearing and increased areas of exposed soil resulting in increased sediment and nutrient loads
- The disturbance of acid sulphate soils
- Spillages / leakage of contaminants into waterways.

These events are expected to be infrequent and of low magnitude; the significance of these indirect impacts on the marine environment of the GBRMP is considered to be negligible. This is discussed in further detail in Section 7.6.3.

Potential impacts - changes to freshwater inflow

Changes to the influx of freshwater in a marine environment may result in adverse impacts to the biological functions of the ecosystem and subsequently affect the conservation significance of the area.

Changes to freshwater inflows as a result of the NGBR Project may result from:

- Reduced infiltration and increased velocities of overland flow due to the clearing of natural vegetative cover
- Increased hardstand / impermeable areas leading to increased runoff of overland flow into waterways
- Alterations to the hydrology of the catchment through the introduction of permanent drainage structures.

However, the likelihood of the NGBR Project causing a significant impact in this regard is considered very remote, given the stormwater management and waterway design measures proposed. This is discussed in further detail in Section 7.6.3; the significance of these indirect impacts on the marine environment of the GBRMP is considered to be negligible.

7.7.3.3 Construction phase – mitigation measures

The construction of the NGBR Project has the potential to increase sediment and nutrient loads if stormwater, waste and other pollutant sources are not appropriately managed. Environmental control measures proposed for the NGBR Project, including stormwater management measures will aim to appropriately manage this risk.

To limit the degradation of downstream water quality during construction activities, mitigation and management will focus on reducing the potential mobilisation of sediments or pollutants, as well as limiting sediment transport from exposed areas.

This will be achieved through the implementation of the following management plans:

- Erosion and Sediment Control Plan (ESCP)
- Acid Sulfate Soils Management Plan (ASS Management Plan)
- Water Quality Management Plan.

These are discussed in more detail in Section 7.6.3; it is expected that the implementation of these management plans will significantly reduce any adverse impacts to the marine environment of the GBRMP.

7.7.3.4 Operations phase – potential impacts

The potential impacts during the operations phase of the NGBR Project on the GBRMP are expected to be similar in nature (albeit of a reduced magnitude) to those experienced during the construction phase (i.e. potential changes to water quality or watercourses which discharge into the GBRMP). The operations of the final rail corridor are not expected to significantly impact the environmental values of the GBRMP, however there is the potential for contamination of the watercourses crossed by the final rail corridor due to accidental spillages or leakage of hazardous substances. The contamination of these watercourses may subsequently affect the water quality within the GBRMP and the ecological integrity of the marine ecosystem (refer to Section 7.6.3).

During the operations phase of the NGBR Project, no further changes to the existing topography or surface cover are expected and it is not anticipated that any further hardstand areas will be developed. It is therefore unlikely that there will be any change to the inflow of freshwater (i.e. stormwater) into waterways and subsequently, the GBRMP.

Potential impacts - changes in water quality

During the operations phase of the NGBR Project it is not anticipated that levels of erosion and sedimentation will increase as a result of operational activities. The most likely source of contamination of waterways during the operations of the NGBR Project will result from accidental spillages of hazardous materials in sensitive areas, i.e. in close proximity to waterways or within significant overland flow paths. Additionally, there is the potential for increased erosion and scouring around waterway crossings in times of heavy flow.

7.7.3.5 Operations Phase – mitigation measures

Water quality management during the operations phase of the NGBR Project primarily comprises an operational water quality monitoring program which will be developed prior to commencement of operations of the NGBR Project; this is discussed in more detail in Section 7.14.3. The ongoing monitoring and management strategy will involve the maintenance of scour protection devices and clearing debris at watercourse crossings on a regular basis.

7.7.4 Significance of residual impacts

This section describes and assesses the significance of the residual impacts of the NGBR Project to environmental values associated with the GBRMP. The residual impacts discussed in this section refer to the expected impact of the NGBR Project once all relevant management and mitigation measures have been implemented.

As outline in Section 7.7.2, an action will require approval under the EPBC Act where:

- The action is taken in the GBRMP and the action has, will have, or is likely to have a significant impact on the environment, or
- The action is taken outside the GBRMP and the action has, will have, or is likely to have a significant impact on the environment in the Great Barrier Reef Marine Park.

An action is considered to have a significant impact on the GBRMP where there is the potential that the action will trigger one or more of the significant impact criteria outlined in the Significant Impact Guidelines. Table 7-28 provides an assessment of the residual impacts of the NGBR Project against these criteria and identifies the likelihood of the project activities resulting in a significant impact to the GBRMP.

Table 7-28 Residual impact significance - Great Barrier Reef Marine Park

Significant impact criteria	Residual impact significance
Modify, destroy, fragment, isolate or disturb an important, substantial, sensitive or vulnerable area of habitat or ecosystem component such that an adverse impact on marine ecosystem health, functioning or integrity in the GBRMP results	The marine environment adjacent to the coastline that will potentially be impacted by the NGBR Project is generally shallow and punctuated by creek mouths, mud flats and mangrove habitats. The wider study area of the GBRMP potentially impacted by the NGBR Project (i.e. between Upstart Bay and Abbot Bay) is characterised by a heterogeneous habitat matrix of soft-sediment, rocky reef, coral, seagrass and algae. The benthic habitat in the Abbot Point area comprises primarily patchy low density seagrass beds and coral cover was found to be generally low. In a regional context, the benthic communities found within the wider study area are not considered to be sensitive or vulnerable.

Significant impact criteria	Residual impact significance
	The NGBR Project will not result in any residual impacts which may adversely affect the health, functioning or integrity of the marine ecosystem within the GBRMP.
Have a substantial adverse effect on a population of a species or cetacean including its life cycle (for example, breeding, feeding, migration behaviour, life expectancy) and spatial distribution	The NGBR Project will not result in any residual impacts which will significantly affect the life cycle or spatial distribution of individual species / cetaceans; this is discussed in further detail in Section 7.10.
Result in a substantial change in air quality or water quality (including temperature) which may adversely impact on biodiversity, ecological health or integrity or social amenity or human health	A conservative air quality assessment was undertaken for the NGBR Project and it was determined that any change to background air quality will be negligible at any of the identified sensitive receptors. On the basis of this assessment and following the implementation of an appropriate dust management plan, no residual air quality impacts are expected to result from the NGBR Project. The NGBR Project will not result in any residual impacts which will significantly affect water quality within the GBRMP.
Result in a known or potential pest species being introduced or becoming established in the GBRMP	The NGBR Project does not directly involve any activities (such as shipping) that could result in any known or potential pest species being introduced or established in the GBRMP. Potential consequential impacts of the NGBR Project are discussed in Section 7.13.
Result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, or social amenity or human health may be adversely affected	A water quality management plan will be developed prior to the commencement of construction activities and implemented throughout the life of the NGBR Project (refer to Section 7.6.3). Subsequently, it is not expected that the NGBR Project will result in the accumulation of contaminants in the marine environment within the GBRMP and therefore any residual impacts will be negligible.
Have a substantial adverse impact on heritage values of the GBRMP, including damage or destruction of an historic shipwreck.	The NGBR Project is entirely terrestrial and will not have an impact on the heritage values of the GBRMP.

7.8 Listed threatened species

Forty-one threatened species listed under the EPBC Act were predicted to occur within the preliminary investigation corridor (refer Appendix A of Volume 2 Appendix F Nature conservation (page 187)). Two threatened species, black ironbox (*Eucalyptus raveretiana*) and squatter pigeon (southern) (*Geophaps scripta scripta*) were confirmed present during field surveys of the preliminary investigation corridor. A further four fauna species are assessed as being likely to occur and 12 species as may occur within the preliminary investigation corridor.

For each of these species, their ecology and status, threatening processes, desktop and survey results and the regional significance of the NGBR Project footprint for the species are discussed in subsequent sections. Due to the linear nature of the project, there is no data presently available regarding the genetic diversity of the listed threatened species known or likely to occur within the final rail corridor.

It is important to note the potential habitat modelling provided for individual species is indicative only. While it is an important tool to inform the impact assessment, area calculations of potential habitat cannot be used to identify known impacts to the species, providing only context and potential habitat for the purpose of the NGBR Project assessment.

7.8.1 Overview

7.8.1.1 Likelihood of occurrence

A summary of the likelihood of occurrence assessment for threatened flora and fauna species is provided in Table Table 7-29 and Table 7-30 respectively.

Table 7-29 Likelihood of occurrence for threatened flora species

Species	EPBC Act	Predicted to occur by PMST	Previously recorded	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
Black ironbox ***Eucalyptus raveretiana***	Vulnerable	✓	WO, HERBRECS	✓	Black ironbox occurs in riparian woodlands on alluvial flats along creek and river banks on sandy or alluvial soils. It is commonly associated with *Melaleuca* spp., *Casuarina cunninghamiana* and *Eucalyptus tereticornis* in the canopy layer. (Calvert *et al*. 2005). It has been recorded from within the preliminary investigation corridor in the Elliot, Bogie and Bowen Rivers, and from Pelican and Sandy Creek.	**Confirmed present** Previously recorded in the desktop search extent and within the preliminary investigation corridor and confirmed present during the field surveys. It was recorded during the surveys within the corridor in Strathmore and Crush Creeks, where it was co-dominant in the canopy with other eucalypts. The condition of riparian habitats was moderate in both creeks in which black ironbox was observed – both Strathmore Creek and Pelican Creek had a relatively sparse canopy layer, and a weedy (to very weedy) understorey.
Bluegrass ***Dichanthium setosum***	Vulnerable	✓	WO, HERBRECS	x	In Queensland, *Dichanthium setosum* (bluegrass) has been reported from the Leichhardt, Morton, North Kennedy and Port Curtis regions. This species occurs in the Mistake Range, in Main Range National Park, and possibly in Glen Rock Regional Park, adjacent to the Main Range National Park (SEWPaC 2013b).	**May occur** This species has previously been recorded within 10 km of the proposed corridor (Wildlife Online). Suitable grassland habitat is likely to exist within the preliminary investigation corridor based on the species known habitat requirements and a desktop assessment of the preliminary investigation corridor.

Species	EPBC Act	Predicted to occur by PMST	Previously recorded	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
Finger panic ***Digitaria porrecta***	Endangered	x	WO, HERBRECS	x	Finger panic occurs within disjunct areas of Queensland, including in the Nebo district (one record), south-west of Mackay; the Central Highlands between Springsure and Rolleston; and from Jandowae south to Warwick (Council of Heads of Australasian Herbaria 2013). It occurs in grassland and open woodlands communities on undulating plains, often road reserves, with an underlying basaltic geology (TSSC 2008mi). A single record for this species is located in the desktop search extent, more than 45 km from the preliminary investigation corridor (Council of Heads of Australasian Herbaria 2013).	**May occur** Previously recorded within 10 km of the preliminary investigation corridor (Wildlife Online). Not previously recorded within the preliminary investigation corridor or its immediate vicinity. Suitable habitat for finger panic is present, however, this species appears to be at its northern-most distribution and rare in this area.
Polianthion minutiflorum	Vulnerable	x	WO, HERBRECS	x	*Polianthion minutiflorum* has been recorded in Queensland in five locations ranging from Redcliffe Vale south to Kingaroy. The species has been recorded within Corymbia and Acacia dominated open woodlands and forests on sandstone outcrops and gullies (TSSC 2008wl; Herbrecs search). The single record from within the desktop search extent is from Redcliffe Vale, 40 km east of the corridor.	**May occur** Previously recorded within 10 km of the preliminary investigation corridor (Wildlife Online). Not previously recorded within the preliminary investigation corridor or its immediate vicinity, however, suitable habitat exists within the corridor
Ozothamnus eriocephalus	Vulnerable	✓	WO, HERBRECS	x	*Ozothamnus eriocephalus* grows on rocky escarpments, slopes and creek gullies in closed rainforest margins and also open eucalypt forest. It is known from the Bowen and Mackay regions of central Queensland (TSSC 2008aas). The nearest record to the preliminary investigation corridor is located on Mt Abbot, just over 5 km west of the corridor in the vicinity of Thurso Station. It is also recorded to the north of Glenden approximately 35 km east of the preliminary investigation corridor (Council of Heads of Australasian Herbaria 2013).	**May occur** Previously recorded within 10 km of the preliminary investigation corridor (Wildlife Online). Not previously recorded within the preliminary investigation corridor or its immediate vicinity.

Species	EPBC Act	Predicted to occur by PMST	Previously recorded	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
Siah's backbone ***Streblus pendulinus***	Endangered	✓	x	x	*Streblus pendulinus* inhabits the east coast of Australia, from Cape York through to south-eastern New South Wales. This species also occurs outside of the Australian mainland on Norfolk Island, Papua New Guinea, Micronesia, Vanuatu, New Caledonia, Fiji Rapa and Hawaii (SEWPaC 2013c). *Streblus pendulinus* is a tree or large shrub, which on the Australian mainland primarily inhabits warmer rainforests along watercourses. This species inhabits altitudes from near sea level to 800 m above sea level.	**May occur** This species has previously been recorded within 10 km of the preliminary investigation corridor, west of Bowen (Mt Abbot and Mt Aberdeen National Park) (Wildlife Online, HERBRECS). Suitable habitat for this species may occur within the preliminary investigation corridor.
Minute orchid ***Taeniophyllum muelleri***	Vulnerable	✓	WO, HERBRECS	x	*Taeniophyllum muelleri* inhabits the east of coast of Australia from Cape York through to New South Wales (SEWPaC 2013d). This small epiphyte species occurs on the outer braches of rainforest trees, coast and coastal ranges from sea level to approximately 250 m above sea level.	**May occur** This species has previously been recorded within 10 km of the preliminary investigation corridor, west of Bowen (Mt Aberdeen National Park) (Wildlife Online, HERBRECS). Suitable habitat for this species may occur within the preliminary investigation corridor.
Aristida granitica	Endangered	✓	WO, HERBRECS	x	One population only of *Aristida granitica* is known from the type locality in the foothills of Mt Pring 10 km west of Bowen, Queensland. Within this location it has been reported to be common (TSSC 2008if). It grows in sandy soil derived from granite and in eucalypt woodland (TSSC 2008if).	**Unlikely to occur** Previously recorded within 10 km of the preliminary investigation corridor (Wildlife Online). Not previously recorded within the preliminary investigation corridor or its immediate vicinity. This species has a highly restricted distribution.

Species	EPBC Act	Predicted to occur by PMST	Previously recorded	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
Miniature moss-orchid ***Bulbophyllum globuliforme***	Vulnerable	✓	x	x	The Miniature moss-orchid is reportedly only found growing on hoop pine (*Araucaria cunninghamii*) throughout the McPherson Range of northeast NSW and southeast Qld communities (TSSC 2008jh). However, the Queensland Herbarium has a record for this species from near Paluma, north west of Townsville (Council of Heads of Australasian Herbaria 2013). The distribution of this species overlaps with the TECs Semi-evergreen vine thicket and Brigalow (TSSC 2008jh).	**Unlikely to occur** Not recorded within the desktop search extent and suitable habitat is generally limited within the preliminary investigation corridor. Suitable habitat for hoop pine was not recorded during field surveys.
Cajanus mareebensis	Endangered	✓	x	x	*Cajanus mareebensis* has been recorded in grassy woodlands dominated by Melaleuca, Acacia, Eucalyptus and Corymbia species within the Cape York and Northern Gulf regions of Queensland (TSSC 2008jl). The species is a perennial trailing herb occurs on sandy soils derived from granite (TSSC 2008jl). It is unclear why it is identified in PMST as it has not been recorded within 400 km of the desktop search extent (Council of Heads of Australasian Herbaria 2013).	**Unlikely to occur** Not recorded within 400 km of the desktop search extent.
Cycas ophiolitica	Endangered	✓	x	x	*Cycas ophiolitica* (Marlborough blue cycad) inhabits eucalypt open forest and woodland communities with a grassy understorey and occur on hill tops or steep slopes, at altitudes of 80-620 m above sea level. It grows on shallow, stony, red clay loams or sandy soils.	**Unlikely to occur** This species has not previously been recorded within the preliminary investigation corridor. However, the preliminary investigation corridor is within the species distribution, and suitable habitat may exist based on a desktop assessment of the preliminary investigation corridor.

Species	EPBC Act	Predicted to occur by PMST	Previously recorded	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
King bluegrass ***Dichanthium queenslandicum***	Endangered	x	WO, HERBRECS	x	King blue grass can be found throughout central Queensland on black cracking clay soils derived from basalt, in association with other *Dichanthium* and *Bothriochloa* spp. within native grasslands and some open woodlands (Simon 1982). It has been recorded approximately 15 km from the preliminary investigation corridor in the desktop search extent (Council of Heads of Australasian Herbaria 2013).	**Unlikely to occur** Previously recorded within 10 km of the preliminary investigation corridor (Wildlife Online). Not previously recorded within the preliminary investigation corridor or its immediate vicinity. Suitable habitat for this species (natural grassland) was not recorded during field surveys.
Omphalea celata	Vulnerable	✓	x	x	*Omphalea celata* has been recorded within the North and South Kennedy regions of central Queensland (Forster 1995). The species occurs within semi evergreen vine thickets along steep gorges and permanent watercourses (Forster 1995). The nearest records are from Hazelwood Gorge near Eungella National Park, more than 65 km east of the preliminary investigation corridor (Council of Heads of Australasian Herbaria 2013).	**Unlikely to occur** Not previously recorded within the desktop search extent but partially suitable habitat exists in the preliminary investigation corridor

Predicted to occur within approximately a 10 km area around the Study Area: SEWPaC Protected Matters Search Tool

* Previously recorded within desktop search extent from sources including Wildlife Online (WO), HERBRECS, Queensland Museum (QM), Birds Australia (BA) and essential habitat mapping (EH)

^ Recorded during field surveys of the preliminary investigation corridor undertaken May/June 2013

Table 7-30 Likelihood of occurrence for threatened fauna species

Species	EPBC Act	Predicted to occur by PMST	Previously recorded	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
Squatter pigeon (southern) ***Geophaps scripta scripta***	Vulnerable	✓	WO	✓	The squatter pigeon (southern) is locally abundant within the northern part of its range (i.e. Brigalow Belt (North) and Desert Uplands Bioregions) (SEWPaC 2013a). It is considered to be common in grazing country north of the Tropic of Capricorn (SEWPaC 2013a). The species occurs in a wide range of habitats wherever there is a grassy understorey. It is often found within close proximity of water bodies (SEWPaC 2013a). The squatter pigeon (southern) has been historically recorded within 10 km of the preliminary investigation corridor (Wildlife Online). This species was confirmed present during field surveys in May and June 2013.	**Confirmed present** Historically recorded in the desktop search extent. Suitable habitat occurs in parts of preliminary investigation corridor. This species was recorded during surveys for the Alpha Coal Project (Rail) EIS (Hancock Prospecting Pty Ltd 2010) and the Water for Bowen EIS (SunWater 2009). A total of eight individual squatter pigeons were recorded during field surveys at four locations within the preliminary investigation corridor or study area. All records of this species from field surveys were from the Suttor River flood plain in the southern half of the preliminary investigation corridor. Squatter pigeons were typically encountered from eucalypt woodland with a grassy understorey, and non-remnant cleared land habitat types. Squatter pigeons were recorded in pairs at each location. Potential habitat for this species occurs throughout the preliminary investigation corridor. Squatter pigeons are associated with eucalypt woodland, fringing riparian vegetation and non-remnant cleared lands/regrowth areas (occurring on land zones 3, 4, 5, 7 and 10) close to water (within 3 km (SEWPaC 2013a)).

Species	EPBC Act	Predicted to occur by PMST	Previously recorded	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
Australian painted snipe ***Rostratula australis***	Endangered Marine Migratory wetland	✓	x	x	The Australian painted snipe has a scattered distribution across eastern and northern Australia (SEWPaC 2013e). Shallow freshwater wetlands are the main habitat for the species (Marchant and Higgins 1993). Such wetlands may include lakes, swamps, claypans, inundated / waterlogged grassland, dams, irrigated crop land and sewage ponds (Marchant and Higgings 1993). Preferred wetland habitats boast emergent vegetation (including tussocks, grasses, sedges, rushes, reeds, canegrass and/or Melaleuca) (Marchant and Higgins 1993). Nesting occurs amongst vegetation in or adjacent to wetlands (SEWPaC 2013e).	**Likely to occur** Predicted to occur, but not previously recorded in the desktop search extent. Potentially suitable habitat occurs near and possibly within the preliminary investigation corridor, associated with vegetated margins of the Caley Valley Wetland. This species was detected at Caley Valley Wetland during surveys undertaken by BAAM (2012).
Black-throated finch (southern) ***Poephila cincta cincta***	Endangered	✓	BA	x	This subspecies is now known from three general areas, namely Townsville, Ingham and scattered sites in central Queensland. The sub-species typically occurs in native grasslands and woodlands along creeks and riverbanks. Mosaics of habitat types that provide sufficient foraging resources (i.e. seed) through the wet season are thought to be required by this species (SEWPaC 2013f). The black-throated finch (southern) has been previously recorded within 10 km of the preliminary investigation corridor (Wildlife Online).	**Likely to occur** Historically recorded in the desktop search extent. Suitable habitat occurs in open woodland habitat featuring an understorey of native grasses, where water is locally available. This species was recorded at Splitter's Creek (northern part of preliminary investigation corridor) during surveys for the Water for Bowen EIS (SunWater 2009). Another record (Birds Australia database, dated April 2012) is located on the Bowen Developmental Road near the intersection of the Cerito-Elphinstone Road adjacent to the Leichhardt Range within the preliminary investigation corridor.

Species	EPBC Act	Predicted to occur by PMST	Previously recorded	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
Masked owl (northern) ***Tyto novaehollandiae kimberli***	Vulnerable	✓	x	x	The masked owl (northern) occurs across northern Australia and is a conventionally accepted subspecies of the masked owl. In Queensland, the northern subspecies occurs across Cape York Peninsula, to a southern distribution limit along the central Queensland coast, with records from Mackay and near Duringa, west of Rockhampton (SEWPaC 2013g). Habitat for the subspecies includes riparian forest, rainforest, open forest Melaleuca swamps, edges of mangroves and the margins of sugar cane fields (SEWPaC 2013g). This species is territorial, occupies a large home range and requires large old growth trees with large hollows for nesting (SEWPaC 2013g).	**May occur** Predicted to occur, but not previously recorded in the desktop search extent. The preliminary investigation corridor is within the species known distribution. Potentially suitable habitat in places, particularly riparian forest vegetation close to Abbot Point.
Red goshawk ***Erythrotriorchis radiatus***	Vulnerable	✓	x	x	The red goshawk prefers landscapes containing a mosaic of habitats including coastal and sub-coastal tall open forest, woodland and rainforest edges (Marchant and Higgins 1993). Forests of intermediate density are particularly favoured, as are ecotones between variably dense habitats (i.e. ecotone between rainforest and sclerophyll forest) (SEWPaC 2013h). Large bird populations (the primary prey of this species) are also an important determinant of red goshawk habitat utilisation (SEWPaC 2013h). It generally avoids open habitats, and is only rarely encountered over agricultural land (Marchant and Higgins 1993). Nesting occurs in tall trees within one kilometre of permanent water, generally in open, biologically rich forest or woodland (Marchant and Higgins 1993). The species is sparsely dispersed across approximately 15 per cent of coastal and sub-coastal Australia. The species occurs at low densities occupying home ranges estimated between 50 – 220 km^2 (SEWPaC 2013h).	**May occur** Predicted to occur, but not previously recorded in the desktop search extent. The preliminary investigation corridor is within the species known distribution. Potentially suitable habitat occurs in preliminary investigation corridor, particularly where tall riparian vegetation occurs along larger watercourses (possible nesting habitat).

Species	EPBC Act	Predicted to occur by PMST	Previously recorded	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
White-bellied storm petrel ***Fregetta grallaria grallaria***	Vulnerable	✓	x	x	The white-bellied storm-petrel occurs across sub-tropical and tropical waters in the Tasman Sea, Coral Sea and, possibly, the central Pacific Ocean (SEWPaC 2013i). In the non-breeding season, it reaches and forages over near-shore waters along the continental shelf of mainland Australia (SEWPaC 2013i). It breeds, in Australian territory, on offshore islets and rocks in the Lord Howe Island group (SEWPaC 2013i). It nests in crevices between large volcanic rocks, and in burrows excavated in banks (SEWPaC 2013i).	**Unlikely to occur** Predicted to occur, but not previously recorded in the desktop search extent. Species distribution does not include the preliminary investigation corridor.
Star finch (eastern sub species) ***Neochima ruficauda ruficauda***	Endangered	✓	x	x	The distribution of the subspecies of the star finch is poorly known, however it is restricted to eastern Queensland (and distribution is likely to be severely fragmented (SEWPaC 2013j). Areas of permanently occupied habitat or permanent populations have not been identified (SEWPaC 2013j). An estimate puts the extant wild population of the subspecies at 50 birds (SEWPaC 2013j). Habitat preferences include grasslands and grassy woodlands near water, sedgelands, swamps and wetlands (Higgins *et al*. 2006; SEWPaC 2013j). The subspecies is also known from disturbed habitats including farmland (Higgins *et al*. 2006; SEWPaC 2013j).	**Unlikely to occur** Predicted to occur, but not previously recorded in the desktop search extent. This subspecies has disappeared from much of its former eastern and central Queensland range, with a lack of recent records (Higgins *et al*. 2006).

Species	EPBC Act	Predicted to occur by PMST	Previously recorded	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
Mammals						
Koala ***Phascolarctos cinereus***	Vulnerable (combined populations of Queensland, NSW and the ACT)	✓	WO, QM	x	In Queensland, the species contains scattered populations throughout moist forests along the coastline, subhumid woodlands in central and southern regions and within Eucalypt woodlands along watercourses within semi-arid areas further west (Melzer *et al*. 2000). The greatest density of koalas occur through central and eastern areas including the Brigalow Belt, Mitchell Grass Downs, Mulga lands and the Desert Uplands (Patterson 1996).	**Likely to occur** Historically recorded in the desktop search extent. The preliminary investigation corridor is within the species known distribution. Suitable habitat occurs within the preliminary investigation corridor within eucalypt woodland and fringing riparian vegetation, based on species known habitat requirements and targeted field habitat assessments.
Northern quoll ***Dasyurus hallucatus***	Endangered	✓	x	x	Species distribution covers much of north eastern Australia, although the current range has contracted considerably such that it is now restricted to six discrete areas across northern Australia (Strahan 1995). The species has no highly specific habitat requirements, though rocky areas associated with open woodland and open forest are considered optimal habitat (Hill and Ward 2010). The preference for rocky habitat may be related to reduced exposure to threatening processes (i.e. vegetation clearing, fire, cane toads, reduced competition with cats) and the diversity of micro-habitats available (Hill and Ward 2010). The modelled distribution of the species, as presented in the Referral Guidelines for the Northern Quoll *Dasyurus hallucatus* (SEWPaC 2013k), indicates that the preliminary investigation corridor coincides with the modelled 'may occur' distribution area for the species.	**May occur** Predicted to occur, but not previously recorded in the desktop search extent. The preliminary investigation corridor is within the SEWPaC modelled 'may occur' distribution for this species. Suitable habitat may occur within the preliminary investigation corridor where areas of rocky eucalypt woodland are present.

Species	EPBC Act	Predicted to occur by PMST	Previously recorded	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
Bare-rumped sheathtail bat ***Saccolaimus saccolaimus nudicluniatus***	Critically endangered	✓	x	x	The bare-rumped sheathtail bat is known from north Queensland and the Northern Territory. Occasional records of this species have been collected from a narrow coastal region (less than 40 km inland) between Ayr and Cooktown. There are only two records of this species from the last two decades, both records are from north-eastern Queensland. There are no recent records of this species from the Northern Territory. Habitat preferences for this species may include alluvial woodlands or fringing riparian vegetation (SEWPaC 2013l).	**Unlikely to occur** Predicted to occur, but not previously recorded in the desktop search extent. Current known distribution does not incorporate the preliminary investigation corridor.
Greater large-eared horseshoe bat ***Rhinolophus philippinensis***	Endangered	✓	x	x	The greater large-eared horseshoe bat is found in lowland rainforest, along gallery forest-lined creeks within open eucalypt forest, Melaleuca forest with rainforest understorey, open savannah woodland and tall riparian woodland of Melaleuca, forest red gum (*E. tereticornis*) and Moreton Bay ash (*E. tesselaris*) (SEWPaC 2013m).	**Unlikely to occur** Predicted to occur, but not previously recorded in the desktop search extent. Potentially suitable habitat may occur within the preliminary investigation corridor in association with densely vegetated fringing riparian vegetation.
Grey-headed flying-fox ***Pteropus poliocephalus***	Vulnerable	✓	x	x	The grey-headed flying fox feeds on canopy fruits and nectar within rainforests, open forests, closed and open woodlands, melaleuca swamps and banksia woodlands. The species is currently not known to occur north of Rockhampton in central Queensland. The historical distribution for this species extended into far-north Queensland (SEWPaC 2013n).	**Unlikely to occur** Predicted to occur, but not previously recorded in the desktop search extent. Current known distribution does not incorporate the preliminary investigation corridor.

Species	EPBC Act	Predicted to occur by PMST	Previously recorded	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
Water mouse ***Xermomys myoides***	Vulnerable	✓	x	x	Although not truly aquatic, the nocturnal water mouse lives near shallow water close to the coast. It occurs in mangrove forests, adjacent freshwater lagoons and swamps and floodplain saline grasslands close to coastal fore-dunes in central and southern Queensland (DEHP 2013). The water mouse builds and shelters in large mud nests like termite mounds, often using exposed tree roots to form the foundations for the mounds (DEHP 2013). It forages in mangrove forests for small crabs, shellfish and worms, and then returns to adjacent sedge-lands during high tide for shelter (SEWPaC 2013o; DEHP 2013).	**Unlikely to occur** Predicted to occur, but not previously recorded in the desktop search extent. Potentially suitable habitat is lacking for this species within the preliminary investigation corridor. Tidal areas with mangrove vegetation around Caley Valley Wetland Elliot and Burdekin Rivers may provide habitat north of the preliminary investigation corridor.
Reptiles						
Ornamental snake ***Denisonia maculata***	Vulnerable	✓	WO, QM	x	The ornamental snake's distribution is confined to the Brigalow Belt North bioregion and parts of the Brigalow Belt South bioregion (SEWPaC 2013p). This species is typically found in areas of brigalow, riverside woodland and open forest on natural levees (SEWPaC 2013p). Habitats featuring cracking clay and sandy substrates are known to be utilised by the species.	**Likely to occur** Historically recorded in the desktop search extent. The preliminary investigation corridor is within the SEWPaC modelled 'known/likely to occur' and 'may occur' distribution for this species. Suitable habitat is likely to exist within the preliminary investigation corridor within vegetation approximately north and south of the Bowen River, and south of the Suttor Developmental Road

Species	EPBC Act	Predicted to occur by PMST	Previously recorded	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
Dunmall's snake ***Furina dunmalli***	Vulnerable	✓	x	x	Dunmall's snake occurs in central and south-east Queensland, with the northern limit of its known range extending between Yeppoon and the Expedition Range (SEWPaC 2013q). It inhabits open forest and woodland habitats. Brigalow growing on cracking clay and loam soils on floodplains is a known habitat for the species (SEWPaC 2013q).	**May occur** Predicted to occur, but not previously recorded in the desktop search extent. The very south of the preliminary investigation corridor abuts the northern distributional limit of the SEWPaC modelled 'may occur' distribution for this species. Limited potentially suitable habitat may occur around where the preliminary investigation corridor intersects the Gregory Developmental Road.
Retro slider ***Lerista allanae***	Endangered	✓	x	x	The retro slider occurs within the Clermont region and inhabits black to black-red soils with dense leaf litter cover or under trees, shrubs and grass tussocks (SEWPaC 2013r). The species has been recorded in *E. orgadophila* open woodlands, *Melaleuca bracteata* closed scrubs and forests and scattered Bauhinia spp. on plains (Covacevich *et al*. 1996). The modelled distribution of the species, as presented in the Referral Guidelines for the Retro Slider *Lerista allanae* (SEWPaC 2013r) indicates that part of the investigation corridor coincides with the modelled 'may occur' distribution for the species.	**May occur** Predicted to occur, but not previously recorded in the desktop search extent. The very south of the preliminary investigation corridor abuts the northern distributional limit of the SEWPaC modelled 'may occur' distribution for this species. Limited potentially suitable habitat may occur south of the Suttor Developmental Road.

Species	EPBC Act	Predicted to occur by PMST	Previously recorded	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
Yakka skink ***Egernia rugosa***	Vulnerable	✓	x	x	The yakka skink is endemic to dry open forests, woodlands and rocky areas of central and eastern Queensland. Yakka skinks live in communal borrow complexes, and often take refuge among low vegetation or under heaped dead timber, logs, rocks and in deep rock crevices (Wilson 2005; SEWPaC 2013s). The species occurs in a wide variety of vegetation types including poplar box (*Eucalyptus populnea*), ironbark (Eucalyptus spp.), brigalow (*Acacia harpophylla*), white cypress pine (Callitris spp.), mulga (*Acacia aneura*), bendee (*Acacia catenulata*) and lancewood (*Acacia shirleyi*) woodland and open forest (SEWPaC 2013s).	**May occur** Predicted to occur, but not previously recorded in the desktop search extent. The preliminary investigation corridor is within the SEWPaC modelled 'may occur' distribution for this species. Suitable habitat may occur within the preliminary investigation corridor in rocky outcrop areas or where eucalypt woodland with suitable timber microhabitats are present.
Mount Cooper striped lerista ***Lerista vittata***	Vulnerable	✓	x	x	The Mount Cooper striped lerista is found in Semi-evergreen Vine Thickets of the Brigalow Belt (North and South) and Nandewar Bioregions, which is not predicted to occur in the investigation corridor (SEWPaC 2013t).	**Unlikely to occur** Predicted to occur, but not previously recorded in the desktop search extent. Potentially suitable habitat is unlikely to exist within the preliminary investigation corridor.

Predicted to occur within approximately a 10 km area around the Study Area: SEWPaC Protected Matters Search Tool

* Previously recorded within desktop search extent from sources including Wildlife Online (WO), HERBRECS, Queensland Museum (QM), Birds Australia (BA) and essential habitat mapping (EH)

^ Recorded during field surveys of the preliminary investigation corridor undertaken May/June 2013

7.8.1.2 Potential impacts and management measures

Construction of the NGBR Project will result in the clearing of a nominally 100 m wide final rail corridor plus temporary (construction) and permanent (operation) ancillary infrastructure footprints located adjacent to the final rail corridor (collectively termed the NGBR Project footprint). The NGBR Project footprint is generally located within the 1,000 m wide preliminary investigation corridor. The NGBR Project's construction process will be intensive for approximately two years.

Construction will occur on three fronts with multiple areas of impact at any one time. Impacts will occur progressively along the rail alignment ahead of bulk earthworks, bridge, culvert, and structures development and the laying of sleepers, ballast and track. It should be noted that the avoidance of significant environmental features and values was incorporated into the earlier route selection stages of the NGBR Project, both during placement and development of the preliminary investigation corridor and during the location of the NGBR Project footprint within the preliminary investigation corridor (refer Section 7.2.1). Within this preliminary investigation corridor, a NGBR Project footprint has been finalised and it is this footprint that is assessed here.

The following are general environmental mitigation and management measures which will be implemented on site during construction and operation of the NGBR Project. These will seek to protect and preserve MNES as well as other environmental values. Avoidance, mitigation and management measures specific to certain MNES are described in Section 7.8.2 to 7.8.6.

Vegetation clearing and habitat loss

Where native vegetation clearing is required for construction, the following management and mitigation measures are recommended:

- The extent of land clearing will be restricted to the amount necessary for the construction of the final rail corridor and ancillary infrastructure (i.e. lay down areas)
- Design locations for ancillary infrastructure to be moved out of vegetation communities and habitats with high ecological values and into non-remnant areas as much as practicable
- Wherever practicable, temporary construction areas, such as site offices, construction stockpile locations, machinery/equipment laydown areas and storages will be located within the final rail corridor in non-remnant areas to reduce the extent of impact on remnant vegetation
- The extent of vegetation clearing will be clearly identified on construction plans and demarcated on site. Areas that must not be cleared or damaged are to also be clearly identified on construction plans and demarcated on site. Clearing extents are to be communicated to all necessary construction personnel involved.
- Pre-clearance surveys will be undertaken in areas identified as potential habitat for threatened flora and fauna species and habitat features prior to commencement of clearing. In areas where these surveys indicate the presence of habitat features known or with the potential to provide habitat for these species, a fauna spotter-catcher will be engaged during clearing activities.
- Remaining areas of remnant vegetation representing TECs or key habitat areas, located adjacent to the final rail corridor, will be fenced using environmentally friendly fencing (or another suitable method) to deter and exclude workers and machinery from entering

these areas and potentially further contributing to indirect degradation though waste dumping and vehicle movements. Fencing may only be necessary along the boundaries where interaction is likely, rather than fencing the entire remnant vegetation patch.

- Rehabilitation activities will commence as soon as possible after any temporary construction areas are no longer required. Rehabilitation will involve revegetating disturbed areas to a state consistent with their original condition and with the adjacent landscape. Revegetation will use flora species of local provenance that were present prior to clearing commencing. A rehabilitation management plan will be developed to detail how disturbed land will be managed and rehabilitated, including (but not limited to) details regarding seed collection, flora regeneration, landscape architecture (i.e. topography) and creation of supplementary habitats (e.g. nesting boxes), where necessary.

Fauna mortality and injury

Management and mitigation measures recommended to reduce fauna mortality during construction and operation of the NGBR Project include:

- Pre-clearance surveys will be undertaken in areas identified as potential habitat for threatened species, prior to commencement of clearing. In areas where these surveys indicate the presence of habitat features known or with the potential to provide habitat for these species, a fauna spotter-catcher will be engaged during clearing activities. Pre-demarcated habitat features identified during the pre-clearance survey will be thoroughly checked by the fauna spotter-catcher and fauna relocation activities are to occur prior to clearing.
- Sequential vegetation clearing will be undertaken to allow more mobile fauna species the opportunity to disperse away from clearing areas
- Procedures in the event that an animal is injured will be developed. Depending on the type and extent of injuries, animals will either be taken to the nearest veterinary practitioner or wildlife care network or humanely euthanized on site by a suitably authorised and trained practitioner.
- All vehicles and plant will stay on pre-determined routes and adhere to site construction and operation rules relating to speed limits. Speed limits will be clearly signposted so as to minimise the potential for fauna impact.
- Any road kill will be dragged to the edge of the road and subsequently removed as quickly as practicable to reduce potential for scavengers to be struck
- Temporary fencing will be erected around construction zones to exclude mobile animals from vegetation clearing and civil works areas
- Work areas should be checked for any trapped fauna before work commences each day
- Where practicable, small open excavations will be securely covered after daily works and when not in use by a barrier impenetrable to fauna. Fauna ramps (e.g. soil/log ramps or wooden planks) will be installed in areas of larger excavation, (e.g. open trenches), to provide a potential means of escape for trapped fauna.
- Where fencing is required, consideration will be given to not using barbed wire on the top strand of wire fences to reduce the risk of fauna entanglement (e.g. bats) resulting in injury or mortality

- Employees will be made aware of environmental responsibilities regarding local fauna and site protocols for encountering fauna during inductions and ongoing environmental awareness training
- The final rail corridor will be fenced along its length to exclude wildlife and livestock. Wildlife friendly infrastructure will be incorporated where required within the design of bridges and culverts to allow safe fauna passage.
- Incidents of wildlife mortality will be recorded and remedial action taken if repeat incidents occur.

Habitat fragmentation

Management and mitigation measures recommended to reduce the impact of habitat fragmentation on local fauna populations include:

- Landscape permeability will be retained. Where fencing is required around cleared areas, 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). Consideration will be given to not using barbed wire on the top strand of wire fences to reduce the risk of fauna entanglement (e.g. bats) resulting in injury or mortality.
- Vegetation clearing will be undertaken in a sequential manner to allow more mobile fauna species the opportunity to disperse away from clearing areas
- Vegetation clearing extents will be kept to the minimum area necessary for construction to reduce the area subject to habitat fragmentation. The extent of vegetation clearing will be clearly identified on construction plans and demarcated on site. Areas that must not be cleared or damaged will also be clearly identified on construction plans and demarcated on site. Clearing extents will be communicated to all necessary construction personnel involved.
- Hollow bearing trees and stags are to be identified during pre-clearance surveys and checked for fauna prior to any clearing activities.

Degradation of vegetation and habitat

Management of environmental factors such as erosion and sedimentation that contribute to the degradation of vegetation through edge effects will be undertaken in accordance with erosion and sediment controls set out in the Environmental Management Plan. This plan will identify all practices to be implemented prior to, during and post-construction. It is recommended that the management approach to vegetation and habitat alteration, degradation and erosion and sediment control actions includes the following:

- Areas of remnant vegetation located adjacent to ancillary infrastructure locations will be fenced using environmentally friendly fencing to deter workers and machinery from entering these areas and potentially further contributing to indirect degradation though waste dumping, vehicle movements and vandalism. Fencing may only be necessary along the boundaries where interaction is likely, rather than fencing the entire remnant vegetation patch.
- Sediment fences and other erosion and sediment control devices, in particular in areas near earthworks, watercourses and key stormwater flow paths, will be installed and maintained in accordance with the ESCP to be developed for the NGBR Project, such that the impacts to water quality and downstream flows are minimised to the greatest extent possible

- All soil or mulch stockpiles should be located away from watercourses and key stormwater flow paths to limit potential for transport of these substances into the watercourses via run-off
- Dust suppression activities will be undertaken where appropriate during construction activities
- Worked areas will be stabilised as soon as practicable after disturbance
- Undertake land clearing during the dry season, where possible, to minimise the likelihood of erosion and sediment mobilisation during and after rainfall events.

Increased prevalence of weeds and pests

Weed and pest species spread, and the potential for introduction of new species, will require management during the construction and operation phases of the NGBR Project. An integrated suite of actions will be developed and implemented to manage these species, including:

- Waste management disposal protocols and procedures will be incorporated into the EMP and include:
  – Disposal of vegetation waste in a manner that avoids potential for spread of weeds
  – Containment of food and waste scraps in securely sealed containers (to minimise potential for pest animals to access food wastes)
- Pest animal occurrence will be monitored and recorded during construction and operation. If increased densities of pest animals are observed, or new pest animals are identified, humane pest controls will be implemented to manage numbers.
- Weed levels will be monitored in areas adjacent to construction activities, in areas subject to potential vegetative change, in any areas that are rehabilitated after construction and within undisturbed or 'control' areas within the NGBR Project footprint. Monitoring will be undertaken annually during construction and operation, with results to be considered in terms of baseline information (collected prior to construction) and with reference to appropriate control (reference) sites. If significant infestations of any weeds occur, or if new infestations of Weeds of National Significance (WONS) or Class 1 or 2 weeds declared under the *Land Protection (Pest and Stock Route Management) Act 2002* are identified, weed control measures will be implemented. Weed control measures will be based on Queensland Department of Agriculture, Forestry and Fisheries (DAFF) and Regional Councils advice. Ongoing monitoring of weed infestations associated with construction activities will occur through implementation of the Weed and Pest Management Plan.
- All vehicles, equipment and materials brought onto site will be inspected and certified as free of weeds and weed seed material, and carry a weed hygiene declaration. Records will be retained to demonstrate compliance with this requirement.
- Soil stripped and stockpiled from areas containing known weed infestations (particularly of declared weeds) will be stored separately and will not be moved to areas free of weeds
- Domestic animals will not be permitted on the NGBR Project during construction and operation.

Construction and operational emissions, habitat alteration and fauna disturbance

Impacts to native fauna behaviour and habitat degradation from light, noise and dust emissions have the potential to occur during both construction and operational phases of the NGBR Project. Management and mitigation measures recommended to reduce these include:

- Directional lighting will be used where lighting is required in construction areas
- Dust suppression actions will be undertaken in all cleared areas, on all unsealed roads, construction and operational areas, at suitably regular intervals and volumes, when required
- Frequent maintenance of machinery and plant will be undertaken to minimise unnecessary noise and exhaust emissions.

7.8.2 Black ironbox

7.8.2.1 Species overview

Black ironbox (*Eucalyptus raveretiana*), listed as vulnerable under the EPBC Act, is a medium sized tree that grows to approximately 25 m and is endemic to Queensland. The species has a wide distribution in coastal and sub-coastal areas of Queensland, from south of Townsville to Nebo, around Rockhampton and areas 100 km west of the city (Queensland Herbarium 2009 cited in TSSC, 2008). Records from the HERBRECS database obtained from the Queensland Herbarium indicate the species is found in two main population areas to the north and north-west of Rockhampton, and centred around Collinsville (primarily to the north and south-east). The species typically occurs along watercourses or on adjacent floodplains/alluvial flats on soils ranging from sandy to heavy clay (SEWPaC 2013a).

To date, it has been recorded from about 23 sites throughout its range. Population data for black ironbox is limited, although it is locally common on some permanent streams, but absent from many others (pers. comm., Bean 2010 cited in TSSC, 2008).

7.8.2.2 Desktop results

Black ironbox was predicted to occur in the preliminary investigation corridor by the Protected Matters Search Tool. The Wildlife Online and HERBRECS databases also identified records of this species within the desktop search extent (refer Section 7.3.1). In the landscape in which the final rail corridor occurs, the HERBRECS data indicates this species has been found in the Bogie and Bowen River catchments.

7.8.2.3 Survey results

Specific survey guidelines for this species are limited to the requirement to survey permanent and semi-permanent streams (SEWPaC 2013a). Assessment of watercourse vegetation within the preliminary investigation corridor was undertaken as part of the terrestrial and aquatic assessments (refer Section 7.3.1).

Black ironbox was identified at two locations, Crush Creek and Strathmore Creek, within the preliminary investigation corridor (Plate 7-1). It was generally present as a dominant canopy species, or as a co-dominant with species such as *Melaleuca leucadendra*, *Casuarina cunninghamiana* and *Eucalyptus tereticornis*, which is consistent with other published information on the species (Calvert, Lokkers, and Cumming 2005; SEWPaC 2013a). The condition of riparian habitats was moderate in both creeks in which black ironbox was observed

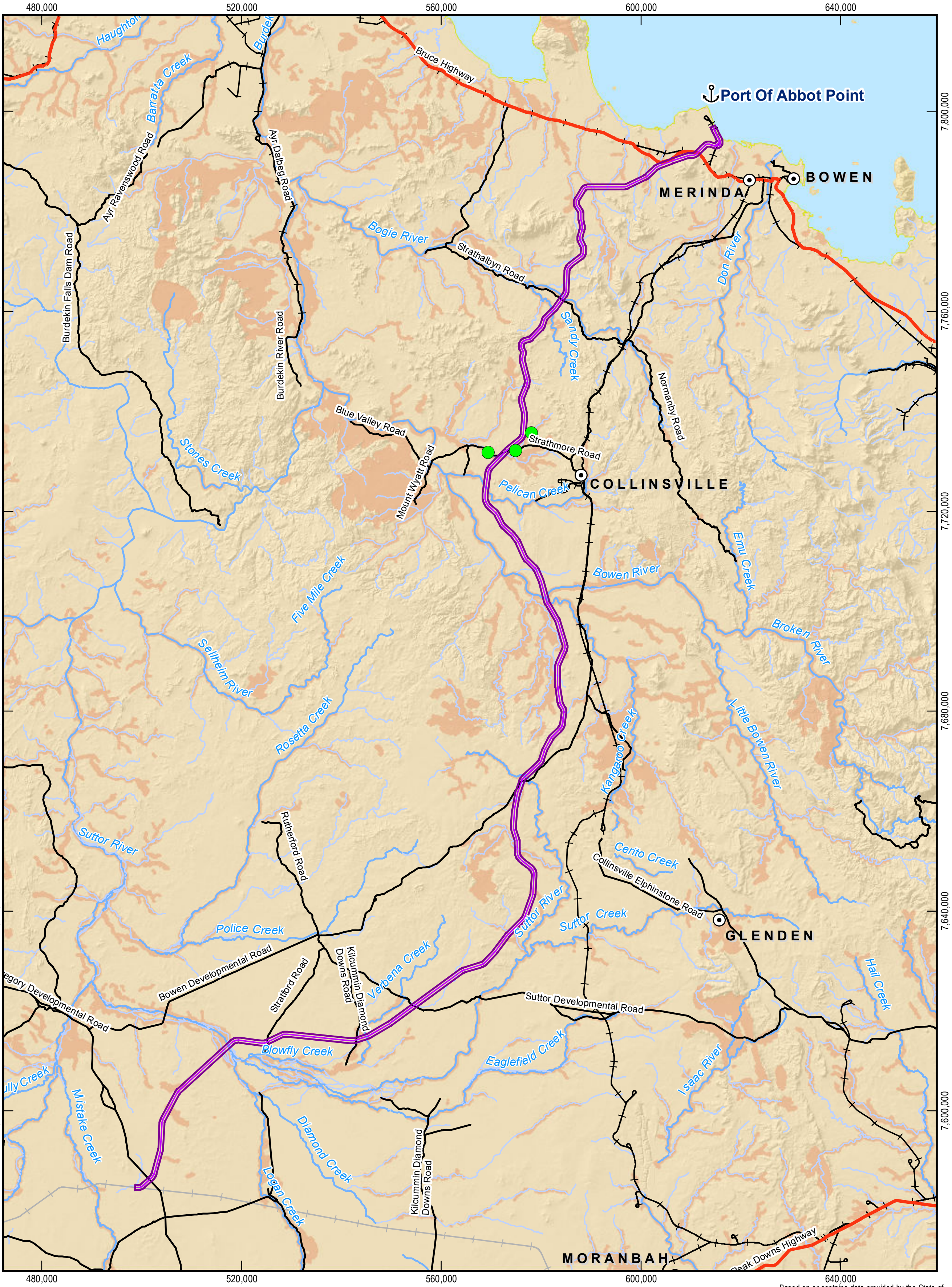
– both Strathmore Creek and Crush Creek had a relatively sparse canopy layer, and a weedy to very weedy understorey.

It has also been identified during field surveys for two other projects in the broader region: the Galilee Coal Project (Waratah Coal Pty Ltd 2011) where the species was recorded around minor ephemeral waterways near Bowen and south of Collinsville; and the Alpha Coal Project (Hancock Prospecting Pty Ltd 2010) in association with riparian vegetation around the Elliot River.

Plate 7-1 Black ironbox at Strathmore Creek (May 2013)

7.8.2.4 Significance of NGBR Project footprint

While it is listed as vulnerable under the EPBC Act, its wide distribution and locally common abundance mean that the species is likely to be present along numerous creek lines within the preliminary investigation corridor and across the broader region. While the final rail corridor is unlikely to contain an important population under the Significant Impact Guidelines, the region may potentially be part of an important population within the greater Burdekin catchment. The potential habitat available for the species within and adjacent to the preliminary investigation corridor is shown in Figure 7-27. Potential habitat comprises REs 11.3.25 and 11.3.37 along major watercourses within the preliminary investigation corridor.



LEGEND

- Population Centres
- Major Port
- *Eucalyptus raveretiana*
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourse (Major)
- Watercourse (Minor)
- Potential Black Ironbox Habitat - Based on DNRM Certified Regional Ecosystems Version 6.1
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

1:1,100,000 Paper Size A4

0 10 20 40

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD adani

Adani Mining Pty Ltd

North Galilee Basin Rail Project

Job Number	41-26457
Revision	B
Date	26 Sep 2013

Black Ironbox potential habitat

Figure 7-27

G:\41\26457\06 GIS\Maps\MXD\1100_Ecology\41_26457_1137_rev_b.mxd

Level 9, 145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010, Potential Habitat/2011; GHD: Fauna Survey Locations/2013. Created by:MS

7.8.2.5 Threatening processes

The primary process threatening black ironbox is habitat disturbance through the introduction and proliferation of exotic weeds species, particularly rubber vine (*Cryptostegia grandiflora*). Rubber vine is capable of smothering mature trees and degrading suitable habitat for the species. Other potential threatening processes identified for the species includes:

- Suppression of seedling development and increased fire frequency and intensity associated with the spread of exotic grasses
- Water resource developments altering environmental flows leading to habitat degradation
- Harvesting for commercial timber.

7.8.2.6 Potential impacts

Construction impacts

Direct impacts

A total of 64.6 ha of potential habitat for the species is mapped within the NGBR Project footprint and will be cleared to facilitate construction. These potential habitat areas are those areas of riparian habitat along a total of seven creek and river corridors (Strathmore Creek, Pelican Creek, Bogie River, Bowen River, Sandy Creek, Crush Creek, Elliot River) comprising REs 11.3.25 and 11.3.37, where black ironbox is generally found to be co-dominant with other Eucalypt species. This is likely to represent an over-estimation of the actual occurrence of black ironbox within the NGBR Project footprint, as it is not certain that the species will be present within every occurrence of the mapped REs within the NGBR Project footprint. Based on previous survey experience in the region, its occurrence is considered less likely south of the Bowen River.

Furthermore, in terms of the actual impact to black ironbox during construction, clearance at creek crossings is only likely to result in the loss of a few individual black ironbox trees at each crossing point where RE 11.3.25 or 11.3.37 is present. Given that the REs will be present as a fringing band along the creek or river, it will remain present on either side of the cleared footprint, as will individual black ironbox trees within those areas. Pollination and seed dispersal is unlikely to be affected by construction activities.

It is therefore considered unlikely that the clearance will result in significant impacts to an important population of the species, either through causing long-term decreases in population size or reducing the area of overall area of occupancy available to that species.

Indirect impacts

No indirect impacts to black ironbark are likely to occur during the construction phase of the NGBR Project.

Operational impacts

The two key threatening processes for this species, relevant to the operational phase, are identified as the proliferation of invasive weed species, and changes to water resources (SEWPaC 2013a).

Direct impacts

No direct impacts to black ironbark are likely to occur during the operational phase of the NGBR Project.

Indirect impacts

Weed species were generally recorded during field surveys, but were not found to be dominant in any particular location or environment. Nevertheless, the presence of rubber vine was noted as abundant at both creek locations where black ironbox was found within the preliminary investigation corridor. Following the implementation of mitigation measures, it is unlikely that the NGBR Project activities will further exacerbate the proliferation of this weed species at these (and other similar) locations.

Alteration of floodplain hydrology has the potential to result in the degradation of suitable habitats and may also decrease the input of floodplain resources into the main creek or river channel, but the inclusion of appropriately sized culverts at key locations within floodplain habitats will reduce the likelihood of these impacts. The construction of bridges over creek and river crossings is likely to have minimal impacts on in-stream flows.

In terms of the significant impact criteria for threatened species, the potential to adversely affect habitat critical to the survival of the species, or to modify the quality of habitat such that the species is likely to decline, is considered to be low. It is therefore considered unlikely that habitats potentially supporting black ironbox will be significantly altered in the operational phase of the NGBR Project.

7.8.2.7 Avoidance, mitigation and management measures

Local and regional priority actions for black ironbox have been identified as follows (TSSC 2008a):

1. Identify populations of high conservation priority
2. Ensure chemicals or other mechanisms used to eradicate weeds do not have a significant adverse impacts on black ironbox
3. Monitor known populations to identify key threats
4. Minimise adverse impacts from land use at known sites, particularly in relation to forest operations and maintenance of stream bank and riparian vegetation integrity
5. Identify and remove weeds in the local area, which could become a threat to black ironbox, using appropriate methods
6. Manage sites to prevent introduction of invasive weeds which could become a threat to the species using appropriate methods
7. Implement a management plan for the control of rubber vine in the region
8. Develop and implement a suitable fire management strategy for black ironbox
9. Undertake appropriate seed collection and storage
10. Investigate options for linking, enhancing or establishing additional populations
11. Implement national translocation protocols (Vallee *et al.* 2004) if establishing additional population is considered necessary and feasible.

Avoidance, mitigation and management measures for black ironbox will be achieved through the implementation of a Species Management Plan, to include the following:

- During detailed design, a targeted threatened species survey for black ironbox will be undertaken by a suitably qualified botanist to locate and map individual trees at key creek crossing points, and gain greater information of the population within the NGBR Project footprint for ongoing adaptive management.

- During detailed design, and using the information from the targeted survey, the extent of habitat clearing will be restricted to the minimum area necessary for the construction of the final rail corridor and ancillary infrastructure.
- During detailed design, temporary construction areas, such as site offices, stockpiles, machinery/equipment laydown areas, etc., will be located outside areas identified as known habitat for black ironbox.
- During pre-construction, in response to priority action #3, a management plan for black ironbox will be developed to manage further impacts for the species, with the view to achieving a ‘no net loss’ approach for the biodiversity values of the species within the final rail corridor.
- During construction, in response to priority action #10, individual saplings of black ironbox will be transplanted, and relocated to similar riparian habitat, where potentially impacted by clearing. Relocated plants will be managed through watering and health monitoring to aid in relocation success; these measures will be undertaken in accordance with the provisions of a detailed management plan to be developed prior to the commencement of construction activities.
- During construction, in response to priority action #1, monitoring and management programs will be implemented to identify, observe and track any changes in vegetation and habitat structure that occur as a result of construction activities. Due to the inherent uncertainties that could result from the works, the approach to management will need to be adaptive. Where significant variations from the changes predicted to occur are identified, this information will be reported and corrective actions implemented as necessary.
- During construction, rehabilitation activities will commence as soon as possible once temporary construction areas are no longer required. Rehabilitation will involve revegetating disturbed areas to a state consistent with their original condition and with the adjacent landscape.Revegetation will use black ironbox seed of local provenance that were present prior to clearing commencing. Long term management plans for land disturbed as a result of construction works will be developed to detail how disturbed land will be managed and rehabilitated, including (but not limited to) details regarding seed collection (if applicable), flora regeneration, landscape architecture (i.e. topography) and creation of supplementary habitats where necessary. The objective of land rehabilitation will be to provide habitat resources for those localised flora and fauna assemblages impacted or affected by construction and operation activities of the NGBR Project.
- During operation, in response to priority action #2, monitoring of the species complexity and condition of vegetation adjacent to constructed areas will be undertaken by a suitably qualified person, at a practicable frequency throughout the operational phase. Where edge effects are affecting and reducing vegetation condition and species complexity, replanting with relevant native understorey species is recommended.
- During operation, in response to priority actions #4 and #5, ongoing yearly monitoring for the presence of weeds and new weed infestations will be undertaken within known populations, particularly in relation to potential rubber vine colonisation. Monitoring and management of existing weeds and any new infestations will be undertaken in accordance with a Weed and Pest Management Plan.

- During operation, in response to priority action #7, areas mapped as known or potential habitat for black ironbox within the NGBR Project footprint that are not subject to vegetation clearing will be protected from frequent fire regimes (defined as burning at intervals of less than five years). If necessary, a fire regime for cool burns every five years within riparian areas could be implemented for fuel load control, seed germination and general management and improvement.

7.8.2.8 Conclusion

An assessment of residual impacts to black ironbox against the Significant Impact Guidelines is provided in Table 7-31.

Table 7-31 Significance of residual impacts on black ironbox

Impact criteria	Project response
Lead to a long term decrease in the size of an important population of the species	Unlikely. Clearance at creek crossings will only impact small numbers of individuals and is unlikely to cause long-term decreases in populations in the region.
Reduce the area of occupancy of an important population	Unlikely. Clearance at creek crossings will only impact a few individuals and is unlikely to reduce the area of occupancy for an important population of the species.
Fragment an existing important population into two or more populations	Unlikely. Pollination and seed dispersal will not be affected by the NGBR Project
Adversely affect habitat critical to the survival of a species	Unlikely. The final rail corridor is unlikely to contain habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	Unlikely. Pollination and seed dispersal will not be affected by the NGBR Project.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely. Although the NGBR Project will impact 64.6 ha of suitable habitat it is unlikely to impact the species to the extent it is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely. Rubber vine was noted as already abundant at both creek locations where black ironbox was recorded. Mitigation and management measures to be implemented for the NGBR Project, such as the Weed and Pest Management Plan, are expected to result in a net decrease in rubber vine in proximity of the final rail corridor.
Introduce disease that may cause the species to decline	Unlikely
Interfere substantially with the recovery of the species	Unlikely

7.8.1 Squatter pigeon

7.8.1.1 Species overview

The squatter pigeon (southern) (*Geophaps scripta scripta*) is a medium sized ground-dwelling pigeon listed as vulnerable under the EPBC Act. The species is widely distributed across Queensland, occurring from the dry tropics of central Queensland to the south-east of the state (SEWPaC 2013b).

At some locations in the northern part of its current distribution, the squatter pigeon (southern) remains locally abundant and is considered to be common in cattle-grazed country north of the Tropic of Capricorn (SEWPaC 2013b). During the 20th century the squatter pigeon (southern) experienced a northwards range contraction, and is now not known to occur in New South Wales (SEWPaC 2013b). At present, the total population size is estimated to be around 40,000 breeding birds, with both the extent and the population size considered to be stable (SEWPaC 2013b). 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 (SEWPaC 2013b).

The squatter pigeon is generally associated with open eucalypt woodland or forest habitat with a grassy understorey, particularly near water (SEWPaC 2013b). The species has also been recorded within disturbed areas, such as around roadsides and stockyards (SEWPaC 2013b).

7.8.1.2 Desktop results

The squatter pigeon was predicted to occur in the preliminary investigation corridor by the Protected Matters Search Tool and was previously recorded in the Wildlife Online database from the desktop search extent.

7.8.1.3 Survey results

The Commonwealth Government's Survey Guidelines for Australia's Threatened Birds (DEWHA 2010) details recommended survey methodologies for detecting the squatter pigeon (southern) - namely area searches or transect surveys, and flushing surveys in suitable habitat. It is recommended that 15 hours over at least three days be invested in area searches/transect surveys (for areas less than 50 ha), and 10 hours over at least three days be invested in flushing surveys (for areas less than 50 ha).

Standardised bird surveys undertaken at 47 sites (27.5 person hours) and 50 habitat assessments were undertaken during the May 2013 field surveys to describe habitat attributes and context within the preliminary investigation corridor. Slow traverses of tracks (by vehicle) were also undertaken whilst driving on internal property roads, with details of any squatter pigeons (southern) observed during these traverses recorded. Squatter pigeon (southern) was recorded in three locations (Plate 7-2): two squatter pigeon (southern) were recorded in eucalypt woodlands on flat plains on the Cerito property on 7 May 2013. Four squatter pigeon were recorded in non-remnant cleared land on the border of the Stratford and Warrigal properties on 9 May 2013. An additional two squatter pigeon (southern) were recorded in eucalypt woodland on flat plains on the Avon Downs property on 10 May 2013.

Squatter pigeon (southern) have also previously been recorded during surveys (February 2012) of the Caley Valley Wetland conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM 2012). These recordings were in locations close to the wetland causeway, along Abbot Point Road and at the western extent of the wetland area. Squatter pigeon (southern) has also previously been recorded within the Abbot Point Terminal 0 rail loop (GHD, 2010).

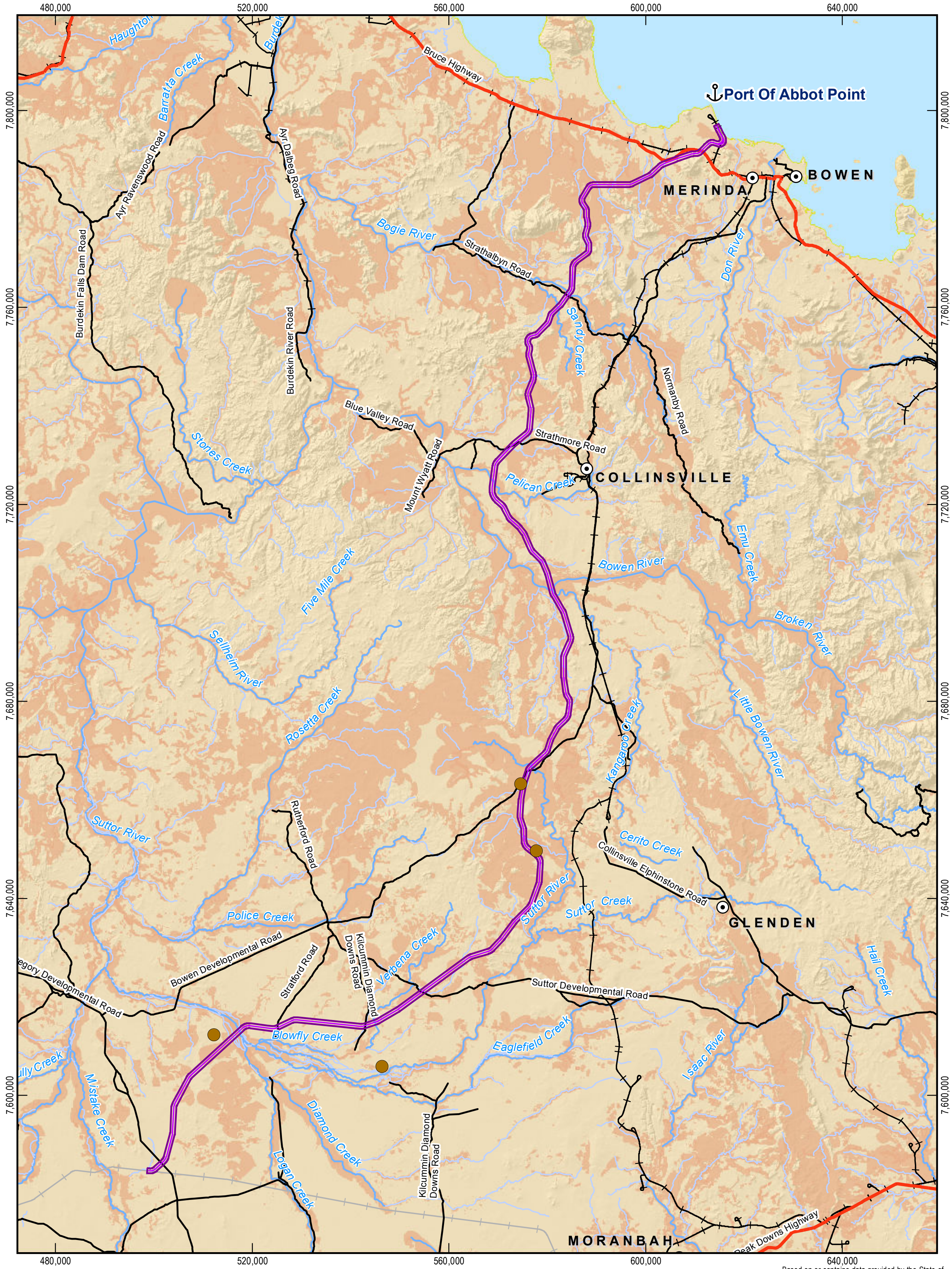
Plate 7-2 Squatter pigeon observed during field surveys (May 2013)

7.8.1.4 Significance of NGBR Project footprint

This species is likely to be common in suitable habitat within the preliminary investigation corridor, and is also likely to be present wherever suitable habitat occurs in the landscape beyond the preliminary investigation corridor. The distribution of the squatter pigeon (southern) is expected to be limited by the availability of drinking water, but it is likely to be present wherever such water resources are present in conjunction with suitable habitat.

The potential habitat available for the species within and adjacent to the preliminary investigation corridor is shown in Figure 7-28. Potential habitat comprises:

- REs and high value regrowth vegetation within the region likely to contain habitat resources for foraging or breeding for the species
- Areas in proximity (three kilometres) of major and minor waterways and palustrine, lacustrine and riverine areas.



LEGEND

- Population Centres
- Major Port
- Squatter Pigeon (Southern)
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourse (Major)
- Watercourse (Minor)
- Potential Squatter Pigeon (Southern) Habitat - Based on DNRM Certified Regional Ecosystems Version 6.1
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

1:1,100,000 Paper Size A4

0 10 20 40

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Job Number 41-26457
Revision B
Date 26 Sep 2013

Squatter pigeon (southern) potential habitat

Figure 7-28

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Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010, Potential Habitat/2011; GHD: Fauna Survey Locations/2013. Created by:MS

7.8.1.5 Threatening processes

There are four identified known threats to the squatter pigeon, these comprise:

- Loss of habitat associated with land clearing (for agriculture and industry)
- Habitat degradation by overgrazing herbivores, particularly livestock (e.g. sheep and cattle)
- Habitat degradation by invasive weeds such as buffel grass (Cenchrus ciliaris)
- Predation by numerous avian and terrestrial predators, most notably by dingos, cats and foxes.

7.8.1.6 Potential impacts

Construction impacts

Direct impacts

A total of 1,788 ha of potential habitat for the subspecies has been mapped within the NGBR Project footprint and will be cleared to facilitate construction. The large extent of potential habitat present is owing to the generalist habitat requirements of the subspecies, capable of occupying a wide range of habitat types. As well as ranging across a number of different habitat types, the subspecies is likely to be locally abundant throughout much of these habitats within the preliminary investigation corridor. Furthermore, the presence of potentially suitable habitat beyond the preliminary investigation corridor suggests that the squatter pigeon (southern) is likely to be present in low densities across the wider landscape.

An overall reduction in the local availability of habitat for the subspecies will occur as a result of the construction of the NGBR Project. It is possible that the subspecies may disperse away from the developed parts of the final rail corridor to alternative suitable habitat within the surrounds. Given that the subspecies is known to inhabit disturbed habitats, as well as areas of remnant vegetation, it may be that individuals will continue to use the final rail corridor following construction (once areas of grassland have re-established within and adjacent to the NGBR Project footprint). Fragmentation impacts are expected to be minor as the subspecies will be able to freely move and migrate between habitats across the constructed NGBR Project. It is therefore considered unlikely that the clearance will result in significant impacts to an important population of the subspecies. Whilst the local area of occupancy of the subspecies will potentially be reduced, the construction of the NGBR Project is highly unlikely to result in long-term decreases in population sizes, fragmentation of populations, disruption of breeding cycles of important populations, or otherwise adverse impacts to habitats critical to the survival of the subspecies.

Indirect impacts

Other than the direct loss of habitat due to vegetation clearing, construction activities have the potential to indirectly degrade the quality of adjacent habitats and habitat edges, through exposure to increased noise, vibration, light, dust, sedimentation and erosion. Exposure to these impacts is unlikely to affect squatter pigeons given the subspecies is known to occur within disturbed habitats. Edge effects may result in the introduction of exotic weeds reducing food resources, and pest fauna predation (i.e. foxes and cats), degrading overall habitat quality adjacent to the final investigation corridor.

Operational impacts

The two primary threats to squatter pigeon (southern), that are potentially relevant to the operational phase of the NGBR Project, are those relating to habitat degradation from weed species, and predation, particularly by foxes and cats (SEWPaC 2013b).

Direct impacts

Current levels of grazing are unlikely to substantially change as a result of the operation of the NGBR Project. Areas within the fenced operation corridor will no longer be subject to grazing pressures.

It is anticipated that fauna mortality will occur to some degree during the operational phase of the NGBR Project. Fauna mortality as a result of train strike has the potential to affect the squatter pigeon (southern), which often forages on the ground, although such isolated events are considered to be unlikely and insignificant at a population level.

Indirect impacts

Other potential impacts on habitat that could lead to degradation include coal dust impacts to flora where vegetation is growing within or immediately adjacent to the final rail corridor. Long term exposure to coal dust may result in changes to vegetation communities immediately adjacent to the rail line, which may in turn alter habitat type and quality for fauna. Dust deposition to occur as a result of the transport of coal is predicted to be at rates significantly below (<20% of) the thresholds identified as likely to have an impact upon crops and livestock (refer Volume 1 Chapter 10 Air quality page 10-17), and these rates are also likely to be broadly similar for native flora and fauna.

The operational phase may facilitate the movement of pest species through the local landscape as a result of the cleared nature of the final rail corridor. However following the implementation of mitigation measures, it is unlikely that the proliferation of weed or pest species will be exacerbated by the operation of the rail line.

Operational impacts are not predicted to adversely affect habitat critical to the survival of the species, or to modify the quality of habitat such that the species is likely to decline. The operation of the NGBR Project is likely to present a risk of collision for individual squatter pigeons (southern) that persist along the length of the final rail corridor. However, this is unlikely to result in a significant impact to the species at a local or regional scale.

7.8.1.7 Avoidance, mitigation and management measures

The federal environment Minister has declared that that a national recovery plan for the squatter pigeon (southern) is not required. However, the following actions have been recommended (EPA 2006; Garnett & Crowley 2000):

- Determine the population size and distribution of the Squatter Pigeon (southern) in southern Queensland and New South Wales, and assess the pigeon's conservation status and requirements.
- Undertake studies in North and Central Queensland to determine the relationship between the pigeon’s abundance, tree density and stocking rates.
- Establish sites for sub-population monitoring. If possible, these sites should be established with the cooperation of local land-owners and/or conservation organisations.
- Develop and implement public education programs and community based tree planting schemes to revegetate favoured habitat types.

- Establish control measures for predators (especially cats and foxes) at important sites.
- Establish conservation measures to protect grassy woodlands and forests.

Avoidance, mitigation and management measures for squatter pigeon will be achieved through the implementation of a Species Management Plan, to include the following:

- During detailed design, a targeted threatened species survey for squatter pigeon will be undertaken in areas identified as potential habitat for the species. In areas where this survey indicates the presence of particular key habitat features known to support squatter pigeon (primarily water source or nesting opportunities), a fauna spotter-catcher will be engaged to accompany clearing crews during construction.
- During detailed design, and using the information from the targeted survey, vegetation clearing extents will be kept to the minimum area necessary for construction to reduce the area subject to habitat fragmentation. The extent of vegetation clearing will be clearly identified on construction plans and demarcated on site. Areas that must not be cleared or damaged will also be clearly identified on construction plans and demarcated in the field. Clearing extents will be communicated to all necessary construction personnel involved.
- During construction, sequential vegetation clearing will be undertaken to allow squatter pigeon the opportunity to disperse away from clearing areas.
- During construction, all vehicles and plant will adhere to site construction and operation rules relating to speed limits. Speed limits will be clearly signposted so as to minimise the potential for fauna impact. Vehicles will be required to stay on pre-determined routes.
- During construction, procedures in the event that an animal is injured will be followed. Depending on the type and extent of injuries, animals will either be taken to the nearest veterinary practitioner or wildlife care network in the region or humanely euthanized on site by a suitably authorised and trained practitioner.
- During construction, incidents of wildlife mortality will be recorded and remedial action taken if repeat incidents occur.
- During construction and operation, domestic animals will not be permitted on the NGBR Project.
- During construction and operation, ongoing yearly monitoring for the presence of weeds and pest fauna will be undertaken within the final rail corridor. Monitoring and management of existing weeds and pest infestations will be undertaken in accordance with the Weed and Pest Management Plan. This will seek to control potential predators of squatter pigeon and protect retained grassy woodland and forests from further weed incursion.

7.8.1.8 Conclusion

An assessment of residual impacts to the squatter pigeon against the Significant Impact Guidelines is provided in Table 7-32.

Table 7-32 Significance of residual impacts on squatter pigeon

Impact criteria	Project response
Lead to a long term decrease in the size of an important population of the species	Unlikely. The final rail corridor is not considered to support an important population of squatter pigeon.
Reduce the area of occupancy of an important population	Unlikely. The final rail corridor is not considered to support an important population of squatter pigeon.
Fragment an existing important population into two or more populations	Unlikely. The final rail corridor is not considered to support an important population of squatter pigeon.
Adversely affect habitat critical to the survival of a species	Potentially. Although the NGBR Project may result in direct impacts to potential squatter pigeon habitat, there is equally suitable habitat available outside the final rail corridor which will not be impacted.
Disrupt the breeding cycle of an important population	Unlikely. The final rail corridor is not considered to support an important population of squatter pigeon.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely. Although the NGBR Project will result in impacts to potential squatter pigeon habitat, it is not considered to be to the extent that will cause the species to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely following the implementation of the Weed and Pest Management Plan.
Introduce disease that may cause the species to decline	Unlikely
Interfere substantially with the recovery of the species	Unlikely

7.8.2 Australian painted snipe

7.8.2.1 Species overview

The Australian painted snipe is a migratory wading bird, which is listed as endangered (as well as marine and migratory) under the EPBC Act. The species has a scattered distribution across eastern and northern Australia (SEWPaC 2013c). It has been recorded from wetlands in all Australian states, however is most prevalent in eastern Australia where it has been recorded at scattered locations throughout much of Queensland, NSW, Victoria and south-eastern South Australia (SEWPaC 2013c). Shallow freshwater wetlands are the main habitat for the Australian painted snipe (Marchant and Higgins 1993a). Such wetlands may include lakes, swamps, claypans, inundated/waterlogged grassland, dams, irrigated crop land and sewage ponds

(Marchant and Higgins 1993a). Preferred wetland habitats boast emergent vegetation (including tussocks, grasses, sedges, rushes, reeds, cane grass and/or *Melaleuca*) (Marchant and Higgins 1993a). Nesting occurs amongst vegetation in or adjacent to wetlands (SEWPaC 2013c).

The extent of occurrence is suspected to be stable at the present time (Garnett and Crowley 2000). Nevertheless, records are erratic with the species being absent from areas in some years and common in others, indicating high levels of natural variability in population numbers and a high degree of mobility within the known distribution range.

7.8.2.2 Desktop results

The Australian painted snipe was predicted to occur in the preliminary investigation corridor by the Protected Matters Search Tool. No historical records for this species were recorded from relevant databases in the desktop search extent.

7.8.2.3 Survey results

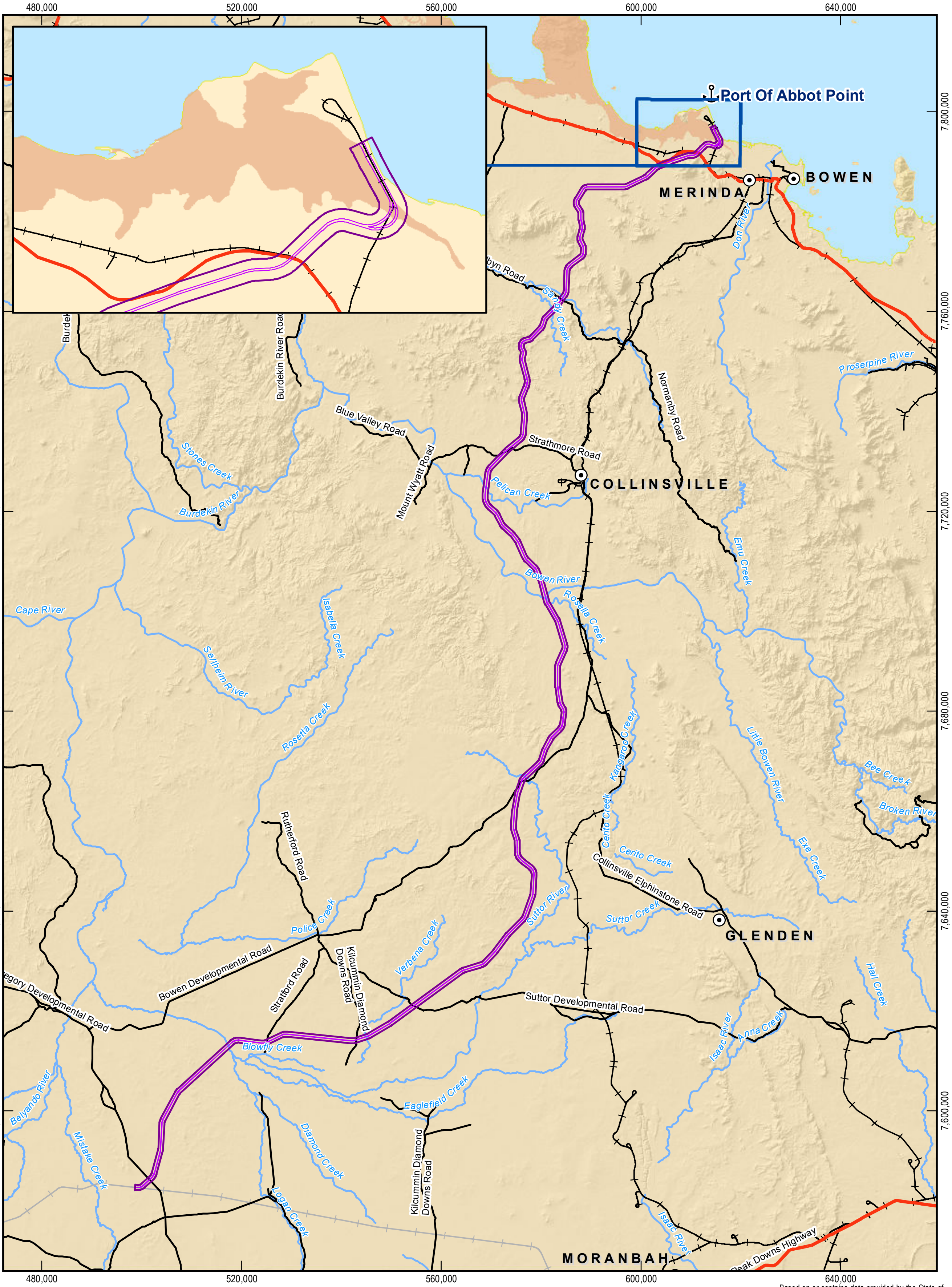
The Commonwealth Government's Survey Guidelines for Australia's Threatened Birds (DEWHA 2010) details recommended survey methodologies for detecting the Australian painted snipe. This includes targeted stationary observations at dawn and dusk of suitable wetland habitat, for a minimum of 10 hours over five days. Land-based area searches or line transects through wetland habitat are also recommended, for a minimum of 10 hours over three days. For both techniques the recommended times relate to sites less than 50 ha, where a wetland is present and holding water (but not flooded).

A total of three person hours were invested in targeted stationary observations within potential Australian painted snipe habitat (Caley Valley Wetland) during one day of the May 2013 field surveys. The Australian painted snipe was not recorded during these surveys, however the species is considered likely to occur within the preliminary investigation corridor in areas of significant wetlands with extensive marginal vegetation, most notably the Caley Valley Wetland. The species has been previously recorded during surveys of the Caley Valley Wetland for the Abbot Point Cumulative Impact Assessment (BAAM, 2012), with three individuals observed at the western extent of the wetland area (February 2012). Note that there are no specific locations attached to records of a further 24 individuals within the wetland, reported during a later June 2012 survey (BAAM), but the site is evidently of value to this species. The area of occupancy of the species is considered likely to have declined with the drainage of wetlands across the broader region (Garnett and Crowley 2000).

7.8.2.4 Significance of NGBR Project footprint

The Australian painted snipe is only likely to be of relevance to the NGBR Project in relation to its likely presence within the complex of wetlands around Caley Valley, locally where suitable marginal vegetation is present. The potential habitat available for the species within and adjacent to the preliminary investigation corridor is shown in Figure 7-29. Potential habitat comprises nationally important wetlands (i.e. Caley Valley Wetland) and coastal surrounds.

The Caley Valley wetland is reported (BAAM, 2012) to support an ecologically significant proportion of the population of Australian painted snipe (more than 0.1%) and thus is considered to represent important habitat for the species. However, the main body of this wetland lies outside of the final rail corridor. No other section of the NGBR Project footprint is considered to support an ecologically significant proportion of the population of the species, or represent important habitat for the Australian painted snipe.



LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- Potential Australian Painted Snipe Habitat - Based on Directory of Important Wetlands and RAMSAR Wetlands
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Australian painted snipe potential habitat

Job Number	41-26457
Revision	B
Date	26 Sep 2013

Figure 7-29

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Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010, Potential Habitat/2011. Created by:MS

7.8.2.5 Threatening processes

The major threat to the Australian painted snipe is the loss or alteration of wetland habitats (SEWPaC 2013c). Degradation may result from changes to water quality, livestock (trampling and overgrazing), altered flow regimes, altered fire regimes and invasive weeds (SEWPaC 2013c). While not recognised as a contributing factor to the species' decline, predation by introduced predators such as foxes and cats may pose a potential threat to the Australian painted snipe (SEWPaC 2013c).

Other threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases.

7.8.2.6 Potential impacts

Construction impacts

Direct impacts

A total of 46 ha of potential habitat for the species has been mapped within the NGBR Project footprint and will be cleared to facilitate construction. The potential habitat mapped for the species corresponds to the area of Nationally Important Wetlands at Caley Valley Wetland. Whilst the wetland as a whole has been mapped as being of potential habitat for Australian painted snipe, the species is highly unlikely to be present throughout this entire wetland. The species favours areas of marginal vegetation and is naturally scarce or rare, often occurring irregularly in small groups and regularly moving between different sites. The survey work conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM 2012) revealed the presence of (three individual) Australian painted snipe at one location only, more than five kilometres west of the NGBR Project preliminary investigation corridor. The location of the sighting was in an area described as 'short and relatively sparse sedge habitat flooded with shallow fresh water on the southern fringe of the main wetland' (BAAM 2012). An extrapolation of this sighting led to the evaluation of the wetland as a whole as supporting nationally important numbers of this species (eight individuals) and representing important habitat for the species.

Assuming that similar habitat occurs within and that the species is present in the area of the NGBR Project footprint at the time of works, construction across wetland areas to the east of the main body of the Caley Valley Wetland may initially encourage the dispersal of this species away from the cleared footprint, if present. This may marginally reduce the overall area of occupancy of this species within the local landscape, but there is a considerable amount of alternative suitable habitat contiguous to and surrounding this area.

Construction through this area may sterilise the habitat immediately surrounding the NGBR Project footprint. However this impact will be short-term, for the duration of construction activities in that area only.

It is therefore considered highly unlikely that the clearance of marginal wetland habitat within the NGBR Project footprint and other potential impacts related to construction activities will result in significant impacts to the species, in terms of the likelihood of causing long-term population declines, fragmentations of populations, disruption of breeding cycles of important populations, or otherwise adverse impacts to habitats critical to the survival of the species.

Indirect impacts

Other than the direct loss of habitat due to vegetation clearing, construction activities have the potential to indirectly degrade the quality of adjacent habitat and habitat edges within Caley Valley Wetland, through exposure to increased noise, vibration, light, dust, sedimentation and erosion. Given the existing levels of ambient industrial noise, vibration, light, dust and sedimentation in the area around the wetland, it is considered unlikely that the additional noise and related disturbances from construction activities will significantly deter the presence of Australian painted snipe, if present (recognising that the closest record of the species is several kilometres to the west).

Operational impacts

The two primary threats to the species, relevant to the operational phase, are habitat degradation and predation (SEWPaC 2013c).

Direct impacts

Australian painted snipe is less likely to be directly impacted by operational mortalities, being a relatively mobile species and restricted to one key area of wetland habitat in a single location adjacent to the operational infrastructure (rather than being present throughout the NGBR Project footprint).

Fauna mortality as a result of train strike has the potential to affect the Australian painted snipe, although such isolated events are considered to be highly unlikely.

Indirect impacts

The Australian painted snipe potential habitat at the Caley Valley Wetland, where the final rail corridor infrastructure crosses the designated wetland, is likely to be susceptible to localised impacts of sedimentation and run-off. Dust settling on water bodies during the operation phase also has the potential to decrease aquatic habitat value within the immediate and downstream areas, as a result of reduced water quality. Dust deposition to occur as a result of the transport of coal is predicted to be at rates significantly below (<20 % of) the thresholds identified as likely to have an impact upon crops and livestock, and these rates are also likely to be broadly similar for native flora and fauna. As such, dust impacts are likely to be low (following the results of air quality modelling carried out for the NGBR Project, refer Volume 1 Chapter 10 Air quality, page 10-17) and the bridge structures proposed over aquatic habitats are likely to minimise impacts on in-stream flows. The implementation of suitable management and mitigation measures will reduce the likelihood of impacts on the Caley Valley Wetland.

The Australian painted snipe is not considered likely to be adversely impacted by movement or noise associated with the operation of trains, as it is not known to be a particularly disturbance-sensitive species. There is also likely to be a partial habituation to this type of regular background noise and movement, if the species is at any time present adjacent to the operational corridor.

As such, whilst the Caley Valley Wetland has been recognised as important habitat for the Australian painted snipe, operational impacts are not predicted to adversely affect habitat critical to the survival of the species, or to modify the quality of habitat such that the species is likely to decline.

7.8.2.7 Avoidance, mitigation and management measures

Recovery actions for Australian painted snipe have been identified as follows (New South Wales NPWS 1999; Garnett and Crowley 2000):

1. Protect and manage habitat at principal breeding and wintering sites and, as a precautionary measure, identify and protect any additional habitat used by the Australian Painted Snipe in the last 10 years
2. Develop guidelines, in consultation with landholders, for the management of suitable wetlands
3. Initiate control programs for feral animals, and erect fencing to prevent grazing and trampling of wetlands by cattle, at suitable wetlands
4. Rehabilitate selected wetlands that were formerly used for breeding
5. Undertake further research to determine movements and improve knowledge of habitat preferences
6. Monitor the population at the landscape scale using the Atlas of Australian Birds to begin with, and determine the breeding range.

Avoidance, mitigation and management measures for Australian painted snipe will be achieved through the implementation of a Species Management Plan, to include the following:

- During detailed design, a targeted threatened species survey for Australian painted snipe will be undertaken in areas identified as potential habitat for the species. In areas where this survey indicates the presence of particular key habitat features known to support Australian painted snipe (primarily areas of marginal wetland vegetation), a fauna spotter-catcher will be engaged to accompany clearing crews during construction.
- During detailed design, and using information from the targeted survey, the extent of habitat clearing will be restricted to the minimum amount necessary for the construction of the final rail corridor and ancillary infrastructure
- During detailed design, temporary construction areas, such as site offices, stockpiles, machinery/equipment laydown areas, etc., will be located outside of areas identified as known or potential habitat for Australian painted snipe
- During pre-construction, in response to priority action #2, a specific management plan for Australian painted snipe will be developed (should the species be confirmed on-site) to manage further impacts for the species, with the view to achieving a ‘no net loss’ approach for the biodiversity values of the species within the final rail corridor
- During pre-construction, an Erosion and Sediment Control Plan will be developed and implemented to include measures to minimise erosion and sedimentation into aquatic habitats
- During pre-construction, a Coal Dust Management Plan will be developed to address the operation of all trains and maintenance activities
- During construction, vegetation clearing and other construction-related activities within the Caley Valley Wetland are to take place during the dry season, wherever possible
- During construction, rehabilitation activities will commence as soon as possible after any temporary construction areas are no longer required. Rehabilitation will involve revegetating disturbed areas to a state consistent with their original condition and with the

adjacent landscape. Long term management plans for land disturbed as a result of construction works will be developed to detail how disturbed land will be managed and rehabilitated, including (but not limited to) flora regeneration, landscape architecture (i.e. topography) and creation of supplementary habitats where necessary. The objective of land rehabilitation will be to provide habitat resources for those localised flora and fauna assemblages impacted or affected by construction and operation activities of the NGBR Project.

- During construction and operation, in response to priority actions #3, ongoing yearly monitoring for the presence of weeds and pest fauna will be undertaken within the final rail corridor where it intersects the Caley Valley Wetland. Monitoring and management of existing weeds and pest infestations will be undertaken in accordance with the Weed and Pest Management Plan.
- During construction and operation, in response to priority action #6, monitoring and management programs will be implemented to identify, observe and track any changes in vegetation and habitat structure within the final rail corridor where it intersects the Caley Valley Wetland, that occur as a result of construction activities. Due to the inherent uncertainties that could result from the works, the approach to management will need to be adaptive. Where significant variations from the changes predicted to occur are identified, this information will be identified and corrective actions implemented as necessary.

7.8.2.8 Conclusion

An assessment of residual impacts to the Australian painted snipe against the Significant Impact Guidelines is provided in Table 7-33.

Table 7-33 Significance of residual impacts on Australian painted snipe

Impact criteria	Project response
Lead to a long term decrease in the size of a population of the species	Unlikely, due to the distance of recorded sightings from the final rail corridor, marginal impact on available habitat and the species' insensitive nature to movement or noise associated with activities similar to those expected activities during the construction and operational phases of the NGBR Project.
Reduce the area of occupancy of the species	Unlikely. A small reduction in potential habitat (46 ha) is expected to be directly impacted by the NGBR Project.
Fragment an existing population into two or more populations	Unlikely. The NGBR Project will not inhibit movement of the species between habitats.
Adversely affect habitat critical to the survival of a species	Unlikely. Although marginal wetland will be directly impacted by the NGBR Project, it is unlikely that this will constitute important breeding, foraging or roosting habitat critical to the survival of the species.

Impact criteria	Project response
Disrupt the breeding cycle of a population	Unlikely, due to the distance of recorded sightings from the final rail corridor and the species' insensitive nature to movement and noise associated with activities similar to those expected during the construction and operational phases of the NGBR Project.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely. Due to the marginal impact on available habitat and the infrequent occupation by the species throughout the year, because of its migratory nature, impacts associated with the NGBR Project is not considered to be to the extent that will cause the species to decline.
Result in invasive species that are harmful to an endangered or critically endangered species becoming established in the endangered species' habitat	Unlikely with the implementation of the Weed and Pest Management Plan.
Introduce disease that may cause the species to decline	Unlikely
Interfere substantially with the recovery of the species	Unlikely

7.8.3 Black-throated finch

7.8.3.1 Species overview

The black-throated finch (southern) (*Poephila cincta cincta*) is a small, stocky bird, listed as endangered under the EPBC Act. The species was previously found throughout eastern and central Queensland, north of the New South Wales border, however it is now only known from the Townsville region and scattered sites in central Queensland (SEWPaC 2013d). The extent of occurrence of the species has declined by approximately 80 per cent since the 1980s, with the majority of this decline in the range of the endangered southern subspecies (SEWPaC 2013d).

This largely sedentary, gregarious bird inhabits grassy open woodland and open forest habitats characterised by trees belonging to the genera *Eucalyptus*, *Corymbia*, *Acacia* and *Melaleuca* (SEWPaC 2013d). Generally it occurs in habitats near watercourses or water bodies - almost all recent records of the subspecies south of the tropics have been in riparian areas (SEWPaC 2013d). Three critical habitat resources required to support the black-throated finch (southern) include:

- 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 2009a; SEWPaC 2013d).

Existing populations of the black-throated finch (southern) are thought to be highly fragmented (SEWPaC 2013d).

7.8.3.2 Desktop results

The black-throated finch (southern) was predicted to occur in the preliminary investigation corridor by the Protected Matters Search Tool. One historical record of this species was recorded within the Birds Australia Atlas database for the desktop search extent (i.e. within the 10 km radius buffer area).

7.8.3.3 Survey results

The Commonwealth Government's Survey Guidelines for Australia's Threatened Birds (DEWHA 2010) details recommended survey methodologies for detecting the black-throated finch (southern). As a guide, it is recommended that 10 hours per day are spent searching for the subspecies (in suitable habitat) over a five day period, for areas less than 50 ha (DEWHA 2010). In addition, surveys targeting waterholes and wood swallow nests are recommended to be carried out over two days for a minimum of six hours per day (DEWHA 2010).

The Background Paper to the Commonwealth Government's Significant Impact Guidelines for the Endangered Black-Throated Finch (southern) (*Poephila cincta cincta*) (DEWHA 2009b) expands upon the recommended survey guidelines presented in the Survey Guidelines for Australia's Threatened Birds. In summary, these guidelines indicate that presence/absence studies should comprise:

- Dry season: water source watching (recommended six hours per day for two days, for each water source in the study area)
- Wet season: water source watching (as described in point above) and targeted woodland searches within 600 m radius of water sources (one hour per hectare for a maximum of ten hours).

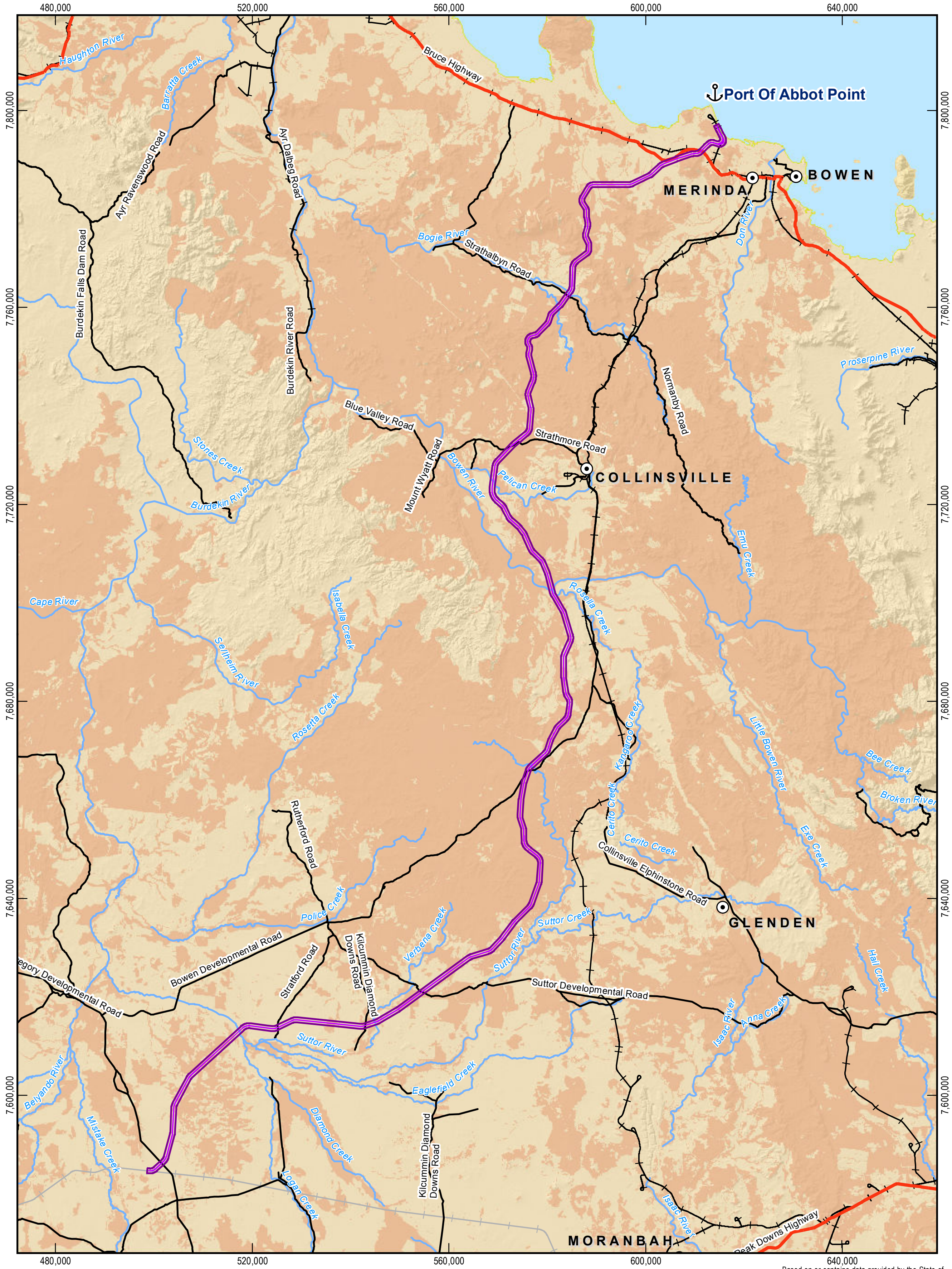
Waterbody / riparian zone standardised bird surveys were undertaken at 19 locations within and near the preliminary investigation corridor during the May 2013 surveys. A total of 11.45 person hours were invested in waterbody/riparian zone standardised bird surveys and watches for black-throated finches (southern) during the survey (time per survey ranged between 0.33 and 1.5 person hours). Watches were carried out at water bodies including farm dams, natural creeks and rivers, wetland fringes and stock troughs. Habitat assessments were also undertaken to describe habitat attributes and context at 50 habitat assessment sites within and near preliminary investigation corridor.

No black-throated finches (southern) were recorded during these surveys for the NGBR Project. However, this species has previously been recorded during the Carmichael Coal Mine and Rail Project EIS (in April/May and November 2011, and May 2012) within the area of the proposed Carmichael Project (Mine) and adjacent Moray Downs property (GHD, 2012). The closest record of the species to the preliminary investigation corridor is a record from Splitter's Creek (cited in GHD 2010), approximately 14 km south-west of Abbot Point, several kilometres west of the preliminary investigation corridor. This species was not recorded on either the Galilee Coal Project (Waratah Coal Pty Ltd, 2011) or the Alpha Coal Project (Hancock Prospecting Pty Ltd, 2010).

7.8.3.4 Significance of NGBR Project footprint

Due to the species' critical habitat requirements (i.e. access to permanent water sources for drinking, native grasslands for feeding and eucalypt species (and associated) woodlands for nesting), it is only likely to occur within the preliminary investigation corridor where these three features exist in close proximity to each other. The potential habitat available for the species within and adjacent to the preliminary investigation corridor is shown in Figure 7-30. Potential habitat comprises REs and high value regrowth vegetation within the region likely to contain habitat resources for foraging or breeding for the species. The large extent of potential habitat corresponds to a wide range of mapped woodland and grassland habitat types that could be used by the subspecies. Previous records of the subspecies exist from the northern, central and southern sections of the preliminary investigation corridor and therefore there is no spatial (range) constraint to further restrict its likely occurrence. An area of five kilometres around each confirmed sighting is arbitrarily classified as being important habitat for the species. Because of the species' requirements for permanent water sources for drinking, native grasslands for feeding and eucalypt species (and associated woodlands) for nesting, it is only likely to occur within the preliminary investigation corridor where these three features exist in close proximity to each other.

The Moray Downs area, comprising the Carmichael Project (Mine), approximately 70 km west of the southern extent of the preliminary investigation corridor, is likely to contain an ecologically important population of the species.



LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- Potential Black-throated Finch Habitat - Based on DNRM Certified Regional Ecosystems Version 6.1
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Revision	A
Date	26 Sep 2013

Black-throated finch potential habitat

Figure 7-30

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Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010, Potential Habitat/2011. Created by:MS

7.8.3.5 Threatening processes

Numerous threatening processes have been identified as contributing to the decline of the black-throated finch (southern). Initial decline of the species coincided with the rapid expansion and development of pastoralism during the 1900s (Franklin 1999). Current identified threats to the black-throated finch (southern) include (SEWPaC 2013d):

- Habitat loss and fragmentation (through land clearing for development)
- Habitat degradation associated with trampling by domestic stock, feral animals and weed infestations
- Changed fire regimes
- Introduction and proliferation of introduced weeds, displacing native grass species
- Illegal trapping
- Predation from introduced pests, particularly European foxes and feral cats
- Hybridisation with the northern subspecies of the black-throated finch (*Poephila cincta atropygialis*).

Other potential threats identified to the black-throated finch include:

- Resource bottlenecks associated with drought and changes in land management practices
- Impacts on seasonal breeding success from cyclonic activity (i.e. destruction of nests).

7.8.3.6 Potential impacts

Construction impacts

Direct impacts

A total of 2,143 ha of potential habitat for the black-throated finch (southern) has been mapped within the NGBR Project footprint and will be cleared to facilitate construction.

In reality, if present, the black-throated finch (southern) is likely to occupy much smaller areas of the footprint, due to both the rarity of the subspecies and the localised and generally sedentary nature of populations; as well as the combination of habitat factors that need to co-exist at the micro-scale (native grassland understorey, nesting trees/scrub and available water) in order to support a viable population of the subspecies.

An overall reduction in the local availability of potential habitat for the subspecies will occur as a result of the construction of the NGBR Project. It is possible that the subspecies may disperse away from the developed parts of the preliminary investigation corridor to alternative suitable habitat within the surrounds. Whilst the loss of habitat may impact black-throated finch (southern), if present, the severance or fragmentation of habitat is likely to be less significant as the subspecies is known to occur within or move between areas of seemingly unsuitable non-remnant vegetation.

No known populations of black-throated finch (southern) occur specifically within the preliminary investigation corridor. On that basis, it is considered unlikely that the removal of potentially suitable habitat within the proposed NGBR Project footprint will result in a significant impact to the subspecies, in terms of the likelihood of causing long-term population decline, fragmentation of populations, disruption of breeding cycles of populations, or otherwise adverse impacts to habitats critical to the survival of the subspecies.

Indirect impacts

Where the final rail corridor infrastructure traverses water bodies, is likely to be susceptible to localised impacts of sedimentation and run-off. Dust settling on water bodies during the operation phase also has the potential to decrease water quality. Dust deposition to occur as a result of the transport of coal is predicted to be at rates significantly below (<20 % of) the thresholds identified as likely to have an impact upon crops and livestock, and these rates are also likely to be broadly similar for native flora and fauna. As such, dust impacts are likely to be low (following the results of air quality modelling carried out for the NGBR Project, refer Volume 1 Chapter 10 Air quality page 10-17). The implementation of suitable management and mitigation measures will reduce the likelihood of impacts on potential habitat for the black-throated finch.

Operational impacts

The key threats relevant to the operation of the NGBR Project are habitat degradation and alteration, weed species invasion (especially exotic pasture grasses) and predation by introduced pest species (SEWPaC 2013d).

Direct impacts

Black-throated finch (southern) is unlikely to be directly impacted by operational mortalities, being a relatively mobile species that is not generally susceptible to collision risk.

The operation of the NGBR Project is unlikely to present a significant barrier to movement across the landscape for any populations of black-throated finch (southern) present, as they will readily cross non-remnant and cleared land areas to move between foraging areas. The species is unlikely to be susceptible to disturbance (and displacement) as a result of operational trains, as it has been found to be present within areas already subject to comparable disturbance impacts from noise, vehicles and people. The background paper to the significant impact guidelines for the endangered black-throated finch (southern), EPBC Act policy statement 3.13 (DEWHA 2009b) recognises that the subspecies has been recorded foraging in modified habitats such as grassy unsealed roadsides, beneath power lines and in rail corridors, where suitable seeding grasses exist.

No area of the preliminary investigation corridor has yet been identified as important habitat for the black-throated finch (southern). Operational impacts are not predicted to adversely affect habitat critical to the survival of the species, or to modify the quality of habitat such that the species is likely to decline.

Indirect impacts

The prevalence of weed species and, in particular, introduced pasture grasses such as buffel grass will need to be carefully managed and monitored to avoid the degradation of native grass communities present within open woodland habitats that could be used by black-throated finch (southern).

The operational phase may facilitate the movement of pest species through the local landscape as a result of the cleared nature of the final rail corridor. The subspecies may be slightly more susceptible to mortalities as a result of predation by pest animals as an indirect impact during NGBR Project operations. However following the implementation of mitigation measures, it is unlikely that the proliferation of pest species will be exacerbated by the operation of the rail line.

7.8.3.7 Avoidance, mitigation and management measures

Recovery actions, documented in the National Recovery Plan for the Black-throated Finch Southern Subspecies (Black-Throated Finch Recovery Team 2007), include:

1. Investigation of breeding requirements and threats to key breeding areas
2. Investigate feeding and other habitat requirements
3. Undertake targeted surveys (to identify habitat)
4. Secure selected sites for conservation
5. Address threats on grazing lands
6. Monitor management effectiveness
7. Determine suitability of birds in captivity for a reintroduction project.

Avoidance, mitigation and management measures for black-throated finch will be achieved through the implementation of a Species Management Plan, to include the following:

- During detailed design, a targeted threatened species survey for black-throated finch will be undertaken in areas identified as potential habitat for the species. In areas where this survey indicates the presence of particular key habitat features known to support black-throated finch (primarily water source or nesting trees), a fauna spotter-catcher will be engaged to accompany clearing crews during construction.
- During detailed design, and using information from the targeted survey, vegetation clearing extents will be kept to the minimum area necessary for construction to reduce the area subject to habitat fragmentation. The extent of vegetation clearing will be clearly identified on construction plans and demarcated on site. Areas that must not be cleared or damaged will also be clearly identified on construction plans and demarcated in the field. Clearing extents will be communicated to all necessary construction personnel involved.
- During detailed design, a Fire Management Plan will be developed during the detailed design phase and will be implemented for all phases of the NGBR Project. As well as documenting protocols and actions for preventing accidentally-lit fires, this plan will outline how fuel loads will be monitored and maintained across the preliminary investigation corridor.
- During detailed design, an Erosion and Sediment Control Plan will be developed and implemented to include measures to minimise coal dust run-off into aquatic habitats.
- During detailed design, a Coal Dust Management Plan will be developed to address the operation of all trains and maintenance activities, consistent with the Aurizon Coal Dust Management Plan.
- During construction, in response to priority action #5, the final rail corridor will be fenced along its length to exclude livestock grazing. This may lead to the herbaceous layer (particularly perennial grasses) improving in condition during the operational phase, enhancing the availability of seeding grasses in the local landscape.

7.8.3.8 Conclusion

An assessment of residual impacts to the black-throated finch against the Significant Impact Guidelines is provided in Table 7-34.

Table 7-34 Significance of residual impacts on black-throated finch

Impact criteria	Project response
Lead to a long term decrease in the size of a population of the species	Unlikely. No known populations occur within the final rail corridor.
Reduce the area of occupancy of the species	Potentially. While an overall reduction in the local availability of habitat for the subspecies will occur as a result of the construction of the NGBR Project, no known populations occur within the final rail corridor.
Fragment an existing population into two or more populations	Unlikely. The NGBR Project will not inhibit movement of the species between habitats and no known populations occur within the final rail corridor.
Adversely affect habitat critical to the survival of a species	Potentially. An overall reduction in potentially suitable habitat for the subspecies will occur as a result of the construction of the NGBR Project.
Disrupt the breeding cycle of a population	Unlikely. Although the species has been found to be present within areas already subject to comparable disturbance impacts from noise, vehicles and people, no known populations occur within the final rail corridor.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely. Although the NGBR Project will result in impacts to potential habitat, no known populations occur within the final rail corridor and it is not considered to be to the extent that will cause the species to decline.
Result in invasive species that are harmful to an endangered or critically endangered species becoming established in the endangered species' habitat	Unlikely, with implementation of the Weed and Pest Management Plan.
Introduce disease that may cause the species to decline	Unlikely
Interfere substantially with the recovery of the species	Unlikely

7.8.4 Koala

7.8.4.1 Species overview

The koala (*Phascolarctos cinereus*) is listed as vulnerable under the EPBC Act for the combined populations of Queensland, New South Wales and Australian Capital Territory. The natural range of this species extends from north-east Queensland to the south-east corner of South

Australia, but its 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 2013e). 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 2013e).

Koala habitat includes a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by species of the genus *Eucalyptus* (TSSC 2012). Temperature, altitude (limited to <800 m above sea level) and leaf moisture at the northern and western range extents affect koala distribution (TSSC 2012). The koala is a leaf-eating specialist, consuming foliage of *Eucalyptus* species and sometimes related genera, including *Corymbia*, *Angophora* and *Lophostemon* (TSSC 2012).

7.8.4.2 Desktop results

The koala was predicted to occur in the preliminary investigation corridor by the Protected Matters Search Tool. One historical record of this species was recorded within the Birds Australia Atlas database for the desktop search extent.

7.8.4.3 Survey results

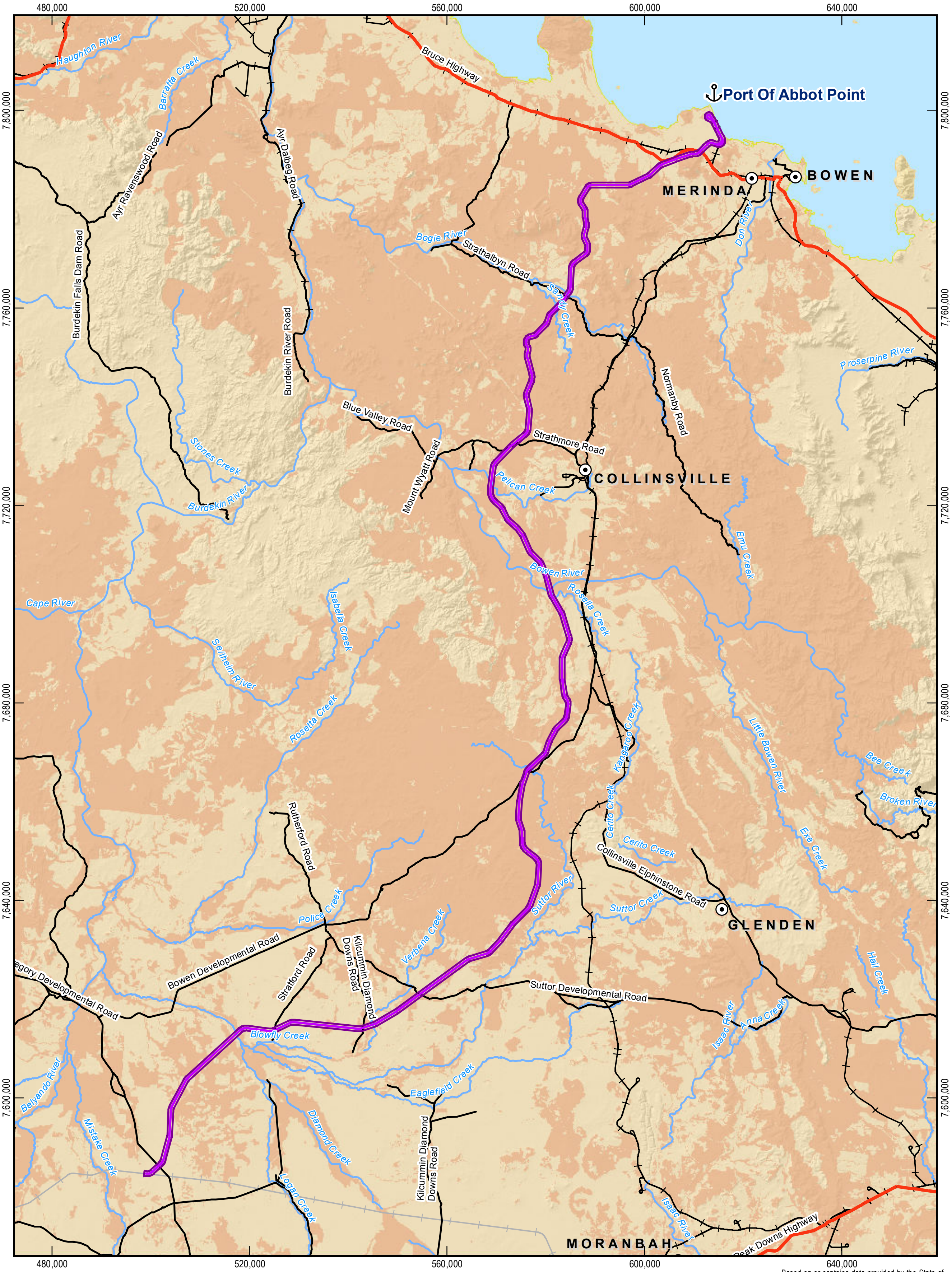
The Interim Koala Referral Advice for Proponents (Koala Referral Guidelines; SEWPaC 2012) details the recommended survey methodologies for determining the presence and density of koala populations within suitable habitat for the species. In addition to assessments of habitat suitability, line transects should be carried out in accordance with Dique, de Villiers and Preece (2003), as outlined in the Queensland Government's Nature Conservation (koala) Conservation Plan 2006 and Management Program 2006 – 2016. For areas greater than 50 ha, transects should be uniformly positioned across the proposed project site (EPA 2006). Where koalas are confirmed as occurring, the spot assessment technique (refer Phillips and Callaghan 2011) should be carried out to estimate the relative importance of the habitat to local populations.

Targeted koala habitat assessments and faecal pellet surveys were undertaken at 10 locations within eucalypt woodland along the preliminary investigation corridor. No koalas (or any evidence thereof) were recorded during field surveys, however the species is considered likely to occur within the preliminary investigation corridor. Records of koala exist to the north and south of the preliminary investigation corridor. The species was found during studies (November 2011) for the Carmichael Coal Mine and Rail EIS (GHD 2012) within the mine site. It has also been recorded on two occasions in the vicinity of Abbot Point as part of the Terminal 0 EIS studies (CDM Smith 2012).

7.8.4.4 Significance of NGBR Project footprint

It is likely that the species occurs at low densities in remnant open eucalypt woodland across the final rail corridor. The presence of potentially suitable habitat beyond the final rail corridor suggests that the koala is also likely to be present in low densities in the wider landscape. Habitat utilisation and abundance within the corridor is likely to be influenced by availability of preferred eucalypt species, abundance of predators (especially dogs), climate change and drought (SEWPaC 2013e).

The potential habitat available for the species within and adjacent to the preliminary investigation corridor is shown in Figure 7-31. Potential habitat comprises REs within the region likely to contain habitat resources for foraging or breeding for the species.



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LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- Potential Koala Habitat - Based on DNRM Certified Regional Ecosystems Version 6.1
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

1:1,100,000 Paper Size A4

0 10 20 40

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Job Number	41-26457
Revision	A
Date	26 Sep 2013

Koala potential habitat — Figure 7-31

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Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010, Potential Habitat/2011. Created by:MS

7.8.4.5 Threatening processes

Koala populations within eastern Australia have suffered substantial decline over three generations, due to a combination and range of factors (TSSC 2012). Key threatening processes include:

- Habitat loss, fragmentation and degradation
- Mortality from vehicle collision and dog attacks
- Spread of disease (chlamydia and koala retrovirus)
- Drought and impacts associated with climate change.

Other potential threats to the species include reductions in the availability of local food resources attributed to bell miner associated dieback and myrtle rust.

7.8.4.6 Potential impacts

Construction impacts

Direct impacts

A total of 2,390 ha of potential habitat for this species is mapped within the NGBR Project footprint and will be cleared to facilitate construction. These potential habitat areas are broad areas of eucalypt woodland REs across the entire extent of the NGBR Project footprint. This is likely to represent a substantial over-estimation of the actual occurrence of koala within the footprint, as it is extremely unlikely that the species will be present within all of these RE areas in the preliminary investigation corridor. Koala populations are likely to be scattered and generally restricted to creek and river crossings where areas of intact, mature eucalypt woodland intersect with the NGBR Project footprint.

If populations of koala are present, these are likely to be in low densities. The presence of potentially suitable habitat beyond the preliminary investigation corridor suggests that the koala is likely to be present in low densities across the wider landscape. No defined ‘important populations’ have been listed by SEWPaC (2012) within Queensland. If present in mature trees within the NGBR Project footprint at the time of vegetation clearance for construction (if not successfully relocated during pre-clearing surveys), koala could be at risk of injury or mortality. As they are most active between dawn and dusk, the risk of being struck by construction vehicles is relatively low.

With respect to the Significant Impact Guidelines (DEWHA 2009c), it is not considered that the likely occurrence of koala within the NGBR Project footprint defines it as part of an ‘important population’ of an EPBC Act listed vulnerable species. The koalas that may occur within the footprint are not likely to be a part of a population that is necessary for a species’ long-term survival and recovery. Based on the low estimated density of koalas within the region and the availability of similarly suitable habitat in the landscape surrounding the NGBR Project footprint, it is not considered that the removal of potentially suitable habitat within the proposed NGBR Project footprint will result in a significant impact to the species, in terms of the likelihood of causing long-term population declines, fragmentations of populations, disruption of breeding cycles of populations, or otherwise adverse impacts to habitats critical to the survival of the species.

Indirect impacts

Areas of potential habitat for koalas, particularly riparian areas bordering watercourses and eucalypt communities, may be indirectly impacted by increased weed and pest prevalence, disturbances to and displacement of the species during construction.

Operation impacts

Direct impacts

The primary threats to koala in relation to the operation of the NGBR Project are the further degradation of retained habitat, the risk of vehicle strike and potential predation by pest species (primarily the domestic dog). The incidence of disease is not considered to be a measurable potential outcome of the NGBR Project.

It is anticipated that fauna mortality will occur during the operational phase of the NGBR Project, particularly for those cryptic and/or less mobile animals. The koala is a less mobile animal and has the potential to be affected by fauna mortality during the operational phase as a result of train strike or collision with maintenance vehicles. Koala mortality resulting from train strike is unlikely to occur and will have a minimal impact on this species at a population level. With appropriate mitigation and management, operational impacts are not predicted to adversely affect habitat critical to the survival of the species, or to modify the quality of habitat such that the species is likely to decline. The operation of the NGBR Project is likely to present a risk of collision for individual koalas that move through the length of the rail corridor. However, this is unlikely to result in a significant impact to the species at a local or regional scale.

Indirect impacts

No measurable indirect operational impacts to the koala have been identified.

7.8.4.7 Avoidance, mitigation and management measures

Threat abatement actions that will support the koala in Queensland, New South Wales and the Australian Capital Territory have been identified as the following (Threatened Species Scientific Committee 2012):

1. Develop and implement a development planning protocol to be used in areas of koala populations to prevent loss of important habitat, koala populations or connectivity options
2. Development plans should explicitly address ways to mitigate risk of vehicle strike when development occurs adjacent to or within koala habitat
3. Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary
4. Identify populations of high conservation priority
5. Investigate formal conservation arrangements, management agreements and covenants on private lands, and for Crown and private land investigate and/or secure inclusion in reserve tenure if possible
6. Manage any other known, potential or emerging threats
7. Development and implement options of vegetation recovery and re-connection in regions containing fragmented koala populations, including inland regions in which koala populations were diminished by drought and coastal regions where development pressures have isolated koala populations

8. Develop and implement a management plan to control the adverse impacts of predation on koalas by dogs in urban, peri-urban and rural environments
9. Engage with private landholders and land managers responsible for the land on which populations occur and encourage these key stakeholders to contribute to the implementation of key conservation management actions.

Avoidance, mitigation and management measures for koala will be achieved through the implementation of a Species Management Plan, to include the following:

- During detailed design, a targeted threatened species survey for koala will be undertaken in areas identified as potential habitat for the species. In areas where these surveys indicate the presence of key habitat features known to support koala populations (primarily intact and mature eucalypt woodlands, dominated by primary food trees and close to watercourses), a fauna spotter-catcher will be engaged to accompany clearing crews during construction. Provision for the potential relocation of fauna, where required, will be made prior to the commencement of clearing.
- During detailed design, and using information from the targeted survey, vegetation clearing extents will be kept to the minimum area necessary for construction to reduce the area subject to habitat fragmentation. The extent of vegetation clearing will be clearly identified on construction plans and demarcated on site. Areas that must not be cleared or damaged will also be clearly identified on construction plans and demarcated in the field. Clearing extents will be communicated to all necessary construction personnel involved.
- During construction, sequential vegetation clearing will be undertaken to allow koala the opportunity to disperse away from clearing areas
- During construction, in response to threat abatement action #2, all vehicles and plant will adhere to site construction and operation rules relating to speed limits. Speed limits will be clearly signposted so as to minimise the potential for fauna impact. Vehicles will be required to stay on pre-determined routes.
- During construction, procedures will be followed in the event that an animal is injured. Depending on the type and extent of injuries, animals will either be taken to the nearest veterinary practitioner or wildlife care network in the region or humanely euthanized on site by a suitably authorised and trained practitioner.
- During construction, incidents of wildlife mortality will be recorded and remedial action taken if repeat incidents occur
- During construction and operation, in response to threat abatement action #8, domestic animals will not be permitted on the NGBR Project during construction and operation.

7.8.4.8 Conclusion

Table 7-35 provides a summary of impacts against scpecies impact criteria for koala. Based on the assessment it is concluded that the project is unlikely to have a significant residual impact on relation to the koala.

Table 7-35 Significance of residual impacts on koala

Impact criteria	Project response
Lead to a long term decrease in the size of an important population of the species	Unlikely, as the final rail corridor is not considered to support an important population of koala.
Reduce the area of occupancy of an important population	Unlikely, as the final rail corridor is not considered to support an important population of koala.
Fragment an existing important population into two or more populations	Unlikely, as the final rail corridor is not considered to support an important population of koala.
Adversely affect habitat critical to the survival of a species	Potentially. Approximately 2,143 ha of suitable habitat occurs within the final rail corridor. However, although suitable habitat will be impacted, this should be considered in the context of the low estimated density of koalas across the region and the availability of similarly suitable habitat in the landscape surrounding the NGBR Project.
Disrupt the breeding cycle of an important population	Unlikely, as the final rail corridor is not considered to support an important population of koala.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely. Although suitable habitat will be impacted, the low estimated density of koalas and the availability of similarly suitable habitat in the landscape surrounding the NGBR Project, it is not considered to be to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely, with implementation of the Weed and Pest Management Plan.
Introduce disease that may cause the species to decline	Unlikely
Interfere substantially with the recovery of the species	Unlikely

7.8.5 Ornamental snake

7.8.5.1 Species overview

The ornamental snake (*Denisonia maculata*) is listed as vulnerable under the EPBC Act. The species is known only from the Brigalow Belt North and parts of the Brigalow Belt South bioregions in association with the drainage system of the Fitzroy and Dawson Rivers (SEWPaC 2013f).

Suitable habitat for this species occurs in remnant vegetation on, or surrounding gilgai mounds and depressions, with the maintenance of these environments important for the persistence of this species (SEWPaC 2013f). Habitat for the ornamental snake is likely to be found in brigalow (*Acacia harpophylla*), gidgee (*Acacia cambagei*), blackwood (*Acacia argyrodendron*) and coolabah (*Eucalyptus coolabah*) dominated vegetation communities as well as grasslands associated with gilgais (SEWPaC 2013f). The ornamental snake's preferred habitat is within woodlands and open forests associated with moist areas, similar to the habitat of frogs, which are its favoured prey (SEWPaC 2013f). Microhabitat for this species includes logs, coarse woody debris and ground litter (SEWPaC 2013f).

7.8.5.2 Desktop results

The ornamental snake was predicted to occur in the preliminary investigation corridor by the Protected Matters Search Tool. The Wildlife Online and Queensland Museum databases also identified records of this species within the desktop search extent.

7.8.5.3 Survey results

The Commonwealth Government's Survey Guidelines for Australia's Threatened Reptiles (SEWPaC 2011a) details recommended survey methodologies for detecting the ornamental snake. The survey guidelines state that no survey methods are known to reliably detect ornamental snakes during dry weather/seasons (SEWPaC 2011a). Searches conducted around suitable gilgai habitat while frogs are active are the most reliable method to encounter this species (SEWPaC 2011a). In the event wet weather inhibits access to gilgai habitats, driving roads at night while frogs are active is also identified as an appropriate survey method (SEWPaC 2011a). Diurnal searches under logs, coarse woody debris, ground litter and other sheltering sites could also be employed (SEWPaC 2011a). The survey guidelines also state that pitfall and funnel trap complexes could be trialled, however that these methods are likely to return low yields (SEWPaC 2011a).

The Commonwealth Government's Draft Referral guidelines for the nationally listed Brigalow Belt Reptiles (SEWPaC 2011b) also identify targeted survey efforts and techniques required to detect the ornamental snake. In summary, the survey techniques suitable for detecting the ornamental snake include:

- One-off diurnal searches of microhabitats during the coolest parts of the day surveying a minimum of 1.5 person hours per hectare of suitably complex habitats over a minimum of three days
- Spotlighting inundated gilgais, riparian habitats, and large logs between dusk and early morning hours surveying a minimum of 1.5 person hours per hectare of suitably complex habitats over a minimum of three nights
- Pitfall and funnel trapping using six 20 litre buckets distributed under a 30 m drift fence where suitable microhabitats occur. Funnel traps should be placed at the end of each pitfall line, with at least two replicates for each habitat type.

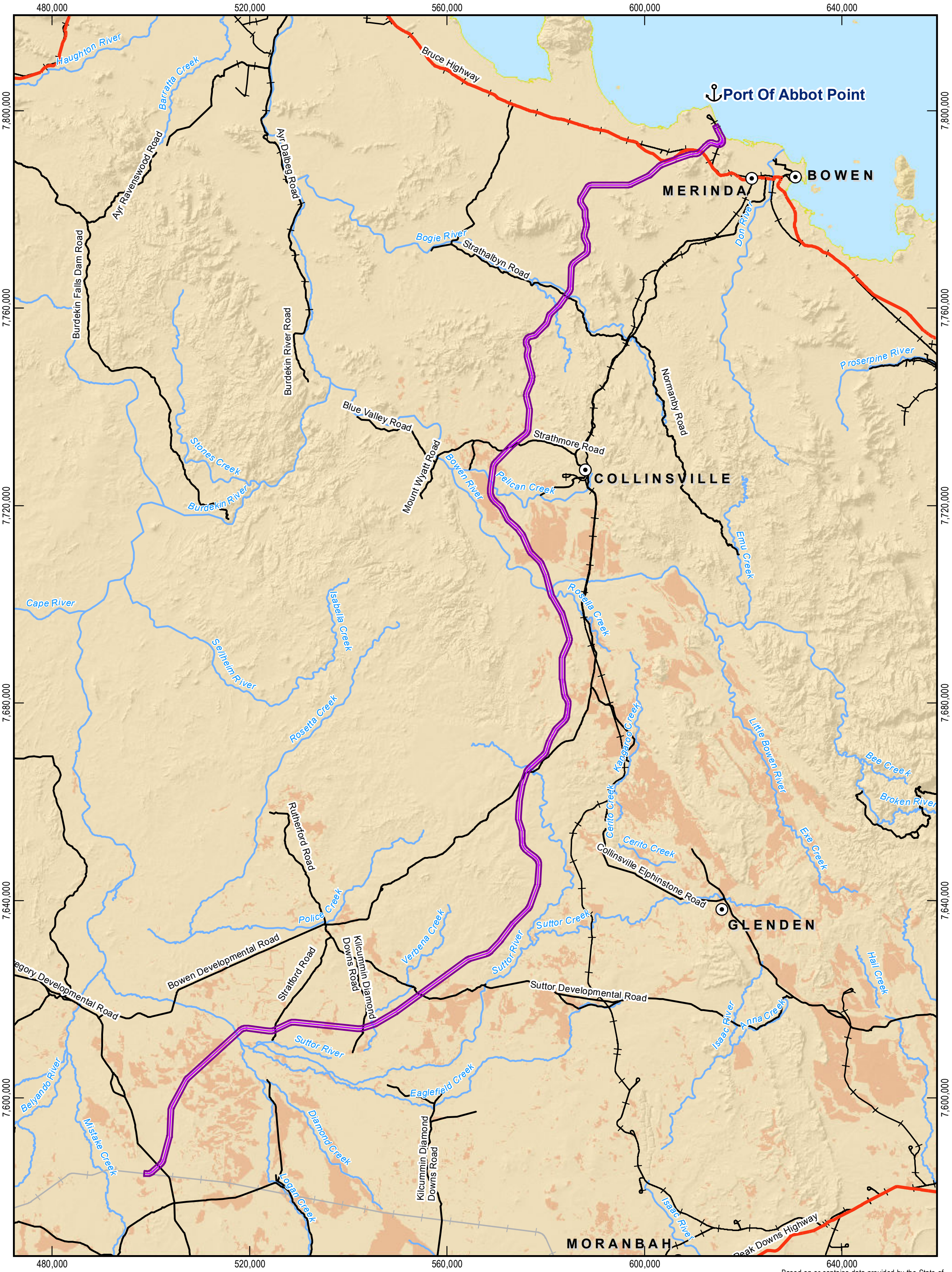
Targeted diurnal active searches of brigalow woodlands, brigalow regrowth and riparian habitats south of (approximately) Collinsville were undertaken at 10 sites (10.5 person hours) during the May 2013 surveys. Nocturnal searches were also carried out over six nights on properties containing these sites (8.5 person hours). A total of 50 habitat assessments were undertaken to describe habitat attributes and context within the preliminary investigation corridor. The species was not recorded during field surveys. The species has previously been previously recorded by GHD (2013) within surveys (May 2013) carried out as part of the Carmichael Coal Mine and Rail

EIS, in the east of the Mine area, over 70 km west of the southern extent of the NGBR Project preliminary investigation corridor.

7.8.5.4 Significance of NGBR Project footprint

Much of the suitable habitat for the species has been cleared for agriculture, mining and urban development, or has been degraded through overgrazing by stock. Important populations occur in remnant brigalow vegetation on, or surrounding, gilgai mounds and depressions. The limiting factor to utilisation of the potentially suitable habitat is likely to be related to the density of frog populations, which in turn may be driven by the localised availability of frog breeding sites.

The potential habitat available for the species within and adjacent to the preliminary investigation corridor is shown in Figure 7-32 and largely mirrors the presence of various brigalow vegetation communities, especially where these are underlain by cracking clays. The presence of this species within the preliminary investigation corridor will be limited by the co-existence of these two features and they are unlikely to be present elsewhere.



LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- Potential Ornamental Snake Habitat - Based on DNRM Certified Regional Ecosystems Version 6.1
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:1,100,000 Paper Size A4

0 10 20 40

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

adani

Adani Mining Pty Ltd
North Galilee Basin Rail Project

Job Number	41-26457
Revision	A
Date	26 Sep 2013

Ornamental snake potential habitat

Figure 7-32

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Level 9, 145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012;
DNRM: Roads/2010, Potential Habitat/2011. Created by:MS

7.8.5.5 Threatening processes

Ornamental snake populations have experienced declines in abundance throughout recent decades, due to a number of possible factors (SEWPaC 2013f). The primary threats to the persistence of this species include:

- Habitat loss through land clearing for development
- Habitat fragmentation
- Habitat degradation by cattle overgrazing and alteration of soil structure
- Alteration of landscape hydrology in gilgai environments
- Alteration of water quality through pollution of watercourses
- Interactions with the cane toad (*Rhinella marina*)
- Invasive weeds
- Predation by feral species, particularly the European red fox and feral cats.

7.8.5.6 Potential impacts

Construction impacts

Direct impacts

Approximately 247 ha of potential habitat for the species have been mapped within the NGBR Project footprint and will be cleared to facilitate construction. Potential habitat for this species was mapped based on the presence of a range of brigalow community REs known to support the species. The presence of this species within the NGBR Project footprint will be limited by the co-existence of various habitat features including gilgais and cracking clay soils among others.

Of the threatened species potentially present within the NGBR Project footprint, ornamental snake is the most likely to be at risk of injury or mortality during construction, particularly during earthworks, because of their propensity to shelter within felled timber materials, cracking clay soils and underground. As they are most active between dawn and dusk, the risk of being struck by construction vehicles is relatively low.

With respect to the Significant Impact Guidelines (DEWHA 2009c), it is not considered likely that the NGBR Project footprint supports an 'important population' of the species because the species was not detected within any part of the preliminary investigation corridor during targeted surveys. Furthermore, the habitat is not considered to constitute habitat for key source populations (being predominantly fragmented and isolated remnants) and it does not occur at or near the limit of the species' distributional range. Should they occur within the NGBR Project footprint, ornamental snakes are not considered to be a part of a population that is necessary for the species' long-term survival and recovery, or habitat critical to the survival of the species.

Indirect impacts

The operational phase may facilitate the movement of weed and pest species through the local landscape as a result of the cleared nature of the final rail corridor. The species may be slightly more susceptible to mortalities as a result of predation by pest animals as an indirect impact during NGBR Project operations. However following the implementation of mitigation measures, it is unlikely that the proliferation of weed and pest species will be exacerbated by the operation of the rail line.

Operational impacts

The key operational threats to the ornamental snake are the potential alteration of hydrology and water quality within habitats in which the species is present, the potential spread of invasive weed species, and predation by and contact with pest species (primarily the cane toad).

Fauna mortality has the potential to occur during the operational phase of the NGBR Project, particularly for cryptic and/or less mobile animals such as the ornamental snake, which is vulnerable to collision with trains when basking on the track or moving across the formation, through the local landscape. However, ornamental snake mortality resulting from train strike is unlikely to occur because of the general scarcity of the species and will have a minimal impact on this species at a population level. Appropriate fauna crossing structures will be installed below the rail formation which will allow passage of ornamental snakes.

Individuals and areas of habitat for ornamental snake may also be subject to indirect impacts resulting from the initial construction and operation of the NGBR Project, potentially including increased weed and pest prevalence and habitat degradation of remaining habitats from edge effects and dust. Dust settling on water bodies during the operation phase also has the potential to decrease aquatic habitat value for frog populations, the key food source for the species, as a result of reduced water quality. Dust deposition to occur as a result of the transport of coal is predicted to be at rates significantly below (<20 % of) the thresholds identified as likely to have an impact upon crops and livestock, and these rates are also likely to be broadly similar for native flora and fauna. As such, dust impacts are likely to be low (following the results of air quality modelling carried out for the NGBR Project, refer Volume 1 Chapter 10 Air quality, page 10-17) and the bridge structures proposed over aquatic habitats are likely to minimise impacts on in-stream flows. The implementation of suitable management and mitigation measures will reduce the likelihood of impacts on the water quality.

With appropriate mitigation and management, operational impacts are not predicted to adversely affect habitat critical to the survival of the species, or to modify the quality of habitat such that the species is likely to decline.

7.8.5.7 Avoidance, mitigation and management measures

A Recovery Plan for Brigalow Belt reptiles was drafted by WWF (Richardson 2006) and outlines the following actions:

1. Avoid clearing / retain habitat
2. Design proposed action to avoid habitat disturbance
3. Establish adequate buffer zones to protect habitat
4. Implement measures to exclude cattle from habitat
5. Maintain habitat connectivity across the landscape, e.g. along roadside reserves, uncultivated land between cropped and pasture-improved areas
6. Retain shelter habitat features in place
7. Translocate habitat features such as rocks from within the development zone to a habitat protection area outside the development zone in an attempt to relocate the population
8. Devise and implement a habitat management plan
9. Implement measures to reduce the risk of invasive and predatory species accessing reptile habitat

10. Devise and implement an appropriate fire management plan

11. Devise and implement water management, sediment erosion and pollution control plans.

Mitigation projects utilising translocation, habitat restoration and captive breeding and release programs are relatively unproven management techniques. Translocation is therefore considered inappropriate as a conservation management tool because the species is hard to capture and hence trapping enough individuals from one site to be significant will be impossible, and in the event of translocation, recapturing enough individuals to effectively monitor the success of the program will be problematic. Although habitat restoration is also an unproven technique, it may be better suited for the recovery and maintenance of brigalow belt reptile populations.

Avoidance, mitigation and management measures for ornamental snake will be achieved through the implementation of a Species Management Plan, to include the following:

- During detailed design, a targeted threatened species survey for ornamental snake will be undertaken in areas identified as potential habitat for the species. In areas where this survey indicates the presence of key habitat features known to support the species (primarily gilgai features with cracking clays within brigalow-dominated woodlands), a fauna spotter-catcher will be engaged to accompany clearing crews during construction. Pre-demarcated habitat features identified during the pre-clearance survey will be thoroughly checked by the fauna spotter-catcher prior to clearing. Provision for the relocation of fauna will be made prior to the commencement of clearing.
- During detailed design, in response to Recovery Plan actions #1 and #2, and using information from the targeted survey, vegetation clearing extents will be kept to the minimum area necessary for construction to reduce the area subject to habitat fragmentation. The extent of vegetation clearing will be clearly identified on construction plans and demarcated on site. Areas that must not be cleared or damaged will also be clearly identified on construction plans and demarcated in the field. Clearing extents will be communicated to all necessary construction personnel involved.
- During construction, vegetation clearing will be undertaken in a sequential manner to allow ornamental snake the opportunity to disperse away from clearing areas.
- During construction and operation, in response to Recovery Plan #9, pest animal occurrence will be monitored and recorded. Monitoring of changes in abundance or distribution of pest animals in the area over the life of the NGBR Project will identify whether the NGBR Project has contributed to an increase in diversity or abundance of these species. If increased densities of pest animals are observed, or new pest animals are identified, humane pest controls will be implemented to manage numbers.

7.8.5.8 Conclusion

An assessment of residual impacts to the ornamental snake against the Significant Impact Guidelines is provided in Table 7-36.

Table 7-36 Significance of residual impacts on ornamental snake

Impact criteria	Project response
Lead to a long term decrease in the size of an important population of the species	Unlikely, as the final rail corridor is not considered to support an important population of ornamental snake.
Reduce the area of occupancy of an important population	Unlikely, as the final rail corridor is not considered to support an important population of ornamental snake.
Fragment an existing important population into two or more populations	Unlikely, as the final rail corridor is not considered to support an important population of ornamental snake.
Adversely affect habitat critical to the survival of a species	Unlikely. The final rail corridor is not considered to contain habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	Unlikely, as the final rail corridor is not considered to support an important population of ornamental snake.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely. Although suitable habitat will be directly impacted by the NGBR Project, no evidence of the species was detected and is not considered to be to an extent that will lead to a decline in the species.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely, with implementation of the Weed and Pest Management Plan.
Introduce disease that may cause the species to decline	Unlikely.
Interfere substantially with the recovery of the species	Unlikely.

7.8.6 Bluegrass

7.8.6.1 Species overview

Bluegrass (*Dichanthium setosum*), listed as vulnerable under the EPBC Act, is an upright perennial grass that occurs in north-west New South Wales and a small area of central Queensland. Habitat preferences include areas of heavy black (basaltic) soils and stony red-brown hard-setting loam with clay subsoil (TSSC 2008b). It is known to occur in disturbed areas including cleared woodland, grazing land and pastures (TSSC 2008b).

The species has been found in association with a broad range of geological and pedalogical conditions, recorded on a number of land zones (i.e. land zones 3, 4, 5, 8, 10, 11 and 12). It has mostly been recorded on level to undulating landforms and adjacent to watercourses; however, some records are from hillsides and ridges and also within brigalow and areas of non-remnant vegetation. These findings indicate this species has very broad habitat requirements.

7.8.6.2 Desktop results

Bluegrass (*Dicanthium setosum*) was predicted to occur within the preliminary investigation corridor by the Protected Matters Search Tool and previously recorded with the desktop search extent by the Wildlife Online and HERBRECS databases.

7.8.6.3 Survey results

The random meander technique (Cropper 1993) is a widely accepted method to survey for rare or threatened plant species or other species of interest that may not occur in surveyed quadrats or sample sites. This technique is particularly suitable for locating species that typically occur at very low densities, or that may be grouped in isolated clumps, as is often the case with many plants listed as rare or threatened.

The species was not recorded during field surveys for the NGBR Project in May 2013. Bluegrass has previously been recorded within 10 km of the preliminary investigation corridor (Wildlife Online). Suitable grassland habitat is likely to exist within the preliminary investigation corridor based on the species' known habitat requirements and a desktop assessment of the preliminary investigation corridor; however the species is known to have a highly restricted distribution and is not considered likely to occur within the final rail corridor.

7.8.6.4 Avoidance, mitigation and management measures

As bluegrass is not considered likely to occur within the final rail corridor, specific avoidance, mitigation and management measures are not necessary at this stage. Further surveys to refine areas of potential habitat for the species will be undertaken during the detailed design stage. As a precaution, appropriate monitoring, avoidance, mitigation and management measures for bluegrass will be incorporated into a Species Management Plan. Should further surveys provide no evidence to indicate the presence of this species, these measures will be removed from the Species Management Plan.

7.8.7 Finger panic grass

7.8.7.1 Species overview

Finger panic grass (*Digitaria porrecta*), listed as endangered under the EPBC Act, is a tufted perennial with grey leaves (2-3 mm wide) and sharp hairs growing up to 60 cm tall (TSSC 2008c). Finger panic grass occurs within disjunct areas of Queensland, including in the Nebo district, south-west of Mackay; the Central Highlands between Springsure and Rolleston; and from Jandowae south to Warwick (Halford 1995). It occurs in *Eucalyptus orgadophila* dominated communities on hills and slopes and *E. tereticornis / E. populnea* communities along drainage lines, situated on dark and fine textured soils with underlying basaltic geology (Halford, 1995; TSSC, 2008c).

7.8.7.2 Desktop results

Finger panic grass was not predicted to occur within the preliminary investigation corridor by the Protected Matters Search Tool, however was previously recorded within 10 km of the preliminary investigation corridor (Wildlife Online and HERBRECS databases).

7.8.7.3 Survey results

The random meander technique (Cropper 1993) is a widely accepted method to survey for rare or threatened plant species or other species of interest that may not occur in surveyed quadrats or sample sites.

The species was not recorded during field surveys for the NGBR Project in May 2013. While suitable habitat was found present within the preliminary investigation corridor, it is located at the northern-most extent of the species known range.

7.8.7.4 Avoidance, mitigation and management measures

As finger panic grass is not considered likely to occur within the final rail corridor, specific avoidance, mitigation and management measures are not necessary at this stage. Further surveys to refine areas of potential habitat for the species will be undertaken during the detailed design stage. As a precaution, appropriate monitoring, avoidance, mitigation and management measures for finger panic grass will be incorporated into a Species Management Plan. Should further surveys provide no evidence to indicate the presence of this species, these measures will be removed from the Species Management Plan.

7.8.8 Polianthion minutiflorum

7.8.8.1 Species overview

Polianthion minutiflorum, a shrub to one metre high, is listed as vulnerable under the EPBC Act. The species has been recorded within discrete locations within Queensland around Redcliffe Vale, Callide Range, East Boogalgopal and Kingaroy (TSSC 2008d). *P. minutiflorum* has been recorded occurring on sandstone slopes and gullies comprising skeletal soils, sometimes on deeper sands on weathered laterite (Kellermann, J., Rye 2006).

7.8.8.2 Desktop results

Polianthion minutiflorum was not predicted to occur within the preliminary investigation corridor by the Protected Matters Search Tool. Records of the species have been previously detailed within 10 km of the preliminary investigation corridor by the Wildlife Online and HERBRECS databases.

7.8.8.3 Survey results

The species was not recorded during field surveys within the preliminary investigation corridor or its immediate vicinity for the NGBR Project in May 2013. Although suitable habitat was found present within the preliminary investigation corridor, the species is known to have a highly restricted distribution and is not considered likely to occur within the final rail corridor.

7.8.8.4 Avoidance, mitigation and management measures

As *Polianthion minutiflorum* is not considered likely to occur within the final rail corridor, specific avoidance, mitigation and management measures are not necessary at this stage. Further surveys to refine areas of potential habitat for the species will be undertaken during the detailed design stage. As a precaution, appropriate monitoring, avoidance, mitigation and management measures for *Polianthion minutiflorum* will be incorporated into a Species Management Plan. Should further surveys provide no evidence to indicate the presence of this species, these measures will be removed from the Species Management Plan.

7.8.9 Ozothamnus eriocephalus

7.8.9.1 Species overview

Ozothamnus eriocephalus, a woody shrub growing to 60 cm high, is listed as vulnerable under the EPBC Act. The species occurs on rocky escarpments, slopes and creek gullies in closed rainforest margins, disturbed notophyll vine forests and also open eucalypt forest (TSSC 2008e; SEWPaC 2013g). The species has also been recorded on creek banks and within crevices on steep granite slopes (TSSC 2008e).It is known from the Bowen and Mackay regions of central Queensland (TSSC 2008e).

7.8.9.2 Desktop results

Ozothamnus eriocephalus was predicted to occur within the preliminary investigation corridor by the Protected Matters Search Tool and previously recorded within 10 km of the preliminary investigation corridor by the Wildlife Online and HERBRECS databases. The nearest record to the preliminary investigation corridor is located on Mt Abbot, just over five kilometres west of the preliminary investigation corridor in the vicinity of Thurso Station. It is also recorded to the north of Glenden, approximately 35 km east of the preliminary investigation corridor (Council of Heads Australiasian Herbaria 2013).

7.8.9.3 Survey results

The species is not readily identified and surveys should be carried out during the flowering season, from March to September (TSSC 2008e).

The species was not recorded during field surveys within the preliminary investigation corridor or its immediate vicinity for the NGBR Project in May 2013.

7.8.9.4 Avoidance, mitigation and management measures

As *Ozothamnus eriocephalus* is not considered likely to occur within the final rail corridor, specific avoidance, mitigation and management measures are not necessary at this stage. Further surveys to refine areas of potential habitat for the species will be undertaken during the detailed design stage. As a precaution, appropriate monitoring, avoidance, mitigation and management measures for *Ozothamnus eriocephalus* will be incorporated into a Species Management Plan. Should further surveys provide no evidence to indicate the presence of this species, these measures will be removed from the Species Management Plan.

7.8.10 Siah’s Backbone

7.8.10.1 Species overview

The *Streblus pendulinus* vulnerable listing under the EPBC Act refers to the species occurrence on Norfolk Island and islands of the Pacific Ocean, and has resulted in the subsequent inclusion of the mainland species (*S. brunonianus*) (SEWPaC 2013h). On the mainland, the species, a large tree or shrub up to six metres, can be found in warm, well-developed rainforests, particularly along watercourses (SEWPaC 2013h).

7.8.10.2 Desktop results

This species was predicted to occur within the preliminary investigation corridor by the Protected Matters Search Tool and has been previously recorded within 10 km of the preliminary investigation corridor, west of Bowen (Mt Abbot and Mt Aberdeen National Park) (Wildlife Online, HERBRECS).

7.8.10.3 Survey results

The species was not recorded during field surveys within the preliminary investigation corridor or its immediate vicinity for the NGBR Project in May 2013. Suitable habitat for this species may occur within the preliminary investigation corridor.

7.8.10.4 Avoidance, mitigation and management measures

As Siah's backbone is not considered likely to occur within the final rail corridor, specific avoidance, mitigation and management measures are not necessary at this stage. Further surveys to refine areas of potential habitat for the species will be undertaken during the detailed design stage. As a precaution, appropriate monitoring, avoidance, mitigation and management measures for Siah's backbone will be incorporated into a Species Management Plan. Should further surveys provide no evidence to indicate the presence of this species, these measures will be removed from the Species Management Plan.

7.8.11 Minute orchid

7.8.11.1 Species overview

Taeniophyllum muelleri is listed as vulnerable under the EPBC Act and inhabits the east coast of Australia from Cape York through to New South Wales (SEWPaC 2013i). This small, epiphytic species occurs on the outer branches of rainforest trees, coast and coastal ranges, approximately 250 m above sea level (SEWPaC 2013i).

7.8.11.2 Desktop results

This species was predicted to occur within the preliminary investigation corridor by the Protected Matters Search Tool. The species has been previously recorded within 10 km of the preliminary investigation corridor, west of Bowen (Mt Aberdeen National Park) (Wildlife Online, HERBRECS).

7.8.11.3 Survey results

The species was not recorded during the May 2013 field surveys, however suitable habitat for this species may occur within the preliminary investigation corridor.

7.8.11.4 Avoidance, mitigation and management measures

As minute orchid is not considered likely to occur within the final rail corridor, specific avoidance, mitigation and management measures are not necessary at this stage. Further surveys to refine areas of potential habitat for the species will be undertaken during the detailed design stage. As a precaution, appropriate monitoring, avoidance, mitigation and management measures for minute orchid will be incorporated into a Species Management Plan. Should further surveys provide no evidence to indicate the presence of this species, these measures will be removed from the Species Management Plan.

7.8.12 Masked owl

7.8.12.1 Species overview

The masked owl (northern), listed as vulnerable under the EPBC Act, occurs across northern Australia and is a conventionally accepted subspecies of the masked owl. In Queensland, the northern subspecies occurs across Cape York Peninsula, to a southern distribution limit along the central Queensland coast, with records from Mackay and near Duaringa, west of Rockhampton (SEWPaC 2013j). Habitat for the subspecies includes riparian forest, rainforest, open forest *Melaleuca* swamps, edges of mangroves, and the margins of sugar cane fields (SEWPaC 2013j). This species is territorial, occupies a large home range and requires large old growth trees with large hollows for nesting (SEWPaC 2013j).

7.8.12.2 Desktop results

The masked owl (northern) was predicted to occur within the preliminary investigation corridor by the Protected Matters Search Tool, but not previously recorded by databases within the desktop search extent.

7.8.12.3 Survey results

A total of 24 person hours across 26 survey sites were dedicated to spotlighting and call playback, and 27.5 person hours across 47 bird surveys sites for the species during the May 2013 field surveys. The species was not recorded during these surveys. The preliminary investigation corridor is within the species known distribution and potentially suitable habitat is available at distinct locations, particularly within riparian forest vegetation close to Abbot Point.

7.8.12.4 Avoidance, mitigation and management measures

As masked owl (northern) is not considered likely to occur within the final rail corridor, specific avoidance, mitigation and management measures are not necessary at this stage. Further surveys to refine areas of potential habitat for the species will be undertaken during the detailed design stage. As a precaution, appropriate monitoring, avoidance, mitigation and management measures for masked owl will be incorporated into a Species Management Plan. Should further surveys provide no evidence to indicate the presence of this species, these measures will be removed from the Species Management Plan.

7.8.1 Red goshawk

7.8.1.1 Species overview

The red goshawk, listed as vulnerable under the EPBC Act, prefers landscapes containing a mosaic of habitats including coastal and sub-coastal tall open forest, woodland and rainforest edges (Marchant and Higgins 1993). Forests of intermediate density are particularly favoured, as are ecotones between variably dense habitats (i.e. ecotone between rainforest and sclerophyll forest) (SEWPaC 2013k). Large bird populations (the primary prey of this species) are also an important determinant of red goshawk habitat utilisation (SEWPaC 2013k). It generally avoids open habitats, and is only rarely encountered over agricultural land (Marchant and Higgins 1993b). Nesting occurs in tall trees within one kilometre of permanent water, generally in open, biologically rich forest or woodland (Marchant and Higgins 1993b). The species is sparsely dispersed across approximately 15 per cent of coastal and sub-coastal Australia. The species occurs at low densities occupying home ranges estimated between 50 – 220 km^2 (SEWPaC 2013k).

7.8.1.2 Desktop results

The red goshawk was predicted to occur within the preliminary investigation corridor by the Protected Matters Search Tool, but not previously recorded by databases within the desktop search extent. The preliminary investigation corridor is within the species known distribution.

7.8.1.3 Survey results

A total of 27.5 person hours across 47 sites were dedicated to bird surveys for the species during the May 2013 field surveys The species was not recorded during these surveys, however potentially suitable habitat occurs in the preliminary investigation corridor, particularly within riparian corridors along larger watercourses where tall riparian vegetation is present (possible nesting habitat).

7.8.1.4 Avoidance, mitigation and management measures

As red goshawk is not considered likely to occur within the final rail corridor, specific avoidance, mitigation and management measures are not necessary at this stage. Further surveys to refine areas of potential habitat for the species will be undertaken during the detailed design stage. As a precaution, appropriate monitoring, avoidance, mitigation and management measures for red goshawk will be incorporated into a Species Management Plan. Should further surveys provide no evidence to indicate the presence of this species, these measures will be removed from the Species Management Plan.

7.8.2 Northern quoll

7.8.2.1 Species overview

The distribution of the northern quoll, listed as endangered under the EPBC Act, covers much of north-eastern Australia, however the current range of the species has contracted considerably and is now thought to be restricted to six discrete areas across northern Australia (Strahan 1995). While the species does not have highly specific habitat requirements, rocky areas associated with open woodland and open forest are considered optimal habitat for the northern quoll (Hill and Ward 2010). The preference for rocky habitat may be related to reduced exposure to threatening processes (i.e. vegetation clearing, fire, cane toads, reduced competition with cats) and the diversity of micro-habitats available (Hill and Ward, 2010).

7.8.2.2 Desktop results

The northern quoll was predicted to occur within the preliminary investigation corridor by the Protected Matters Search Tool, but not previously recorded by databases within the desktop search extent. The preliminary investigation corridor is within the SEWPaC modelled ‘may occur’ distribution for this species (SEWPaC 2013l).

7.8.2.3 Survey results

A total of 21 person hours were dedicated to spotlighting and 37 person hours to diurnal active searches for latrine sites for the species during the May 2013 field surveys. No evidence of species was observed during these field surveys, however suitable habitat may occur within the preliminary investigation corridor where areas of rocky eucalypt woodland are present.

7.8.2.4 Avoidance, mitigation and management measures

As northern quoll is not considered likely to occur within the final rail corridor, specific avoidance, mitigation and management measures are not necessary at this stage. Further surveys to refine areas of potential habitat for the species will be undertaken during the detailed design stage. As a precaution, appropriate monitoring, avoidance, mitigation and management measures for northern quoll will be incorporated into a Species Management Plan. Should further surveys provide no evidence to indicate the presence of this species, these measures will be removed from the Species Management Plan.

7.8.3 Dunmall's snake

7.8.3.1 Species overview

Dunmall's snake (*Furina dunmalli*) is listed as vulnerable under the EPBC Act. The species occurs in central and south-east Queensland, with the northern limit of its known range extending between Yeppoon and the Expedition Range (SEWPaC 2013m). The species inhabits open forest and woodland habitats. Brigalow growing on cracking clay and loam soils on floodplains is a known habitat for the species (SEWPaC 2013m).

7.8.3.2 Desktop results

Dunmall's snake was predicted to occur within the preliminary investigation corridor by the Protected Matters Search Tool, but not previously recorded by databases within the desktop search extent. The southern-most extent of the preliminary investigation corridor abuts the northern distributional limit of the SEWPaC modelled 'may occur' distribution for this species.

7.8.3.3 Survey results

A total of 37 person hours were dedicated to diurnal active searches for the species during the May 2013 field surveys. The species was not recorded during these surveys, however limited potentially suitable habitat may be located south of the Suttor Developmental Road.

7.8.3.4 Avoidance, mitigation and management measures

As Dunmall's snake is not considered likely to occur within the final rail corridor, specific avoidance, mitigation and management measures are not necessary at this stage. Further surveys to refine areas of potential habitat for the species will be undertaken during the detailed design stage. As a precaution, appropriate monitoring, avoidance, mitigation and management measures for Dunmall's snake will be incorporated into a Species Management Plan. Should further surveys provide no evidence to indicate the presence of this species, these measures will be removed from the Species Management Plan.

7.8.4 Retro slider

7.8.4.1 Species overview

The retro slider, listed as endangered under the EPBC Act, occurs within the Clermont region, inhabiting black to black-red soils with dense leaf litter cover or under trees, shrubs and grass tussocks (SEWPaC 2013n). The species has been recorded in *Eucalyptus orgadophila* open woodlands, *Melaleuca bracteata* closed scrubs and forests and scattered *Bauhinia* spp. on plains (Covacevich *et al*. 1996).

7.8.4.2 Desktop results

The retro slider was predicted to occur within the preliminary investigation corridor by the Protected Matters Search Tool, but not previously recorded by databases within the desktop search extent. The modelled distribution of the species, as presented in the Referral Guidelines for the Retro Slider indicates that the southern-most extent of the investigation corridor coincides with the modelled ‘may occur’ distribution for the species (SEWPaC 2013n).

7.8.4.3 Survey results

A total of 37 person hours were dedicated to active searches for the species during the May 2013 field surveys. The species was not recorded during the May 2013 field surveys. Limited potentially suitable habitat may occur south of the Suttor Developmental Road.

7.8.4.4 Avoidance, mitigation and management measures

As retro slider is not considered likely to occur within the final rail corridor, specific avoidance, mitigation and management measures are not necessary at this stage. Further surveys to refine areas of potential habitat for the species will be undertaken during the detailed design stage. As a precaution, appropriate monitoring, avoidance, mitigation and management measures for retro slider will be incorporated into a Species Management Plan. Should further surveys provide no evidence to indicate the presence of this species, these measures will be removed from the Species Management Plan.

7.8.5 Yakka skink

7.8.5.1 Species overview

The yakka skink is listed as vulnerable under the EPBC Act and is endemic to dry open forests, woodlands and rocky areas of central and eastern Queensland. Yakka skinks live in communal borrow complexes, and often take refuge among low vegetation or under heaped dead timber, logs, rocks and in deep rock crevices (Wilson 2005; SEWPaC 2013o). The species occurs in a wide variety of vegetation types including poplar box (*Eucalyptus populnea*), ironbark (*Eucalyptus* spp.), brigalow (*Acacia harpophylla*), white cypress pine (*Callitris* spp.), mulga (*Acacia aneura*), bendee (*Acacia catenulata*) and lancewood (*Acacia shirleyi*) woodland and open forest (SEWPaC 2013o).

7.8.5.2 Desktop results

The yakka skink was predicted to occur within the preliminary investigation corridor by the Protected Matters Search Tool, but not previously recorded by databases within the desktop search extent. The preliminary investigation corridor is within the SEWPaC modelled ‘may occur’ distribution for this species (SEWPaC 2013o).

7.8.5.3 Survey results

A total of 21 and 37 person hours were dedicated to spotlighting and diurnal active searches for defecation sites, respectively, for the species during the May 2013 field surveys. No evidence of the species was recorded during the May 2013 field surveys, however suitable habitat may occur within the preliminary investigation corridor in rocky outcrop areas or where eucalypt woodland with suitable timber microhabitat is present.

7.8.5.4 Avoidance, mitigation and management measures

As yakka skink is not considered likely to occur within the final rail corridor, specific avoidance, mitigation and management measures are not necessary at this stage. Further surveys to refine areas of potential habitat for the species will be undertaken during the detailed design stage. As a precaution, appropriate monitoring, avoidance, mitigation and management measures for yakka skink will be incorporated into a Species Management Plan. Should further surveys provide no evidence to indicate the presence of this species, these measures will be removed from the Species Management Plan.

7.8.6 Green sawfish (Pristis zijsron)

7.8.6.1 Species overview

The green sawfish is listed as vulnerable under the EPBC Act. Green sawfish inhabit inshore marine waters, estuaries, river mouths, embankments and along sandy and muddy beaches (SEWPaC 2013h). Records indicate that green sawfish occurred along the east coast of Queensland and New South Wales prior to the 1960s; however, after this period, there have been no reports of this species south of Cairns (Stevens et al. 2005).

7.8.6.2 Desktop results

The green sawfish was predicted to occur within the preliminary investigation corridor by the Protected Matters Search Tool, but not previously recorded by databases within the desktop search extent. The modelled distribution of the species indicates that the northern extent of the investigation corridor coincides with the modelled distribution for the species (SEWPaC 2013x).

7.8.6.3 Survey results

Aquatic habitat assessments were undertaken within the preliminary investigation corridor over a period of three days. Suitable habitat for this species was confirmed as present within the northern extent of the preliminary investigation corridor. The green sawfish is, however, unlikely to occur upstream of barriers.

7.8.6.4 Avoidance, mitigation and management measures

As green sawfish is not considered likely to occur within the final rail corridor, specific avoidance, mitigation and management measures are not necessary at this stage. Further surveys to refine areas of potential habitat for the species will be undertaken during the detailed design stage. As a precaution, appropriate monitoring, avoidance, mitigation and management measures for green sawfish will be incorporated into a Species Management Plan. Should further surveys provide no evidence to indicate the presence of this species, these measures will be removed from the Species Management Plan.

7.8.7 Summary

A summary of potential direct and indirect impacts, proposed mitigation measures and residual impact assessment is provided below in Table 7-37.

Table 7-37 Summary of impacts, threats and mitigation measures for species

Threatened species	Direct impacts	Indirect impacts	Mitigation measures	Residual impact assessment against the Guidelines	Offsets required?
Black ironbox (*Eucalyptus raveretiana*)	**Construction** • Direct loss of 64.6 ha of potential habitat • Potential direct loss of individuals • Alteration of stream and floodplain hydrology	**Operation** • Proliferation of exotic weeds (particularly rubber vine)	Targeted surveys during detailed design, locating and marking any individual trees Manage potentially mobilised pollutants through the implementation of an Environmental Management Plan. Micro-scale adjustments of clearing footprints to avoid potentially suitable habitat. Establishment and implementation of the following: • Water Quality Management Plan • Fire Management Plan • Erosion and Sediment Control Plan • Weed and Pest Management Strategy Avoidance of large mature trees where practicable Locate temporary structures and infrastructure within the construction footprint to avoid further clearing Salvage/translocation of young saplings and seedlings Installation of culverts and erosion and sediment controls at stream crossings Rehabilitation of temporarily disturbed areas On-going monitoring of vegetation communities along the final rail corridor	The final rail corridor of the NGBR Project will reduce the extent of available habitat of known populations; however it is unlikely to contain an important population or habitat critical to the survival of the species. Offsets will be acquired to compensate losses of this listed species.	Yes
Squatter pigeon (southern) (*Geophaps scripta scripta*)	**Construction** • Direct loss of 1,788 ha of potential habitat • Individual mortality through vehicle collisions	**Construction** • Degradation of surrounding habitat through edge effects (e.g. weed spread and	Targeted surveys during detailed design, locating and marking key habitat features Micro-scale adjustments of clearing footprints to avoid potentially suitable habitat. Establishment and implementation of the following: • Water Quality Management Plan • Fire Management Plan	The NGBR Project may potentially have a significant impact on the species. While an important population is not considered to occur within the final rail corridor, potential habitat will be	Yes

Threatened species	Direct impacts	Indirect impacts	Mitigation measures	Residual impact assessment against the Guidelines	Offsets required?
	Operation • Individual mortality through train/maintenance vehicle collisions	predation) • Noise, light, dust and vibration **Operation** • Habitat degradation due to weed spread, noise, light, dust and vibration.	• Dust Management Plan • Erosion and Sediment Control Plan • Weed and Pest Management Strategy Locate temporary structures and infrastructure within the construction footprint to avoid further clearing Maintain a register of wildlife incidents Sequential vegetation clearing to allow species to disperse away from cleared areas and clearing activities Fauna spotter-catcher present during vegetation clearing (to check/clear feeding areas, roosting or nesting sites) Salvage habitat features Rehabilitation of temporarily disturbed areas Vehicle speed limits imposed on associated maintenance tracks to reduce risk of fauna mortality On-going monitoring of vegetation communities along the final rail corridor	impacted that may be habitat critical to the survival of the species. Any impact to potential habitat critical to the survival of the species will be managed through the implementation of mitigation measures. Offsets will be acquired to compensate losses of this listed species.	
Australian painted snipe (*Rostratula australis*)	**Construction** • Direct loss of 45.6 ha of potential habitat • Habitat fragmentation **Operation** • Individual mortality through train/maintenance vehicle collisions	**Construction** • Degradation of surrounding habitat through edge effects (e.g. weed spread and sedimentation) • Noise, light, dust and vibration • Potential for reduced water quality	Targeted surveys during detailed design, locating and marking key habitat features Micro-scale adjustments of clearing footprints to avoid potentially suitable habitat. Establishment and implementation of the following: • Water Quality Management Plan • Fire Management Plan • Dust Management Plan • Erosion and Sediment Control Plan • Weed and Pest Management Strategy Locate temporary structures and infrastructure within the construction footprint to avoid further clearing	The NGBR Project is unlikely to have a significant impact on the species. The NGBR Project is unlikely to impact on recorded populations in the region. Any impact to potential habitat critical to the survival of the species will be managed through the implementation of mitigation measures. Offsets under the EPBC Act are therefore not required however due to	Yes

Threatened species	Direct impacts	Indirect impacts	Mitigation measures	Residual impact assessment against the Guidelines	Offsets required?
		Operation • Habitat degradation due to weed spread, noise, light, dust and vibration.	Maintain a register of wildlife incidents Sequential vegetation clearing to allow species to disperse away from cleared areas and clearing activities Fauna spotter-catcher present during vegetation clearing (to check/clear feeding areas, roosting or nesting sites) Salvage habitat features Rehabilitation of temporarily disturbed areas Vehicle speed limits imposed on associated maintenance tracks to reduce risk of fauna mortality On-going monitoring of vegetation communities along the final rail corridor	State offset requirements, offsets to compensate losses of this listed species.will still be acquired.	
Koala (*Phascolarctos cinereus*)	**Construction** • Direct loss of 2,390 ha of potential habitat **Operation** • Individual mortality through train/maintenance vehicle collisions	**Construction** • Degradation of surrounding habitat through edge effects (e.g. weed spread and sedimentation) • Noise, light, dust and vibration **Operation** • Habitat degradation due to weed spread, noise, light, dust and vibration.	Targeted surveys during detailed design, locating and marking key habitat features Micro-scale adjustments of clearing footprints to avoid potentially suitable habitat. Establishment and implementation of the following: • Water Quality Management Plan • Fire Management Plan • Dust Management Plan • Erosion and Sediment Control Plan • Weed and Pest Management Strategy Locate temporary structures and infrastructure within the construction footprint to avoid further clearing Maintain a register of wildlife incidents Sequential vegetation clearing to allow species to disperse away from cleared areas and clearing activities Fauna spotter-catcher present during vegetation clearing (to check/clear feeding areas, roosting or nesting sites)	The NGBR Project may potentially have a significant impact on habitat available for the species. While an important population is not considered to occur within the final rail corridor, potential habitat will be impacted that may be habitat critical to the survival of the species.	Yes

Threatened species	Direct impacts	Indirect impacts	Mitigation measures	Residual impact assessment against the Guidelines	Offsets required?
			Salvage habitat features possible Rehabilitation of temporarily disturbed areas Vehicle speed limits imposed on associated maintenance tracks to reduce risk of fauna mortality On-going monitoring of vegetation communities along the final rail corridor		
Black-throated finch (southern) (*Poephila cincta cincta*)	**Construction** • Direct loss of 2,143 ha of potential habitat **Operation** • Individual mortality through train/maintenance vehicle collisions	**Construction** • Degradation of surrounding habitat through edge effects (e.g. weed spread and sedimentation) • Noise, light, dust and vibration **Operation** • Habitat degradation due to weed spread, noise, light, dust and vibration.	Targeted surveys during detailed design, locating and marking key habitat features Micro-scale adjustments of clearing footprints to avoid potentially suitable habitat. Establishment and implementation of the following: • Water Quality Management Plan • Fire Management Plan • Dust Management Plan • Erosion and Sediment Control Plan • Weed and Pest Management Strategy Locate temporary structures and infrastructure within the construction footprint to avoid further clearing Maintain a register of wildlife incidents Sequential vegetation clearing to allow species to disperse away from cleared areas and clearing activities Fauna spotter-catcher present during vegetation clearing (to check/clear feeding areas, roosting or nesting sites) Salvage habitat features Rehabilitation of temporarily disturbed areas Vehicle speed limits imposed on associated maintenance tracks to reduce risk of fauna mortality On-going monitoring of vegetation communities along the	The NGBR Project may potentially have a significant impact on the species. While an important population is not considered to occur within the final rail corridor, potential habitat critical to the survival of the species will be impacted. Offsets will be acquired to compensate losses of this listed species	Yes

Threatened species	Direct impacts	Indirect impacts	Mitigation measures	Residual impact assessment against the Guidelines	Offsets required?
			final rail corridor		
Ornamental snake (*Denisonia maculata*)	**Construction** • Direct loss of 246 ha of potential habitat **Operation** • Individual mortality through train/maintenance vehicle collisions	**Construction** • Degradation of surrounding habitat through edge effects (e.g. weed spread and sedimentation) • Noise, light, dust and vibration **Operation** • Habitat degradation due to weed spread, noise, light, dust and vibration.	Targeted surveys during detailed design, locating and marking key habitat features Micro-scale adjustments of clearing footprints to avoid potentially suitable habitat. Establishment and implementation of the following: • Water Quality Management Plan • Fire Management Plan • Dust Management Plan • Erosion and Sediment Control Plan • Weed and Pest Management Strategy Locate temporary structures and infrastructure within the construction footprint to avoid further clearing Maintain a register of wildlife incidents Sequential vegetation clearing to allow species to disperse away from cleared areas and clearing activities Fauna spotter-catcher present during vegetation clearing (to check/clear feeding areas, roosting or nesting sites) Salvage habitat features Rehabilitation of temporarily disturbed areas Vehicle speed limits imposed on associated maintenance tracks to reduce risk of fauna mortality On-going monitoring of vegetation communities along the final rail corridor	The NGBR Project is unlikely to have a significant impact on the species. The final rail corridor is unlikely to contain an important population or habitat critical to the survival of the species. Any indirect impacts will be managed through the implementation of mitigation measures. Offsets will be acquired to compensate losses of this listed species	Yes

7.9 Threatened ecological communities

7.9.1 Overview

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

The Protected Matters Search Tool (refer Appendix G of Volume 2 Appendix F Nature conservation (page 292)) identified three TECs predicted to occur within the final rail corridor:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) – endangered
- Semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar Bioregions – endangered
- Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin – endangered.

The location of these TECs is shown in Figure 7-33. The occurrence of TECs was predicted based on the presence of TEC constituent regional ecosystems (REs) occurring within the preliminary investigation corridor. This assessment was undertaken using DNRM version 6 certified RE mapping. Based on previous project experience within the region, it is likely that the mapped extent of these REs is an over-estimation of their actual presence on the ground. The values of these communities and their presence or likely presence within the preliminary investigation corridor are discussed below.

7.9.1.1 Survey effort

Terrestrial survey sites were selected to target mapped areas of TECs and / or the constituent regional ecosystmes (REs). In particular, sites considered likely to provide habitat for listed threatened species were targeted, including mapped ‘endangered’ or ‘of concern’ remnant vegetation, mapped essential habitat and ecosystems that provide important function such as riparian vegetation and wetlands.

Assessment of TECs at each selected survey site involved recording the vegetation community structure and the dominant species composition of each stratum comprising the vegetation community. This is consistent with the ‘quaternary’ level of assessment of the CORVEG methodology developed by the Queensland Herbarium and outlined in Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland (Neldner et al. 2012). Overall, flora surveys were undertaken at 350 ‘quaternary’ level survey sites over a total of 11 survey days by two ecologists,

7.9.1.2 Potential impacts

The NGBR Project has the potential to have both direct and indirect impacts on TECs, throughout both the construction and operational phases. The following section outlines potential impacts to TECs as a result of the NGBR Project.

Construction

Construction of the NGBR Project will involve the clearing of a nominally 100 m wide final rail corridor plus temporary (construction) and permanent (operation) ancillary infrastructure footprints located adjacent to the final rail corridor (collectively termed the NGBR Project footprint, illustrated in Figure 7-3). The NGBR Project's construction phase will be intensive for approximately two years.

Construction will occur on three fronts with multiple areas of impact at any one time. Direct impacts (i.e. vegetation clearing) will occur progressively along the rail alignment ahead of bulk earthworks, bridge, culvert, and structures development and the laying of sleepers, ballast and track. It should be noted that the avoidance of significant environmental features and values was incorporated into the earlier route selection stages of the NGBR Project (as described in Section 7.3.3), both during development of the preliminary investigation corridor and during the location of the final rail corridor. It is the NGBR Project footprint that is assessed here.

Key impacts to TECs that are likely to result from construction of the NGBR Project are:

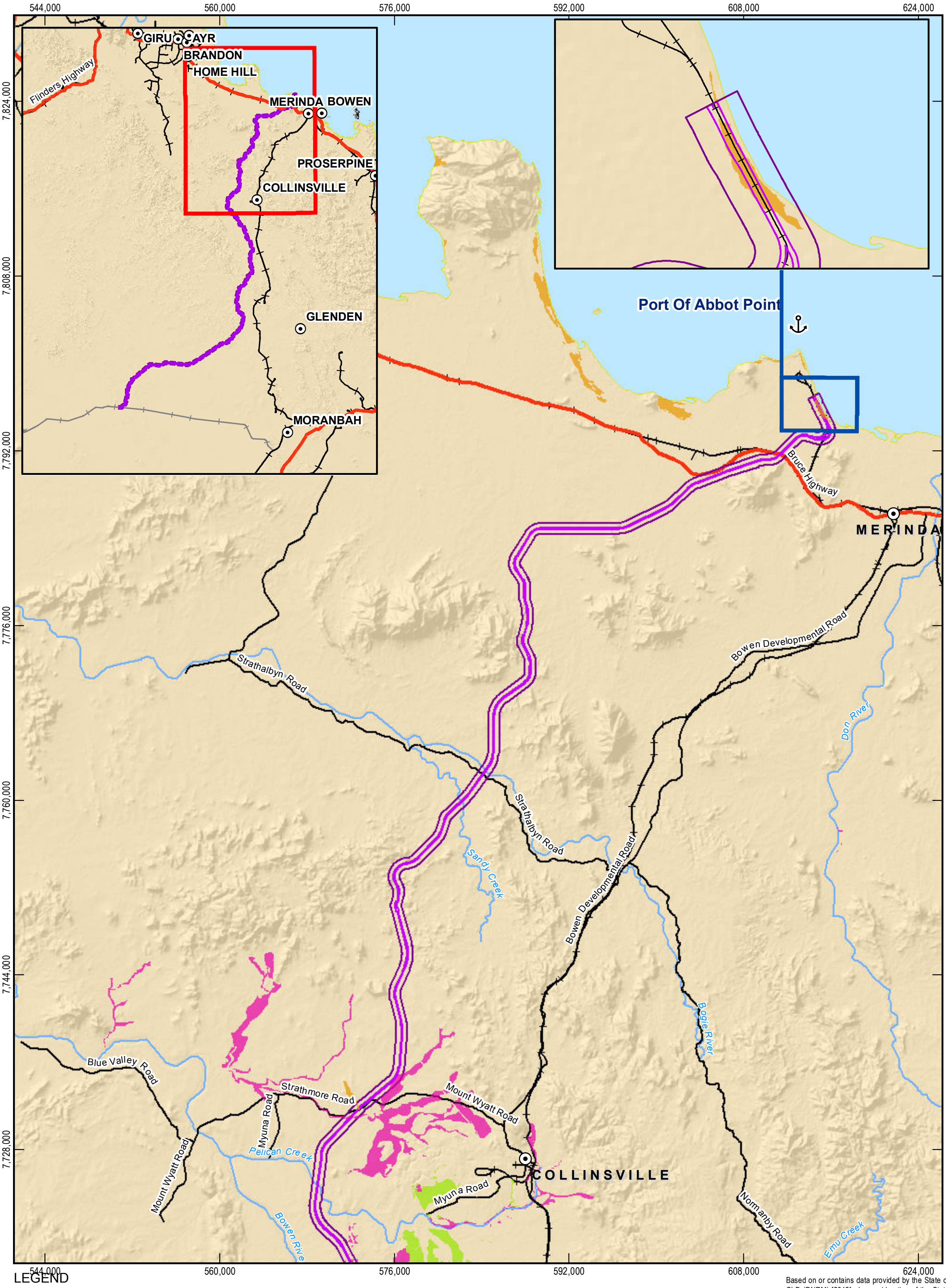
- Reduction in TEC extents as a result of vegetation clearing
- Fragmentation of previously intact areas of TECs.

Operation

Potential impacts to TECs that may result from the operation of the NGBR Project are:

- Degradation of retained areas of TEC around NGBR Project infrastructure
- Increased spread and prevalence of introduced weeds and/or pest species
- Degradation of TECs through increased fire severity (as a result of altered fuel characteristics)
- Dust deposition impacting the photosynthetic ability of vegetation.

The impacts of fragmentation of TECs attributed to operation of the NGBR Project are considered to be relatively minor, within a regional context.



LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Railway
- Watercourses (Major)
- Semi-evergreen Vine Thickets of the Brigalow Belt Bioregions (North and South)
- Brigalow (*Acacia harpophylla* dominant and co-dominant)
- Natural Grasslands of the Queensland Central Highlands and the Northern Fitzroy Basin
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

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North Galilee Basin Rail Project

Job Number	41-26457
Revision	A
Date	26 Sep 2013

Threatened Ecological Communities

Figure 7-33

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Level 9, 145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010, Threatened Ecological Communities/2011. Created by:MS

7.9.2 Brigalow

7.9.2.1 Species overview

The brigalow TEC (*Acacia harpophylla dominant and co-dominant*) is listed as endangered under the EPBC Act. This ecological community is characterised by the presence of brigalow (*Acacia harpophylla*) as one of the three most abundant tree species (Butler 2007). Brigalow is usually dominant in the tree layer or co-dominant with other species such as *Casuarina cristata* (belah), other species of *Acacia*, or species of *Eucalyptus*. Occasionally, belah or species of *Acacia* or *Eucalyptus* may be more common than brigalow within the broad matrix of brigalow vegetation. The structure of the vegetation ranges from open forest to open woodland. The height of the tree layer varies from about 9 m in low rainfall areas (averaging around 500 mm per annum) to around 25 m in higher rainfall areas (averaging around 750 mm per annum) (Butler 2007). A prominent shrub layer is usually present. Within Queensland, 16 REs are described as forming part of this TEC.

7.9.2.2 Desktop results

The brigalow TEC was identified within the Protected Matters Search Tool (refer Appendix G of Volume 2 Appendix F Nature conservation (page 292)) as a 'community known to occur within area'. A likelihood of occurrence assessment (as per the methodology described in Section 7.4) determined that this TEC was 'likely to occur' within the preliminary investigation corridor.

7.9.2.3 Survey results

Field surveys confirmed this TEC as occurring within the preliminary investigation corridor. Further information on where this TEC occurs within the preliminary investigation corridor is provided below.

7.9.2.4 Significance of NGBR Project footprint

A total of five of the 16 constituent REs (11.4.8, 11.4.9, 11.3.1, 11.12.21 and 11.9.1) are mapped within the final rail corridor (refer Figure 7-33). In particular, two large patches of brigalow TEC were identified during field surveys within the final rail corridor.

One patch was identified within the southern part of the final rail corridor immediately to the south of the Suttor River crossing. The brigalow TEC at this location was generally in moderate condition and is subject to some grazing pressure.

The second patch was located within the central part of the final rail corridor, to the north of the Bowen Developmental Road. The brigalow TEC at this location was in good condition, being largely untouched and restricted to undisturbed hills and gullies.

Each existing cluster of brigalow is dominated by collections of small, isolated remnants that are highly fragmented within a predominantly non-remnant landscape.

In total, 100 ha of brigalow TEC is mapped as occurring within the NGBR Project footprint (final rail corridor plus ancillary infrastructure). The calculation of 100 ha of brigalow is based on the mapped presence of constituent REs and is a conservative estimation of the actual on-ground presence of this TEC.

Plate 7-3 Brigalow, Avon Downs (May 2013)

7.9.2.5 Threatening processes

Brigalow communities have undergone a severe decline since the 1940s and now occupy 10 per cent of their former range. The main threatening process is broad scale clearing, which historically has been done to create grasslands for grazing. Broad scale clearing of remnant and regrowth vegetation is now managed through legislation in Queensland. Therefore, the main threatening process for this TEC is legislatively controlled. However, it is unlikely that the brigalow TEC will recover to its former state, given that the vast majority of the cleared areas where this community once dominated are now productive grazing lands.

The brigalow TEC is threatened by any activities that further reduce its extent, cause a decline in the condition of the vegetation, or impede its recovery; the most important current threats are clearing, fire, plant and animal pests, and lack of knowledge (Butler 2007).

7.9.2.6 Potential impacts

Construction

The construction of the NGBR Project is likely to reduce the extent of the TEC present within the local landscape and increase fragmentation at a highly localised scale. However, this is not considered likely to result in a substantial change to the occurrence, composition or condition of the TEC within the local or regional landscape.

The 100 ha potential impact area is 0.0002 per cent of the extent of Brigalow TEC in the bioregion, based on regional ecosystem data (DEHP 2009).

Operation

The severance SEVT TECs will occur to previously fragmented remnants of these communities at the impact locations. The fragmentation impacts resulting from the NGBR Project are therefore unlikely to have substantial regional consequences.

Following clearing, buffel grass and other introduced species may build up along the edges of retained native vegetation and, over time, begin to out-compete other native species present. The Brigalow TECs surveyed within the final rail corridor were generally subject to heavy infestations of weed species (both introduced and declared species). Within Brigalow TECs, this was primarily an understorey of introduced and invasive pasture grasses

The proliferation of weeds within or adjacent to areas of TEC also has the potential for flow on indirect impacts on TECs through fire. Where fuel characteristics have changed (i.e. the introduction of grass pasture species and subsequently fuel load), fire is considered to be a high threat to some TECs (SEWPaC, 2013a). Fire has been shown to cause rapid degradation of some TEC communities in Queensland (SEWPaC, 2013a).

Dust deposition is not anticipated to have an impact on TECs. The dust deposition predicted to occur as a result of the transport of coal is predicted to be at rates significantly below (<20% of) the thresholds identified as likely to have an impact upon crops and livestock, these rates are expected to be broadly similar for native flora and fauna (Volume 2 Appendix I Air quality).

7.9.2.7 Avoidance, mitigation and management measures

Avoidance, mitigation and management measures for Brigalow TEC will be achieved through the implementation of a Flora and Fauna Management Plan, to include the following:

- Additional surveys involving the ground-truthing of potential Brigalow TEC areas to identify which areas satisfy TEC criteria, and subsequently refine impact calculations
- Micro-scale adjustments of clearing footprints to avoid confirmed Brigalow TEC vegetation
- Manage the spread and invasion of weed and pest species into TECs through the implementation of a Weed and Pest Management Plan
- Manage potential impacts resulting from fire through the implementation of a Fire Management Plan
- Manage the potential to mobilised pollutants such as fuels, chemicals and oils through the implementation of an Environmental Management Plan.

Additional targeted field surveys will be undertaken to determine whether or not the potential TEC areas meet the criteria for TEC status. Further surveys undertaken prior to submission of the Final EIS will be incorporated into the Final EIS and the results used to inform detailed design.

Micro-scale adjustments to clearing footprints, particularly where some flexibility may exist (such as location of temporary infrastructure/lay down areas), will be investigated during detailed design to avoid TEC areas and minimise direct impacts to TECs.

The potential to mobilise chemicals or other pollutants that may adversely affect Brigalow TEC will be managed through the implementation of an Environmental Management Plan. A Fire Management Plan will be developed prior to construction commencing and implemented during for all phases of the NGBR Project. As well as documenting protocols and actions for preventing accidentally-lit fires, this plan will outline how fuel loads will be monitored and maintained across the NGBR Project footprint (and adjacent areas, as necessary).

A Weed and Pest Management Plan will be developed to manage pest and weed species during constcution and operation. The plan will incorporate the following:

- Management of introduced animals in and adjacent to cleared areas including monitoring and management of pest animals
- Monitoring, management and where necessary eradication of weeds, disposal of green waste, and vehicle/plant weed wash down protocols in and adjacent to cleared areas
- Monitoring of remnant vegetation along the edge of the final rail corridor for the presence of weeds. Eradication and/or rehabilitation/restoration to prevent the spread of these species into remnant vegetation areas

- Weed mapping will be undertaken prior to commencement of construction. Mapping will cover the final rail corridor and ancillary infrastructure but will be particularly focused at high risk locations.

Temporary construction areas will be rehabilitated as soon as possible following construction (i.e. once they have ceased to serve their intended purposes) within and adjacent to TECs, with the aim of preventing opportunities for weed incursion. A Decommissioning and Rehabilitation Plan will be developed with the overall aim of minimising the amount of land disturbed at any one time during the life of the NGBR Project. Methodologies will be developed during pre-construction to progressively revegetate disturbed areas.

Where significant impacts to Brigalow TEC occur, offsetting measures will look for opportunities to reconnect previously-fragmented areas of TEC vegetation with a focus upon enhancing local networks and corridors of TECs. This is discussed further in Section 7.13.

7.9.2.8 Conclusion

An assessment of residual impacts to the brigalow TEC against the Significant Impact Guidelines is provided in Table 7-38.

Table 7-38 Residual impacts on brigalow TEC

Significant impact criteria	Project response
Reduce the extent of an ecological community	Likely. The NGBR Project is expected to clear approximately 100 ha of brigalow TEC. This criterion will be satisfied via the acquisition of offsets to maintain or increase the extent of this TEC, refer Section 7.13. There will be no significant residual impact.
Fragment or increase fragmentation of an ecological community	Likely. The NGBR Project is expected to clear approximately 100 ha of brigalow TEC, increasing fragmentation throughout the landscape. This criterion will be satisfied via the acquisition of offsets to maintain or increase the extent of this TEC; refer Section 7.13. There will be no significant residual impact.
Adversely affect habitat critical to the survival of an ecological community	Unlikely. The NGBR Project is not likely to impact any areas critical to the survival of this ecological community.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	Unlikely. Impacts arising as a result of the NGBR Project are not expected to modify or destroy factors necessary for the survival of the brigalow TEC.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a	Unlikely. Weed and pest incursions as a result of the NGBR Project will be managed through the implementation of a Weed and Pest

Significant impact criteria	Project response
decline or loss of functionally important species	Management Plan, as described in Section 7.14.5.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: • Assisting invasive species, that are harmful to the listed ecological community, to become established, or • Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community	Unlikely. Weed and pest incursions as a result of the NGBR Project will be managed through the implementation of a Weed and Pest Management Plan as described in Section 7.14.5. Similarly, the mobilisation of fertilisers, herbicides or other chemicals or pollutants will be managed through the implementation of an Environmental Management Plan as described in Section 7.14.
Interfere with the recovery of an ecological community	Likely. The NGBR Project will involve the removal of approximately 100 ha of brigalow TEC. The removal of this area of TEC is likely to interfere with the recovery of this TEC at a regional scale. This criterion will be satisfied via the acquisition of offsets to maintain or increase the extent of this TEC; refer Section 7.15. There will be no significant residual impact.

7.9.3 Semi-evergreen vine thicket

7.9.3.1 Species overview

The listed TEC comprises semi-evergreen vine thickets (SEVT) in eastern Queensland and northern New South Wales (TSSC 2001). This TEC is listed as endangered under the EPBC Act.

Semi-evergreen vine thicket (SEVT) is considered an extreme form of dry seasonal subtropical rainforest (McDonald 1996). It is generally characterised by the prominence of trees with microphyll sized leaves (i.e. leaves usually 2.5–7.6 cm long), the presence of bottle trees (*Brachychiton* spp.) as emergents from the vegetation, and the thickets occurring in areas with a subtropical, seasonally dry climate on soils of high to medium fertility (Webb and Tracey 1994).

The SEVT ecological community extends from the Townsville area in Queensland to northern New South Wales. It is mostly located within the Brigalow Belt Bioregion. In Queensland, the remnant vine thicket patches are mostly scattered from coastal dunes and river deltas in the vicinity of Townsville and Ayr through the northern and central parts of the Brigalow Belt Bioregion to its south-eastern parts between Jandowae and Killarney on the Queensland/New South Wales border (Queensland Herbarium 2002).

In 2005, only about 140,000 ha of the TEC in the Brigalow Belt Bioregion remained as scattered patches (from Appendix 3 of McDonald 2007), or approximately 16 per cent of its pre-clearing area. It was estimated that approximately 1,000 ha of SEVT remained in the region, with the majority located along the eastern coastline to the south of Cape Upstart (CDM Smith 2012).

7.9.3.2 Desktop results

The SEVT TEC was identified within the Protected Matters Search Tool (Appendix G of Volume 2 Appendix F Nature conservation (page 292)) as a 'community known to occur within area'. A likelihood of occurrence assessment determined that this TEC was 'likely to occur' within the preliminary investigation corridor.

7.9.3.3 Survey results

Field surveys subsequently confirmed this TEC as occurring within the preliminary investigation corridor. Further information on where this TEC occurs within the preliminary investigation corridor is provided below.

7.9.3.4 Significance of NGBR Project footprint

Two SEVT constituent REs (11.2.3 and 11.11.18) were mapped within the final rail corridor (refer Figure 7-33). SEVT was confirmed present during field surveys at one location within the final rail corridor.

A vine thicket community meeting the requirements of the SEVT TEC was identified on a series of dunes and swales in the Caley Valley area, immediately north of Saltwater Creek. The main body of this vine thicket community was located to the east of the Abbot Point Road, however sections of vine thicket were established within the final rail corridor on the western side of the existing railway line/road corridor.

In total, 36 ha of SEVT are mapped as occurring within the NGBR Project footprint. The mapped TEC occurs in one key location at the northern extent of the final rail corridor, adjacent to the Caley Valley Wetland. The TEC at this location is fragmented by existing road and rail infrastructure.

Far larger areas of SEVT vegetation are mapped outside of the final rail corridor, surrounding Glenden and Collinsville to the east of the final rail corridor, and along the Abbot Bay coastline to the north-west of the corridor. No large swathes of well-connected or intact SEVT vegetation are proposed to be traversed or severed by the NGBR Project.


Plate 7-4 SEVT in landscape (left) and close-up (right) (May 2013)

7.9.3.5 Threatening processes

The SEVT TEC is threatened by high levels of fragmentation, lack of connectivity between fragments, continued clearing, inappropriate fire regimes, invasion by introduced pasture species and increased grazing by domestic stock and native animals (SEWPaC 2013a).

7.9.3.6 Potential impacts

Construction

Highly localised fragmentation is likely to occur as a result of NGBR Project construction activities. No large swathes of well-connected or intact SEVT vegetation are proposed to be severed by the NGBR Project footprint. Far larger areas of SEVT vegetation are mapped outside of the final rail corridor, surrounding Glenden and Collinsville to the east of the corridor, and along the Abbot Bay coastline to the north-west of the corridor.

The construction of the NGBR Project is likely to reduce the extent of the TEC present within one particular area of the final rail corridor and increase fragmentation at a highly localised scale, although the community at this location is already fragmented by existing road and rail infrastructure. Overall, this is not considered likely to result in a substantial change to the occurrence, composition or condition of the TEC within that local landscape or in a regional context.

The 35.8 ha potential impact area is 0.0003 per cent of the extent of SEVT TEC in the bioregion, based on regional ecosystem data (DEHP 2009).

Operation

The severance SEVT TECs will occur to previously fragmented remnants of these communities at the impact locations. The fragmentation impacts resulting from the NGBR Project are therefore unlikely to have substantial regional consequences.

Following clearing, buffel grass and other introduced species may build up along the edges of retained native vegetation and, over time, begin to out-compete other native species present. The SEVT TECs surveyed within the final rail corridor were generally subject to heavy infestations of weed species (both introduced and declared species). Particularly along the fringes of the Caley Valley wetland, a number of weeds such as prickly acacia were dominant in places.

The proliferation of weeds within or adjacent to areas of TEC also has the potential for flow on indirect impacts on TECs through fire. Where fuel characteristics have changed (i.e. the introduction of grass pasture species and subsequently fuel load), fire is considered to be a high threat to some TECs (SEWPaC, 2013a). Fire has been shown to cause rapid degradation of some TEC communities in Queensland, including SEVT (SEWPaC, 2013a).

Dust deposition is not anticipated to have an impact on TECs. The dust deposition predicted to occur as a result of the transport of coal is predicted to be at rates significantly below (<20% of) the thresholds identified as likely to have an impact upon crops and livestock, these rates are expected to be broadly similar for native flora and fauna (Volume 2 Appendix I Air quality).

7.9.3.7 Avoidance, mitigation and management measures

Avoidance, mitigation and management measures for SEVT TEC will be achieved through the implementation of a Flora and Fauna Management Plan, to include the following:

- Additional surveys involving the ground-truthing of potential SEVT TEC areas to identify which areas satisfy TEC criteria, and subsequently refine impact calculations
- Micro-scale adjustments of clearing footprints to avoid confirmed SEVT TEC vegetation
- Manage the spread and invasion of weed and pest species into SEVT TEC through the implementation of a Weed and Pest Management Plan
- Manage potential impacts resulting from fire through the implementation of a Fire Management Plan
- Manage potentially mobilised pollutants through the implementation of an Environmental Management Plan.

Additional targeted field surveys will be required to determine whether or not the potential SEVT TEC areas meet the criteria for TEC status. Further surveys undertaken prior to submission of the Final EIS will be incorporated into the Final EIS and the results used to inform detailed design.

Micro-scale adjustments to clearing footprints, particularly where some flexibility may exist (such as location of temporary infrastructure/lay down areas), may be possible to avoid TEC areas and minimise direct impacts to TECs.

The potential to mobilise chemicals or other pollutants that may adversely affect the TECs will be managed through the implementation of an Environmental Management Plan. A Fire Management Plan will be developed during the detailed design phase and will be implemented for all phases of the NGBR Project. As well as documenting protocols and actions for preventing accidentally-lit fires, this plan will outline how fuel loads will be monitored and maintained across the NGBR Project footprint (and adjacent areas, as necessary).

A Weed and Pest Management Plan will be developed to manage pest and weed species during construction and operation of the NGBR Project. The plan will incorporate the following:

- Management of introduced animals in and adjacent to cleared areas including monitoring and management of pest animals
- Monitoring, management and where necessary eradication of weeds, disposal of green waste, and vehicle/plant weed wash down protocols in and adjacent to cleared areas
- Monitoring of remnant vegetation along the edge of the final rail corridor for the presence of weeds. Eradication and/or rehabilitation/restoration to prevent the spread of these species into remnant vegetation areas

- Weed mapping will be undertaken prior to commencement of construction. Mapping will cover the final rail corridor and ancillary infrastructure but will be particularly focused at high risk locations.

Temporary construction areas will be rehabilitated as soon as possible following construction (i.e. once they have ceased to serve their intended purposes) within and adjacent to TECs, with the aim of preventing opportunities for weed incursion. A Decommissioning and Rehabilitation Plan will be developed with the overall aim of minimising the amount of land disturbed at any one time during the life of the NGBR Project. Methodologies will be developed to progressively revegetate disturbed areas.

Where significant impacts to SEVT TECs occur, offsetting measures will look for opportunities to reconnect previously-fragmented areas of TEC vegetation with a focus upon enhancing local networks and corridors of TECs. This is discussed further in Section 7.15.

7.9.3.8 Conclusion

An assessment of residual impacts to the SEVT TEC against the Significant Impact Guidelines is provided in Table 7-39.

Table 7-39 Residual impacts on SEVT TEC

Significant impact criteria	Project response
Reduce the extent of an ecological community	Likely. The NGBR Project is expected to clear approximately 36 ha of SEVT TEC. Offsets will be acquired to maintain or increase the extent of this TEC, ultimately satisfying this criterion, refer Section 7.15. There will be no significant residual impact.
Fragment or increase fragmentation of an ecological community	Likely. The NGBR Project is expected to clear approximately 36 ha of SEVT TEC, increasing fragmentation at a highly localised scale within the landscape. This criterion will be satisfied via the acquisition of offsets to maintain or increase the extent of this TEC; refer Section 7.15. There will be no significant residual impact.
Adversely affect habitat critical to the survival of an ecological community	Unlikely. The NGBR Project is not likely to be impacting any areas critical to the survival of this ecological community.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	Unlikely. Impacts arising as a result of the NGBR Project are not expected to modify or destroy factors necessary for the survival of the SEVT TEC.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a	Unlikely. Weed and pest incursions as a result of the NGBR Project will be managed through the implementation of a Weed and Pest

Significant impact criteria	Project response
decline or loss of functionally important species	Management Plan, as described in Section 7.14.5.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: • Assisting invasive species, that are harmful to the listed ecological community, to become established, or • Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community	Unlikely. Weed and pest incursions as a result of the NGBR Project will be managed through the implementation of a Weed and Pest Management Plan, as described in Section 7.14.5. Similarly, the mobilisation of fertilisers, herbicides or other chemicals or pollutants will be managed through the implementation of an Environmental Management Plan, as described in Section 7.14.
Interfere with the recovery of an ecological community	Potentially. The NGBR Project will involve the removal of approximately 36 ha of SEVT TEC. The removal of this area of TEC is likely to interfere with the recovery of this TEC at a highly localised scale. This criterion will be satisfied via the acquisition of offsets to maintain or increase the extent of this TEC; refer Section 7.15. There will be no significant residual impact.

7.9.4 Natural grasslands

7.9.4.1 Species overview

The natural grasslands TEC is a tussock grassland community comprised of a number of native grass species throughout its range, depending upon factors such as rainfall, soil and geology. The TEC is endemic to Queensland, extending from Collinsville in the north to the Carnarvon National Park in the south, and broadly occurs within the Fitzroy River Basin and the Brigalow Belt North bioregion (TSSCadq 2008). The TEC is acknowledged (TSSCadq 2008) to only occur in certain subregions of the Brigalow Belt bioregion; in relation to the preliminary investigation corridor, this correlates to the Northern Bowen Basin subregion, comprising the area between the Suttor Development Road and a point just south of Pelican Creek.

Native tussock grasslands, such as the natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin, once occurred over a large area of Australia (TSSCadq 2008). However, in general, natural grasslands TEC has been heavily affected by disturbance and degradation throughout the State and there are very few patches of undisturbed natural grasslands remaining (TSSCadq 2008).

7.9.4.2 Desktop results

The natural grasslands TEC was identified within the Protected Matters Search Tool (Appendix G of Volume 2 Appendix F Nature conservation (page 292)) as a ‘community known to occur within area’. A likelihood of occurrence assessment determined that this TEC ‘may occur’ within the preliminary investigation corridor.

7.9.4.3 Survey results

Field surveys were unable to confirm the presence of this TEC within the preliminary investigation corridor.

7.9.4.4 Significance of NGBR Project footprint

Four grassland REs that have the potential to be constituents of the natural grasslands TEC are mapped within the final rail corridor (refer Figure 7-33).

The sample of potentially constituent REs that were accessed and surveyed during fieldwork was not considered to meet the criteria for TEC designation. However, private property access limitations meant that not all areas of potential natural grassland TEC were able to be surveyed and small areas of this TEC may occur based on the mapped presence of constituent native grassland REs. Once private property access is negotiated, further field surveys are required (during or immediately post-wet season, to allow flowering grasses to be identified) to confirm whether this TEC is present within the final rail corridor.

7.9.4.5 Threatening processes

The main identified threats to natural grasslands TEC are grazing, cropping and pasture improvement, weeds and pest animals, mining activities, construction of roads and other infrastructure (SEWPaC 2013b).

7.9.4.6 Potential impacts

Construction

No direct impact to the natural grasslands TEC is envisaged assuming that mapped constituent REs that have not been surveyed (due to access restrictions) do not meet the TEC criteria, as per constituent REs that were surveyed in adjacent properties.

Once landowner access has been negotiated, additional surveys to confirm whether the remaining mapped constituent REs meet the TEC criteria will be conducted. If confirmed present in these areas, the construction of the NGBR Project is likely to reduce the extent of this TEC and increase fragmentation by a marginal degree.

7.9.4.7 Avoidance, mitigation and management measures

As natural grasslands TEC is not considered likely to occur within the final rail corridor, specific avoidance, mitigation and management measures are not necessary at this stage. Further surveys to refine areas of potential habitat for the species will be undertaken during the detailed design stage. As a precaution, appropriate monitoring, avoidance, mitigation and management measures for natural grasslands TEC will be incorporated into a Flora and Fauna Management Plan. Should further surveys provide no evidence to indicate the presence of this TEC, these measures will be removed from the plan.

7.9.4.8 Conclusion

An assessment of residual impacts to the natural grasslands TEC against the Significant Impact Guidelines is provided in Table 7-40.

Table 7-40 Residual impacts on natural grasslands TEC

Significant impact criteria	Project response
Reduce the extent of an ecological community	Unlikely. The sample of potentially constituent REs that were accessed and surveyed during fieldwork was not considered to meet the criteria for TEC designation. However, private property access limitations meant that not all areas of potential natural grassland TEC were able to be surveyed and small areas of this TEC may occur based on the mapped presence of constituent native grassland REs. Once private property access is negotiated, further field surveys are required to confirm whether this TEC is present within the final rail corridor. In the event that this TEC is present within the NGBR footprint, this criterion will be satisfied via the acquisition of offsets to maintain or increase the extent of this TEC; refer Section 7.15. There will be no significant residual impact.
Fragment or increase fragmentation of an ecological community	The sample of potentially constituent REs that were accessed and surveyed during fieldwork was not considered to meet the criteria for TEC designation. However, private property access limitations meant that not all areas of potential natural grassland TEC were able to be surveyed and small areas of this TEC may occur based on the mapped presence of constituent native grassland REs. Once private property access is negotiated, further field surveys are required to confirm whether this TEC is present within the final rail corridor. In the event that this TEC is present within the NGBR footprint, offsets will be acquired to maintain or increase the extent of this TEC, ultimately satisfying this criterion, refer Section 7.15.
Adversely affect habitat critical to the survival of an ecological community	Unlikely. The TEC has not been confirmed within the final rail corridor and the NGBR Project is not likely to be impacting any areas critical to the survival of this ecological community.
Modify or destroy abiotic (non-living) factors	Unlikely. The TEC has not been confirmed

Significant impact criteria	Project response
(such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	within the final rail corridor and impacts arising as a result of the NGBR Project are not expected to modify or destroy factors necessary for the survival of the natural grassland TEC.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species	Unlikely. The TEC has not been confirmed within the final rail corridor. Weed and pest incursions as a result of the NGBR Project will be managed through the implementation of a Weed and Pest Management Plan, as described in Section 7.14.5.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: • Assisting invasive species, that are harmful to the listed ecological community, to become established, or • Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community	Unlikely. The TEC has not been confirmed within the final rail corridor. Weed and pest incursions as a result of the NGBR Project will be managed through the implementation of a Weed and Pest Management Plan, as described in Section 7.14.5. Similarly, the mobilisation of fertilisers, herbicides or other chemicals or pollutants will be managed through the implementation of an Environmental Management Plan, as described in Section 7.14.
Interfere with the recovery of an ecological community	Unlikely. The sample of potentially constituent REs that were accessed and surveyed during fieldwork was not considered to meet the criteria for TEC designation. However, private property access limitations meant that not all areas of potential natural grassland TEC were able to be surveyed and small areas of this TEC may occur based on the mapped presence of constituent native grassland REs. Once private property access is negotiated, further field surveys are required to confirm whether this TEC is present within the final rail corridor. In the event that this TEC is present within the NGBR footprint, this criterion will be satisfied via the acquisition of offsets to maintain or increase the extent of this TEC; refer Section 7.15. There will be no significant residual impact.

7.9.5 Summary

A summary of potential direct and indirect impacts, proposed mitigation measures and residual impact assessment is provided below in Table 7-41.

Table 7-41 Summary of potential direct and indirect impacts, proposed mitigation measures and residual impacts

TEC	Potential direct impacts	Potential indirect impacts	Proposed mitigation measures	Residual impact assessment against the Guidelines	Offsets required?
Brigalow (*Acacia harpophylla* dominant and co-dominant)	**Construction:** Direct loss of 100.3 ha of brigalow TEC Fragmentation of previously intact areas of TEC	**Operation:** Degradation of retained areas of TEC Increased spread and prevalence of introduced weeds and/or pest species	Additional survey to refine areas of actual TEC occurrence and refine impacts. Micro-scale adjustments of clearing footprints to avoid TEC vegetation. Implementation of a Weed and Pest Management Plan to manage weed and pest species. Manage potential impacts resulting from fire through the implementation of a Fire Management Plan. Manage potentially mobilised pollutants through the implementation of an Environmental Management Plan.	The NGBR Project is likely to have a significant impact on this TEC as it will reduce the extent, increase fragmentation and interfere with the recovery of this TEC. Offsets will be acquired to compensate losses of this TEC.	Yes
Semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar regions	**Construction:** Direct loss of 35.8 ha of SEVT TEC Fragmentation of previously intact areas of TEC	**Operation:** Degradation of retained areas of TEC Increased spread and prevalence of introduced weeds and/or pest species	Additional survey to refine areas of actual TEC and refine impacts. Micro-scale adjustments of clearing footprints to avoid TEC vegetation. Implementation of a Weed and Pest Management Plan to manage weed and pest species. Manage potential impacts resulting from fire through the implementation of a Fire Management Plan. Manage potentially mobilised pollutants through the implementation of an Environmental Management Plan.	The NGBR Project is likely to have a significant impact on this TEC as it will reduce the extent, increase fragmentation (at a highly localised scale) and interfere with the recovery of this TEC. Offsets will be acquired to compensate losses of this TEC.	Yes

TEC	Potential direct impacts	Potential indirect impacts	Proposed mitigation measures	Residual impact assessment against the Guidelines	Offsets required?
Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin	**Construction:** No direct impacts predicted	**Operation:** No indirect impacts predicted	Additional survey in areas where access was previously unavailable, to confirm whether the TEC is present within the NGBR Project footprint in those locations. Micro-scale adjustments of clearing footprints to avoid TEC vegetation. Implementation of a Weed and Pest Management Plan to manage weed and pest species Manage potential impacts resulting from fire through the implementation of a Fire Management Plan. Manage potentially mobilised pollutants through the implementation of an Environmental Management Plan.	The NGBR Project is not likely to have a significant impact on this TEC as it has not been confirmed within or adjacent to the final rail corridor. Additional survey is areas where access was previously unavailable will confirm this.	Unlikely

7.10 Listed migratory species

7.10.1 Overview

Three listed migratory (bird) species were confirmed present within the preliminary investigation corridor during field surveys, with a further 25 bird species and one reptile species being likely to occur within that corridor. In addition, three migratory marine mammal species are considered likely to occur within the area adjacent to the preliminary investigation corridor. Each of these is discussed individually below, in terms of their ecology and status, desktop and survey results and the predicted significance of the NGBR Project footprint for that species.

In determining the significance of the NGBR Project footprint to a listed migratory species, an area of 'important habitat' is defined as:

- Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the 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.

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an 'ecologically significant proportion' of the population varies with the species (each circumstance will need to be evaluated). Some factors that should be considered include:

- The species' population status
- Genetic distinctiveness
- Species-specific behavioural patterns (for example, site fidelity and dispersal rates).

7.10.1.1 Likelihood of occurrence

A summary of the likelihood of occurrence assessment undertaken for migratory birds is provided in Table 7-42 and Table 7-43.

Table 7-42 Likelihood of occurrence for migratory bird species

Species	EPBC Act	Prediction of occurrence and previous records	Habitat preferences and known distributions	Likelihood of occurrence
Great egret ***Ardea alba***	Migratory wetland Marine	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - yes	The great egret is a partially migratory species, with northern hemisphere birds moving south from areas with cold winters. This species breeds in colonies in trees close to large lakes with reed beds or other extensive wetlands. The great egret feeds in shallow water or drier habitats, spearing fish, frogs or insects with its long, sharp bill (Pizzey and Knight 2008).	**Confirmed present** This species was recorded within the preliminary investigation corridor during field surveys in June 2013. Suitable habitat for this species occurs within the preliminary investigation corridor.
Caspian tern ***Hydroprogne caspia***	Migratory	Predicted to occur by PMST# - no Previously recorded* - WO, BA Recorded from field surveys^ - yes	The Caspian tern is widespread along coastal regions of Queensland, from Torres Strait, along the east coast to Tasmania and South Australia (Higgins and Davies 1996).Within this range, this species inhabits sheltered coastal embayments, including harbours, lagoons, inlets, bays, estuaries and river deltas, usually with sandy or muddy margins. Foraging usually occurs in open wetlands, including lakes and rivers, preferring sheltered shallow water near margins, but may also occur in open coastal waters. Breeding habitats for the Caspian tern include low islands, cays, spits, banks and beaches of sand or shell, and may occur in open or among low or sparse vegetation and roosting generally occurs on bare exposed sand or shell spits, banks or shores of coasts, lakes, estuaries, coastal lagoons and inlets (Pizzey and Knight 2008).	**Confirmed present** Although Caspian tern was not predicted to occur through the EPBC Act Protected Matters Search, this species was recorded within the preliminary investigation corridor during field surveys in June 2013.
Glossy ibis ***Plegadis falcinellus***	Migratory	Predicted to occur by PMST# - no Previously recorded* - WO Recorded from field surveys^ - yes	The glossy ibis, the smallest ibis known in Australia, generally occurs throughout the Australian mainland. This species inhabits well vegetated wetlands, wet pastures, rice fields, floodwaters, floodplains, brackish or occasionally saline wetlands and occasionally dry grasslands (Pizzey and Knight 2008).	**Confirmed present** Although glossy ibis was not predicted to occur through the EPBC Act Protected Matters Search, this species was recorded within the preliminary investigation corridor during field surveys in June 2013.
Fork-tailed swift ***Apus pacificus***	Migratory Marine Marine	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	This species is widespread across eastern Australia, generally present during the summer (between the months of October and April), and forages over and above a wide variety of habitat types, including urban areas, open country, woodland, wetlands and coastlines (Pizzey and Knight 2008). They feed (and roost) on the wing, taking a wide variety of aerial invertebrate prey. The fork-tailed swift is likely to be regular non-breeding visitor to (the air space above) the preliminary investigation corridor. Populations of this species are believed to be relatively stable throughout much of its range.	**Likely to occur** Suitable habitat for this species occurs within the preliminary investigation corridor.

Species	EPBC Act	Prediction of occurrence and previous records	Habitat preferences and known distributions	Likelihood of occurrence
Little tern ***Sternula albifrons***	Migratory Marine Marine	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	The little tern prefers coastal habitats and inshore waters, especially the mouths or downstream reaches of rivers (Pizzey and Knight 2008). This species takes fish by aerial dives, and breeds on islands and beaches. Caley Valley Wetland, in the northern extent of the preliminary investigation corridor, provides suitable foraging habitat and the coastal environment may also provide suitable roosting habitat for this species.	**Likely to occur** Historically recorded in the desktop search extent. Potentially suitable habitat occurs within and near preliminary investigation corridor at the Caley Valley Wetland. This species was detected at the Caley Valley Wetland during surveys undertaken for the Abbot Point Multi Cargo Facility EIS (NQBP 2009).
White-bellied sea-eagle ***Haliaeetus leucogaster***	Migratory terrestrial Migratory wetland	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	The white-bellied sea-eagle occurs from India through south-east Asia to Australia on coasts and major waterways (Pizzey and Knight 2008). It feeds mainly on aquatic animals, such as fish, turtles and sea snakes, but it takes birds and mammals as well. Impacts to this species are likely to occur through bioaccumulation of prey species or reduced foraging habitat.	**Likely to occur** Caley Valley Wetland, in the northern extent of the preliminary investigation corridor, provides suitable habitat for the white-bellied sea-eagle.
White-throated needletail ***Hirundapus caudacutus***	Migratory terrestrial Migratory wetland	Predicted to occur by PMST# - yes Previously recorded* - WO Recorded from field surveys^ - no	White-throated needletail breeds in rocky hills in central Asia and southern Siberia and migrates in the winter to Australia where it is widespread across eastern and south-eastern Australia. It spends most of its life in the air, living on the insects it catches in its beak (Pizzey and Knight 2008).	**Likely to occur** Suitable habitat for this species occurs within the preliminary investigation corridor.
Barn swallow ***Hirundo rustica***	Migratory terrestrial Migratory wetland	Predicted to occur by PMST# - yes Previously recorded* - no Recorded from field surveys^ - no	The preferred habitat of the barn swallow is open country with low vegetation, such as pasture, meadows and farmland, preferably near water (Pizzey and Knight 2008). This swallow avoids heavily wooded or precipitous areas and densely built-up locations. It feeds on insects, foraging in open country and over coastal and inland waters. Barn swallows are strongly migratory and their wintering grounds cover much of the Southern Hemisphere as far south as central Argentina, the Cape Province of South Africa, and northern Australia.	**Likely to occur** This species is common and widespread and is considered to be regularly present within the preliminary investigation corridor.
Rainbow bee-eater ***Merops ornatus***	Migratory terrestrial Migratory wetland	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	This species is generally widespread and abundant across eastern Australia, migrating locally and regionally, such that the majority of individuals are present during the summer months, moving northwards (to Northern Australia and beyond) for the winter (Pizzey and Knight 2008). Rainbow bee-eater generally inhabit and favour habitats including eucalypt woodlands, rainforest, damp gullies and coastal scrub, where they will	**Likely to occur** Suitable habitat for this species occurs within the investigation corridor. This species is considered to be regularly present within the preliminary investigation corridor.

Species	EPBC Act	Prediction of occurrence and previous records	Habitat preferences and known distributions	Likelihood of occurrence
			breed, roost and forage on a wide variety of invertebrate prey.	
Black-faced monarch ***Monarcha melanopsis***	Migratory terrestrial Migratory wetland	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	The black-faced monarch is found along the entire eastern seaboard of Australia (Pizzey and Knight 2008). This species occurs in a wide range of common habitats including coastal habitats and woodlands.	**Likely to occur** Suitable habitat for this species occurs within the preliminary investigation corridor. The black-faced monarch is considered to be occasionally present within the preliminary investigation corridor.
Spectacled monarch ***Symposiarchus trivirgatus***	Migratory terrestrial Migratory wetland	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	The spectacled monarch is a small flycatcher that is distributed along the east coast of Queensland and New South Wales to north of Sydney (Pizzey and Knight 2008). This species inhabits the understorey of mountain and lowland rainforests, thickly wooded vegetation and riparian vegetation including mangrove forests (Pizzey and Knight 2008). The spectacled monarch migrates to Queensland and New South Wales to breed from Papua New Guinea from September/ October to May (Birdlife International 2013). Resident populations of this species occur along central Queensland coast (Rockhampton) and northern Cape York Peninsula (Birdlife International 2013).	**Likely to occur** Suitable habitat for this species occurs within the preliminary investigation corridor. The spectacled monarch is considered to be occasionally present within the preliminary investigation corridor.
Satin flycatcher ***Myiagra cyanoleuca***	Migratory terrestrial Migratory wetland	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	Satin flycatchers inhabit temperate forests and subtropical or tropical moist lowland forests. The satin flycatcher is an insectivorous woodland bird that is widespread in eastern Australia and vagrant to New Zealand (SEWPaC 2013aa). In central Queensland, the satin flycatcher is most common in coastal areas but is also scattered on the Great Divide and occasionally further west. The satin flycatcher overwinters in northern Australia and Papua New Guinea, returning to south-eastern Australia in the summer (SEWPaC 2013aa). Habitat for this species includes heavily vegetated gullies in forests, taller woodlands, trees in open country and coastal forests along eastern Australia (Pizzey and Knight 2007). The majority of individuals are recorded in wet sclerophyll eucalypt forests near wetlands or watercourses (SEWPaC 2013aa). Satin flycatchers forage in the canopy and sub-canopy of trees where they feed primarily on insects. Breeding occurs during the summer period with nests usually located in a fork on an outer tree branch. Satin flycatchers return to the same locality each year, often nesting in the same tree (SEWPaC 2013aa).	**Likely to occur** Suitable habitat for this species occurs within the preliminary investigation corridor. This species is considered occasionally present within the preliminary investigation corridor.
Rufous fantail ***Rhipidura***	Migratory terrestrial	Predicted to occur by PMST# - yes	The rufous fantail mostly inhabits dense, moist habitats, often in damp understorey or mid-stories, gullies and eucalypt forests, but also in rainforests, woodlands, and mangroves in North-east Queensland (Higgins	**Likely to occur** Suitable habitat for this species

Species	EPBC Act	Prediction of occurrence and previous records	Habitat preferences and known distributions	Likelihood of occurrence
rufifrons	Migratory wetland	Previously recorded* - WO, BA Recorded from field surveys^ - no	*et al*. 2006). This species is widespread on the east of the Great Dividing Range from Cape York to the NSW border, including offshore islands (Higgins *et al*. 2006).	occurs within the preliminary investigation corridor. The rufous fantail is considered to be regularly present within the preliminary investigation corridor.
Common sandpiper ***Actitis hypoleucos***	Migratory wetland Marine	Predicted to occur by PMST# - yes Previously recorded* - no Recorded from field surveys^ - no	The common sandpiper is widespread in small numbers along all coastlines of Australia, with habitat areas of national importance in Queensland including the South-eastern Gulf of Carpentaria and Cairns Foreshore. The common sandpiper utilises a wide range of wetlands, coastal and inland, estuaries, streams and other water bodies where it forages in shallow water and on bare soft mud at the edges of wetlands. Roosting occurs in roots or branches of mangroves. During the southern migration, populations will arrive in Queensland around August, with the northward migration occurring between February and May (SEWPaC 2013ab).	**Likely to occur** Suitable habitat for this species occurs in the northern extent of the preliminary investigation corridor near the coast.
Cattle egret ***Ardea ibis***	Migratory wetland Marine	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	The cattle egret is often found in dry grassy habitats, unlike most herons which are associated with shallow water. It feeds on insects, especially grasshoppers, and is usually found with cattle and other large animals which disturb small creatures which the egrets then catch.	**Likely to occur** Suitable habitat for this species occurs within grassland habitat within the preliminary investigation corridor.
Sharp-tailed sandpiper ***Calidris acuminata***	Migratory wetland Marine	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	The sharp-tailed sandpiper inhabits muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation; including lagoons, swamps, lakes and pools near the coast. This species also utilises flooded plains, paddocks and other ephemeral wetlands, but leaves when they dry. The sharp-tailed sandpiper forages around the edge of wetlands or intertidal mudflats, on bare wet mud/sand, in shallow water and among inundated vegetation (Higgins and Davies 1996).	**Likely to occur** Suitable habitat for this species occurs in the northern extent of the preliminary investigation corridor near the coast
Red-necked stint ***Calidris ruficollis***	Migratory wetland Marine	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	The red-necked stint occurs mostly in coastal areas, such as bays, lagoons, estuaries with intertidal mudflats, often near spits and banks, and sometimes on sandy shores. The red-necked stint also occurs in ephemeral or permanent shallow wetlands. Foraging occurs mostly on intertidal mudflats or sandflats. They also forage in wetlands and samphire and roost on sheltered beaches, spits or areas of mud or sand, sometimes in saltmarsh and vegetation (SEWPaC 2013ac). This species is distributed along most of the Australian coastline with large densities on the Victorian and Tasmanian coasts. The red-necked stint has been recorded in all	**Likely to occur** Suitable habitat for this species occurs in the northern extent of the preliminary investigation corridor near the coast.

Species	EPBC Act	Prediction of occurrence and previous records	Habitat preferences and known distributions	Likelihood of occurrence
			coastal regions, and found inland in all states when conditions are suitable (SEWPaC 2013ac).	
Greater sand plover ***Charafrius leschenaultii***	Migratory wetland Marine	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	The greater sand plover is a medium sized brown and white plover. This species occurs in coastal areas of all states, with the greatest number of individuals occurring in the north-west of Australia (SEWPaC 2013ad). While in its non-breeding grounds in Australia, the greater sand plover is almost entirely coastal, inhabiting sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks, as well as estuarine lagoons (SEWPaC 2013ad).	**Likely to occur** Suitable habitat for the greater sand plover is limited within the investigation corridor and is confined to the northern extent of the preliminary investigation corridor within coastal areas.
Lesser sand plover ***Charadrius mongolus***	Migratory wetland Marine	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	The lesser sand plover is widespread in coastal regions in Australia and has been recorded in all states. In the non-breeding grounds in Australia, this species usually occurs in coastal littoral and estuarine environments. Suitable habitats include large inertial sand flats or mudflats in sheltered bays, harbours and estuaries and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms and rocky outcrops. This species is seldom recorded far from the coast, soaks, at the margins of lakes and swamps with associated artesian bores.	**Likely to occur** Suitable habitat for the lesser sand plover is limited within the preliminary investigation corridor and is confined to the northern extent of the NGBR Project within coastal areas.
Latham's snipe ***Gallinago hardwickii***	Migratory wetland Marine	Predicted to occur by PMST# - yes Previously recorded* - WO Recorded from field surveys^ - no	Latham's snipe is a medium sized migratory wader. This species spends the non-breeding season predominately in eastern Australia. Suitable habitat for this species includes shallow freshwater wetlands of various kinds with bare mud or shallow water for feeding, with good nearby vegetation cover for shelter form non breeding habitat areas. However, this species is also known to inhabit saline or brackish water, artificial habitats and areas close to human activity.	**Likely to occur** Suitable habitat for this species occurs within permanent and ephemeral wetlands within the preliminary investigation corridor.
Grey-tailed tattler ***Heteroscelus brevipes***	Migratory wetland Marine	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	This species is usually found around shores of rock, shingle, gravel or shells and also on intertidal mudflats. In parts of Queensland it is most abundant in areas with dense beds of seagrass.	**Likely to occur** Suitable habitat for this species is limited the northern extent of the preliminary investigation corridor near the coast.
Bar-tailed godwit ***Limosa lapponica***	Migratory wetland Marine	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	The bar-tailed godwit occurs in coastal areas of all Australian states. This species mainly inhabits coastal areas including large intertidal sandflats, banks, estuaries, inlets, harbours, coastal lagoons and bays and forages near the edge of water in the shallow water, mainly in tidal estuaries and harbours.	**Likely to occur** Suitable habitat for this species is limited the northern extent of the preliminary investigation corridor near the coast.

Species	EPBC Act	Prediction of occurrence and previous records	Habitat preferences and known distributions	Likelihood of occurrence
Eastern curlew ***Numenius madagascariensis***	Migratory wetland Marine	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	The distribution of the eastern curlew within Australia is primarily coastal. Found in all states including Tasmania, this species predominately occurs in the north, east and south-east regions. The eastern curlew is rarely recorded inland with preferred habitat for this species including sheltered coastal areas with large intertidal mudflats or sandflats, often with seagrass beds (Higgins and Davies 1996).	**Likely to occur** Historically recorded in the desktop search extent. Potentially suitable habitat occurs within and near preliminary investigation corridor at the Caley Valley Wetland.
Little curlew ***Numenius minutus***	Migratory wetland Marine	Predicted to occur by PMST# - yes Previously recorded* - no Recorded from field surveys^ - no	This wader bird is a strongly migratory species, wintering during the non-breeding season in Australasia. In Queensland, the little curlew is generally widespread in coastal regions with some inland records (SEWPaC 2013ae). This species feeds in short, dry grassland and sedge land, including dry floodplains and black soil plains, which have scattered shallow freshwater pools. When resting during the hottest part of the day, this species congregates around shallow pools, river beds and water-filled tidal channels or may also rest in grassy open woodland or sparsely vegetated flood plains.	**Likely to occur** Suitable habitat for this species occurs within the preliminary investigation corridor.
Whimbrel ***Numenius phaeopus***	Migratory wetland Marine	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	Whimbrel inhabit intertidal mudflats of sheltered coasts, harbours, lagoons, estuaries and river deltas, preferring mudflats with mangroves and occasionally on sandy beaches, rocky islets, reefs and platforms at low tide. This species is also found in saline grasslands, sewage farms, and infrequently recorded using saline or brackish lakes near coastal areas, coastal dunes and sports grounds. This species forages on intertidal mudflats and along muddy banks of estuaries and coastal lagoons, in non-vegetated areas or among mangroves. Whimbrel regularly roost in mangroves and other structures that flood at high tide including branches of mangroves around mudflats, estuaries and occasionally in tall coastal trees (Higgins and Davies 1996). The whimbrel is found along almost the entire coast of Queensland. This species arrives in northern Australia from August and move south along the coast, dispersing widely along the coast during the non-breeding period. They begin the return migration from February, with influxes in Queensland from March to April and depart the north coasts by late April. Non-breeding birds also over-winter in Australia (SEWPaC 2013af).	**Likely to occur** Suitable habitat for this species occurs within the preliminary investigation corridor.
Grey plover ***Pluvialis squatarola***	Migratory wetland Marine	Predicted to occur by PMST# - yes Previously recorded* - no Recorded from field surveys^ - no	The grey plover is almost entirely coastal in Australia, inhabiting sheltered embayments, estuaries, lagoons with mudflats and sandflats, rocky coasts with wave-cut platforms, reef flats or reefs with muddy lagoons. Inhabiting Australia during their non-breeding season, the grey plover forages on large areas of exposed mudflat and beaches of sheltered coastal shores such as inlets, estuaries and lagoons (Pizzey and Knight 2008).	**Likely to occur** Suitable habitat for this species is limited the northern extent of the preliminary investigation corridor near the coast.

Species	EPBC Act	Prediction of occurrence and previous records	Habitat preferences and known distributions	Likelihood of occurrence
Marsh sandpiper ***Tringa stagnatilis***	Migratory wetland Marine	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	The marsh sandpiper inhabits coastal and inland wetlands throughout Australia (Pizzey and Knight 2008). This species is widespread in Queensland; however, there are limited records north of Cooktown. This species is migratory, spending the non-breading season in Australia, Africa or southern Asia and breeding in the Northern Hemisphere from Eastern Europe to eastern Siberia. This species forages in shallow water at the edge of wetlands where it probes the wet mud of mudflats or feeds among marshy vegetation for insects, molluscs and crustaceans.	**Likely to occur** Suitable habitat for this species occurs within the northern extent of the preliminary investigation corridor near the coast.
Terek sandpiper ***Xenus cinereus***	Migratory wetland Marine	Predicted to occur by PMST# - yes Previously recorded* - BA Recorded from field surveys^ - no	The terek sandpiper has a primarily coastal distribution in Australia, with occasional sighting inland (Pizzey and Knight 2008). This migratory species breeds in northern Europe in countries including Finland, Russia and Estonia and spends the non-breeding season in Africa, Asia, New Guinea, New Zealand and Australia. During the non-breeding season, this species is widespread across coastal Queensland. The terek sandpiper forages in open soft intertidal mudflats or in sheltered estuaries, embayments, harbours or lagoons. This species has also been recorded to utilise islets, mudbanks, sandbanks and pits, mangroves and occasionally samphire.	**Likely to occur** Suitable habitat for this species occurs within the northern extent of the preliminary investigation corridor near the coast.

Predicted to occur within approximately a 10 km area around the Study Area: SEWPaC Protected Matters Search Tool

* Previously recorded within desktop search extent from sources including Wildlife Online (WO), HERBRECS, Queensland Museum (QM), Birds Australia (BA) and essential habitat mapping (EH)

^ Recorded during field surveys of the preliminary investigation corridor undertaken May/June 2013

Table 7-43 Likelihood of occurrence for migratory marine species

Species	EPBC Act	Prediction of occurrence and previous records	Habitat preferences and known distributions	Likelihood of occurrence
Dugong *Dugong dugon*	Migratory marine	Predicted to occur by PMST# - yes Twenty-four dugongs were observed within the Abbot Point area during a 12 month survey period in 2009 (GHD 2009). During these monthly surveys, dugongs were noted to be associated primarily with widely distributed but low biomass seagrass meadows (*Halodule uninervis* and *Halophila spinulosa)* to the east and south-east of the existing Port facilities.	The Great Barrier Reef Region supports globally significant populations of dugong; this being one of the reasons the area was given World Heritage status. In the GBR the most important areas are around Hinchinbrook Island, Cleveland Bay and Shoalwater Bay (SEWPaC 2013ag). While seagrass meadows occur at Abbot Point, these are patchy and highly variable in density. Abbot Point is not considered as high value habitat for dugong. An "important population" (with regard to EPBC Act criteria) of dugong is not considered to occur at Abbot Point; the location is not of critical importance to the species" breeding capability and the site is not located at the limit of the species" range.	**Likely to occur** Dugongs are associated with seagrass meadows and shallow bays, with Dugongs known to occur around Abbot Point (GHD, 2010) and the area within Upstart Bay is considered to be a Dugong protection area. Along the Queensland coastline dugongs mostly occur in large, north facing bays (such as Upstart Bay) that are sheltered from prevailing southeast winds.
Estuarine crocodile ***Crocodylus porosus***	Migratory marine	Predicted to occur by PMST# - yes Previously recorded* - no	The estuarine crocodile is the largest species of crocodile in the world, with an average male crocodile 5 m long and weighing 450 kg. This species occurs from Rockhampton in Queensland, throughout coastal areas of the Northern Territory to near Broome in Western Australia and inhabits coastal waters, estuaries, freshwater sections of lakes, inland swamps and marshes. This species has been recorded from the Burdekin River Basin (SEWPaC 2013ah).	**Likely to occur** The estuarine crocodile is likely to occur within the preliminary investigation corridor where large permanent pools of water are present within the major rivers of the Burdekin Basin, including the Bowen and Bogie Rivers and Pelican Creek. This species may also occur within deeper tidal creeks associated with the Caley Valley Wetland, including Splitters and Mount Stuart Creeks.
Indo-Pacific Humpback Dolphin ***Sousa chinensis***	Migratory marine	Predicted to occur by PMST# - yes This species has been observed at Abbot Point (GHD 2010).	Indo-pacific humpback dolphins are typically associated with shallow, coastal and estuarine waters. Humpback dolphins studied extensively in other coastal areas, such as Townsville and the Great Sandy Straits, are present year round with no significant seasonal differences (Parra *et al*. 2006). Calves and/or juveniles are also seen year round within coastal waters. Research to date suggests most individual dolphins do not reside permanently in these coastal locations but undergo	**Likely to occur** Suitable habitat for this species occurs within the wider study area.

Species	EPBC Act	Prediction of occurrence and previous records	Habitat preferences and known distributions	Likelihood of occurrence
			transient, short term and long term occupations within these areas (Parra *et al*. 2006). A preference for creek and river mouths has been observed as well as association with dredged channels and breakwaters (Parra *et al*. 2006).	
Australian Snubfin Dolphin ***Orcaella heinsohni*** **(previously *Orcaella brevirostris*)**	Migratory marine	Predicted to occur by PMST# - yes This species has been observed at Abbot Point (GHD 2010).	This species occurs in shallow coastal waters and is often associated with estuaries and river mouths (CDM Smith 2012).	**Likely to occur** Suitable habitat for this species occurs within the wider study area
Killer whale ***Orcinus orca***	Migratory marine	Predicted to occur by PMST# - yes Previously recorded* - no	Killer whales occur throughout the worlds' oceans. Marine mammals provide much of the food required by the killer whale (Van Dyck and Strahan 2008). The preferred habitat of killer whales includes oceanic, pelagic and neritic (relatively shallow waters over the continental shelf) regions, in both warm and cold waters.	**May occur** Suitable habitat for this species occurs within the wider study area.
Bryde's whale ***Balaenoptera edeni***	Migratory marine	Predicted to occur by PMST# - yes Previously recorded* - no	Bryde's Whale is a pelagic species found in tropical and warm temperate waters exceeding 16.3 °C (Kato 2002). The coastal form of Bryde's Whale appears to be limited to the 200 m depth limited by suitable prey (Best *et al*. 1984). The offshore form is found in deeper water (500 m to 1,000 m).	**Unlikely to occur** Habitat for this species is not present.
Mackerel shark ***Lamna nasus***	Migratory marine	Predicted to occur by PMST# - yes Previously recorded* - no	The mackerel shark is typically found in cooler pelagic waters to the south of the wider study area (CDM Smith 2012).	**Unlikely to occur** Habitat for this species is not present.

7.10.1.2 Potential impacts

All of the listed migratory species confirmed present or likely to occur within the preliminary investigation corridor are generally widespread and abundant species that range across a variety of habitat types at different times of the year.

Of these, only the migratory woodland bird species and birds of prey are likely to be subject to direct impacts resulting from the NGBR Project, such as habitat loss and degradation, whereas the majority of aerial, wetland and shorebird species will be primarily present (at least in any notable numbers and aggregations) within the main body of the Caley Valley Wetland and adjacent coastline areas, which will not be subject to direct impacts resulting from the NGBR Project. Figure 7-34 illustrates the NGBR Project in relation to the Caley Valley Wetland and adjacent coastal areas.

Construction

Construction of the NGBR Project will result in the clearing of a nominally 100 m wide final rail corridor plus temporary (construction) and permanent (operation) ancillary infrastructure footprints located adjacent to the final rail corridor (collectively termed the NGBR Project footprint). The NGBR Project footprint is generally located within the 1,000 m wide preliminary investigation corridor. The NGBR Project’s construction process will be intensive for approximately two years.

Construction will occur on three fronts with multiple areas of impact at any one time. Impacts will occur progressively along the rail alignment ahead of bulk earthworks, bridge, culvert, and structures development and the laying of sleepers, ballast and track. It should be noted that the avoidance of significant environmental features and values was incorporated into the earlier route selection stages of the NGBR Project, both during placement and development of the preliminary investigation corridor and during the location of the NGBR Project footprint within the preliminary investigation corridor (refer Section 7.3.3). Within this preliminary investigation corridor, a NGBR Project footprint has been finalised and it is this footprint that is assessed here.

In total, approximately 4,215 ha of land are predicted to be affected (with approximately 2,571 ha of remnant vegetation to be cleared).

Habitat fragmentation – Caley Valley Wetland

It is noted that Caley Valley Wetland is known habitat for a number of migratory species. The NGBR Project has the potential to impact the Caley Valley Wetland resulting in fragementation of habitat from the clearing of vegetation and disruption to the aquatic environment through the construction of waterway crossings.

Figure 7-34 shows the footprint of the NGBR Project in relation to the Caley Valley Wetland. Vegetation clearing during construction has the potential to result in localised fragmentation of habitats adjacent to the NGBR Project. Fragmentation can increase the isolation of wildlife populations, by reducing their capacity to move between habitat remnants. The NGBR Project generally follows any existing cleared railway corridor within the Caley Valley Wetland and subsequently has avoided additional fragmentation of wetland habitat and in doing so minimised vegetation clearing within the wetland.

The NGBR Project will cross a tributary of the Caley Valey wetland which achieves more desirable crossing (similar to a defined watercourse crossing) compared to the development of a larger scale wetland crossing, and associated encroachment and barrier in wetland habitats.

Addtionally, the existing hydrology of aquatic habitats within the study area has been previously altered as a result of existing road and rail crossings, dam and weirs, and human-made bund walls within the Caley Valley Wetland near Abbot Point.

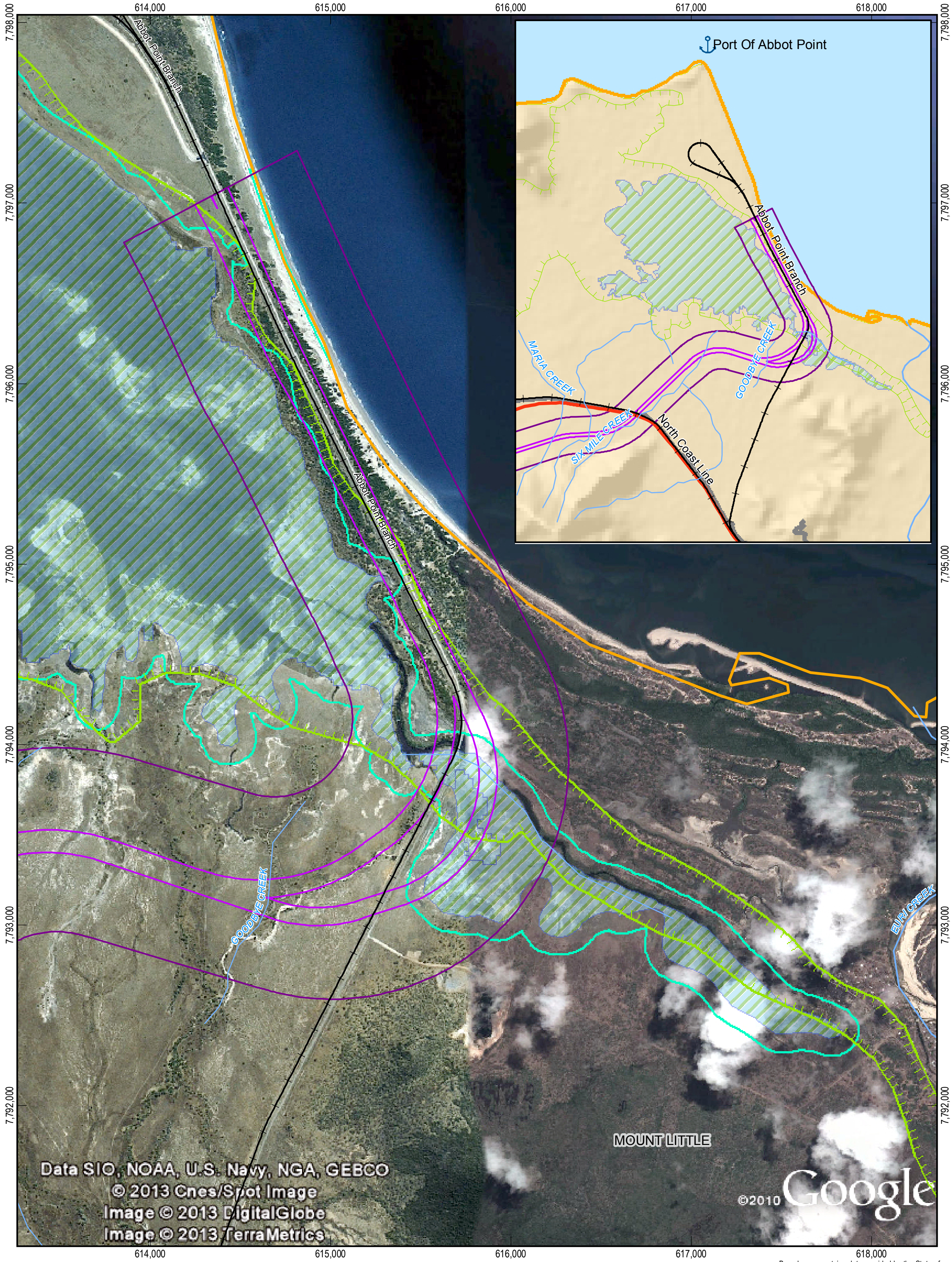
Suitable aquatic passageways for aquatic fauna is important to prevent declines in species abundance, species distribution truncation, localised extinction and a reduction in species diversity (Marsden and Power 2007).

The construction of waterway crossings has the potential to disturb and impair the movement of aquatic fauna within a waterway by creating temporary barriers to migration up and downstream. Temporary barriers to fish movement may be required during construction of bridge and culvert structures, to create suitably stable and dry working conditions. Construction activities for bridge and culvert structures will be scheduled during the dry season where possible to minimise impacts to fish movement. The design of temporary in-stream barriers would allow fish passage, particularly where the barrier will be in place for months rather than days or weeks, or will be in place through the wet season. At the completion of construction works within the waterway, the in-stream barrier would be removed and the waterway bed and banks returned to their original profile and stability so that long-term fish passage at the site is not compromised once the temporary barrier is removed. Therefore, the temporary barriers required during construction are not anticipated to have long term effects on aquatic fauna abundance or distribution and no aquatic species or habitats of conservation significance would be affected by the temporary barriers.

An application under the *Fisheries Act 1994* will be obtained where culvert or bridge installation requires works within a defined waterway.

Operation

Once the final rail corridor has been cleared and constructed, the most likely potential impacts to migratory species will comprise the risk of mortality or injury through collision, disturbance from the operation of trains (and/or maintenance activities) and the subsequent degradation of habitats through the increased prevalence of weed and/or pest species and/or incidence of fire.



LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Railway
- Watercourse (Minor)
- Wetland Protection Area (Caley Valley Wetlands)
- Wetland Protection Trigger Area
- Great Barrier Reef World Heritage Area
- Directory of Important Wetlands (Caley Valley Wetlands)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

1:30,000 @ A4

0 0.5 1

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

adani

Adani Mining Pty Ltd

North Galilee Basin Rail Project

Job Number	41-26457
Revision	B
Date	14 Nov 2013

Caley Valley Wetland and adjacent coastal areas

Figure 7-34

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145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway/2007; Adani: NGBR Corridor 13/05/2013, NGBR Corridor 06/06/2013, DNRM: Roads/2010, Gazzetted Places/2012, World Hertage Area/2012, WPA, WPA Trigger/2011, DIPW/2005, Google Earth Professional: Image extracted July 2013. Created by:MS

7.10.2 Great egret

7.10.2.1 Species overview

The great egret is listed as marine and migratory under the EPBC Act and is a partially migratory species, with northern hemisphere birds moving south from areas with cold winters. This species breeds in colonies in trees close to large lakes with reed beds or other extensive wetlands. The great egret feeds in shallow water or drier habitats, spearing fish, frogs or insects with its long, sharp bill (Pizzey and Knight 2008).

7.10.2.2 Desktop results

The great egret was previously recorded within the desktop search extent (Wildlife Online, Birds Australia). Suitable habitat for this species occurs within the preliminary investigation corridor and it was recorded within this corridor during field surveys in May and June 2013.

7.10.2.3 Survey results

Great egret was recorded in five locations during field surveys for the NGBR Project. One great egret was recorded in an ephemeral wetland alongside undulating rocky terrain on Tabletop property on 13 June 2013. Four great egret were recorded at Strathmore property on 14 May 2013, three utilising natural and artificial water body habitat and one within an area of broadly SEVT habitat. One great egret was recorded in non-remnant habitat on Disney property on 14 June 2013. A final single great egret was recorded in estuarine wetland near Abbot Point on 16 May 2013.

This species has also previously been recorded within the preliminary investigation corridor during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.2.4 Significance of NGBR Project footprint

The species is likely to be locally common along the length of the final rail corridor wherever suitable wetland habitat occurs. This will primarily be at farm dams, creek crossings, any other ephemeral wetlands and within the Caley Valley Wetland, adjacent to the NGBR Project footprint.

The species is not in decline or at the limit of its range within the NGBR Project footprint. The Caley Valley Wetland is reported (BAAM, 2012) to support an ecologically significant proportion of the population of great egret (more than 0.1%) and thus is considered to represent important habitat for the species. However, the main body of this wetland lies outside of the NGBR Project footprint. No other part of the final rail corridor is considered to support an ecologically significant proportion of the population of the species, or represent important habitat for the great egret.

7.10.2.5 Threatening processes

The great egret is under threat from the loss and/or degradation of foraging and (especially) breeding habitat through:

- Alteration of water flows (for example harvesting of water for irrigation purposes that prevents or limits inundation of wetlands)
- Drainage and/or clearing of wetlands for development

- Frequent burning of wetland vegetation used as nest sites
- Salinisation and invasion by exotic plants or fishes.

7.10.2.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts to and mitigation for the great egret are assessed and discussed in Section 7.10.33 on migratory wetland bird species.

7.10.3 Caspian tern

7.10.3.1 Species overview

The Caspian tern is listed as marine and migratory under the EPBC Act and is widespread along coastal regions of Queensland, from Torres Strait, along the east coast to Tasmania and South Australia (Higgins and Davies 1996). Within this range, this species inhabits sheltered coastal embayments including harbours, lagoons, inlets, bays, estuaries and river deltas, usually with sandy or muddy margins. Foraging usually occurs in open wetlands, including lakes and rivers, preferring sheltered shallow water near margins, but may also occur in open coastal waters. Breeding habitats for the Caspian tern include low islands, cays, spits, banks and beaches of sand or shell, and may occur in open or among low or sparse vegetation. Roosting generally occurs on bare exposed sand or shell spits, banks or shores of coasts, lakes, estuaries, coastal lagoons and inlets (Pizzey and Knight 2008).

7.10.3.2 Desktop results

The Caspian tern was previously recorded within the desktop search extent (Wildlife Online, Birds Australia). It was not predicted to occur through the Protected Matters Search Tool.

7.10.3.3 Survey results

Caspian tern was recorded in three locations during field surveys for the NGBR Project. Four Caspian tern were recorded utilising natural and artificial water body habitat on Stratford property on 9 May 2013. Also on 9 May 2013, a single Caspian tern was recorded in non-remnant cleared land on the border of the Stratford and Warrigal properties. Another single Caspian tern was recorded in estuarine habitat near Abbot Point on 16 May 2013.

Caspian tern has also previously been recorded within the preliminary investigation corridor during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.3.4 Significance of NGBR Project footprint

Caspian tern is expected to be primarily present in association with the main body of the Caley Valley Wetland (and nearby coastal habitats), adjacent to the NGBR Project footprint, but may also be present as individuals or in small numbers in association with freshwater wetland areas (larger farm dams, for example) that are scattered along the route (as per Stratford records).

The species is not in decline or at the limit of its range within the NGBR Project footprint. As with the great egret, the Caley Valley Wetland is reported (BAAM, 2012) to support an ecologically significant proportion of the population of Caspian tern (more than 0.1%) and thus is considered to represent important habitat for the species. However, the main body of this wetland lies outside of the NGBR Project footprint. No other part of the final rail corridor is considered to support an ecologically significant proportion of the population of the species, or represent important habitat for the Caspian tern.

7.10.3.5 Threatening processes

The Caspian tern is vulnerable to a range of threats including:

- Habitat loss and degradation
- Exposure to contamination and bioaccumulation effects, and disease including avian botulism
- Human disturbance at breeding sites, trampling by cattle, predation of chicks, and entanglement with fishing lines/nets
- Weather events and sea level rises damaging breeding sites.

7.10.3.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the Caspian tern are assessed and discussed in Section 7.10.33 on migratory wetland bird species.

7.10.4 Glossy ibis

7.10.4.1 Species overview

The glossy ibis is listed as marine and migratory under the EPBC Act and generally occurs throughout the Australian mainland. This species inhabits well vegetated wetlands, wet pastures, rice fields, floodwaters, floodplains, brackish or occasionally saline wetlands and occasionally dry grasslands (Pizzey and Knight 2008).

7.10.4.2 Desktop results

The glossy ibis was previously recorded within the desktop search extent (Wildlife Online). It was not predicted to occur through the Protected Matters Search Tool.

7.10.4.3 Survey results

Glossy ibis was recorded in three locations during field surveys for the NGBR Project. Four glossy ibis were recorded utilising natural and artificial water body habitat on Stratford property on 9 May 2013. A single glossy ibis was recorded within an area broadly comprising eucalyptus woodland on flat plains on Avon Downs property on 10 May 2013. Additionally, twelve glossy ibis were recorded in estuarine habitat near Abbot Point on 16 May 2013.

Glossy ibis has also previously been recorded within the preliminary investigation corridor during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.4.4 Significance of NGBR Project footprint

The species is likely to be present as individuals or in small numbers within wet grassland and freshwater wetlands (such as farm dams with marginal vegetation) where these habitats occur along the NGBR Project footprint. The species is not in decline or at the limit of its range within the NGBR Project footprint. The Caley Valley Wetland, adjacent to the NGBR Project footprint, is reported (BAAM, 2012) to support small numbers of glossy ibis and did not meet the criteria for consideration as important habitat for this species at that time. No part of the NGBR Project footprint is considered to support an ecologically significant proportion of the population of the species, or represent important habitat for the glossy ibis.

7.10.4.5 Threatening processes

The glossy ibis is under threat from the destruction and degradation of wetland habitats, through:

- Water diversion and drainage away from suitable sites
- Clearing, grazing and burning activities
- Increased salinity, pesticide use and invasion by exotic plants or fishes.

7.10.4.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts to and mitigation for the glossy ibis are assessed and discussed in Section 7.10.33 on migratory wetland bird species.

7.10.5 Fork-tailed swift

7.10.5.1 Species overview

This species is listed as marine and migratory under the EPBC Act. It is widespread across eastern Australia, generally present during the warmer months (between October and April), and forages over and above a wide variety of habitat types, including urban areas, open country, woodland, wetlands and coastlines (Pizzey and Knight 2008). They feed (and roost) on the wing, taking a wide variety of aerial invertebrate prey. Populations of this species are believed to be relatively stable throughout much of its range.

7.10.5.2 Desktop results

The fork-tailed swift was previously recorded within the desktop search extent (Wildlife Online, Birds Australia). Suitable habitat for the species occurs within the preliminary investigation corridor and the species is likely to occur regularly as a non-breeding visitor to (the air space above) the corridor and will range widely across this area.

7.10.5.3 Survey results

The fork-tailed swift was not observed during any of the field surveys carried out for the NGBR Project or during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, 2012).

7.10.5.4 Significance of NGBR Project footprint

Because of the wide ranging nature of the fork-tailed swift and its transient occupancy of the air space above a variety of different habitat types (primarily those alongside the coastal zone), the NGBR Project footprint is not considered to constitute important habitat for the species or to support an ecologically significant proportion of the population of the species.

7.10.5.5 Threatening processes

There are no documented significant threats to the fork-tailed swift in Australia.

7.10.5.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the fork-tailed swift are assessed and discussed in Section 7.10.33 on migratory aerial bird species.

7.10.6 Little tern

7.10.6.1 Species overview

The little tern is listed as marine and migratory under the EPBC Act and prefers coastal habitats and inshore waters, especially the mouths or downstream reaches of rivers (Pizzey and Knight 2008). This species takes fish by aerial dives, and breeds on islands and beaches. Caley Valley Wetland, in the northern extent of the preliminary investigation corridor, provides suitable foraging habitat and the coastal environment may also provide suitable roosting habitat for this species.

7.10.6.2 Desktop results

The little tern was previously recorded in the desktop search extent (Wildlife Online, Birds Australia). Potentially suitable habitat occurs within and near to the preliminary investigation corridor at the Caley Valley Wetland and the species is likely to occur within such coastal wetland areas.

7.10.6.3 Survey results

Little tern was not recorded during field surveys for the NGBR Project in May and June 2013. However, this species has previously been recorded within the preliminary investigation corridor during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, 2012) and during surveys undertaken for the Abbot Point Multi Cargo Facility EIS (NQBP 2009).

7.10.6.4 Significance of NGBR Project footprint

Little tern is unlikely to be present anywhere along the NGBR Project footprint other than within the Caley Valley Wetland and nearby coastal habitats that lie adjacent to this footprint.

Little tern was recorded utilising the Caley Valley Wetland during previous surveys including those undertaken by BAAM (March 2012). At that time, flocks of the species (numbering up to 48 individuals) were observed foraging over the freshwater wetland on two consecutive days. It therefore appears that the wetland supports moderate numbers of this species on an irregular basis. It is not considered to constitute important habitat for the species, nor do these numbers suggest that an ecologically significant proportion of the population is present.

7.10.6.5 Threatening processes

This species is under threat from:

- Destruction of nesting sites through habitat loss due to development, or through predation, collection or trampling of eggs and young
- Disturbance at nesting sites through human activities (primarily recreation and tourism) and pets or feral animals
- Loss and degradation of foraging grounds, such as estuarine habitats and in-shore waters.

7.10.6.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the little tern are assessed and discussed in Section 7.10.33 on migratory wetland bird species.

7.10.7 White-bellied sea eagle

7.10.7.1 Species overview

The white-bellied sea-eagle is listed as marine and migratory under the EPBC Act and occurs from India through south-east Asia to Australia on coasts and major waterways (Pizzey and Knight 2008). It feeds mainly on aquatic animals, such as fish, turtles and sea snakes, but it takes birds and mammals as well. The white-bellied sea-eagle is a wide-ranging species that uses a variety of habitat types, but its presence is generally limited by the presence of large wetlands and permanent water sources.

7.10.7.2 Desktop results

The white-bellied sea-eagle was previously recorded in the desktop search extent (Wildlife Online, Birds Australia). Potentially suitable habitat for the species occurs within the preliminary investigation corridor, particularly at the Caley Valley Wetland and across adjacent coastal areas, and the species is likely to occur in these areas.

7.10.7.3 Survey results

White-bellied sea-eagle was not recorded during field surveys for the NGBR Project in May and June 2013. However, this species has previously been recorded within the preliminary investigation corridor during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, 2012).

7.10.7.4 Significance of NGBR Project footprint

As the presence of this species is likely to be limited by the occurrence of large wetlands and waterbodies, it is only likely to be present along the NGBR Project footprint at major creek crossing points, large farm dams, and in association with the Caley Valley Wetland and adjoining coastal habitats, adjacent to the footprint.

Wide-ranging individuals, or single pairs, may be present in the vicinity of the NGBR Project footprint around suitable wetland habitat features. It was estimated that the Caley Valley Wetland and adjoining coastline supported a total of six to eight white-bellied sea-eagle during surveys carried out by BAAM (February and March 2012). This does not constitute an ecologically significant proportion of the population of the species and the area is not considered to represent important habitat for the species.

7.10.7.5 Threatening processes

The main threats to the white-bellied sea-eagle are:

- The loss of habitat due to land development
- The disturbance of nesting pairs by human activity.

7.10.7.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the white-bellied sea-eagle are assessed and discussed in Section 7.10.33 on migratory bird of prey species.

7.10.8 White-throated needletail

7.10.8.1 Species overview

White-throated needletail is listed as marine and migratory under the EPBC Act. It breeds in rocky hills in central Asia and southern Siberia and migrates in the winter to Australia where it is widespread across eastern and south-eastern Australia. It spends most of its life in the air, living on the insects it catches in its beak (Pizzey and Knight 2008).

7.10.8.2 Desktop results

The white-throated needletail was previously recorded in the desktop search extent (Wildlife Online, Birds Australia). Suitable habitat for this species occurs within the preliminary investigation corridor and the species is likely to occur regularly as a non-breeding visitor to (the air space above) the corridor and will range widely across this area.

7.10.8.3 Survey results

The white-throated needletail was not observed during any of the field surveys carried out for the NGBR Project or during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, 2012).

7.10.8.4 Significance of NGBR Project footprint

Because of the wide ranging nature of the white-throated needletail and its transient occupancy of the air space above a wide variety of different habitat types (primarily alongside the coastal zone), the NGBR Project footprint is not considered to constitute important habitat for the species or to support an ecologically significant proportion of the population of the species.

7.10.8.5 Threatening processes

White-throated needletail is considered to be principally under threat from collision with overhead wires and other structures, such as windows and lighthouses.

7.10.8.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts to and mitigation for the white-throated needletail are assessed and discussed in Section 7.10.33 on migratory aerial bird species.

7.10.9 Barn swallow

7.10.9.1 Species overview

The barn swallow is listed as marine and migratory under the EPBC Act. Its preferred habitat is open country with low vegetation, such as pasture, meadows and farmland, preferably near water (Pizzey and Knight 2008). This swallow avoids heavily wooded or precipitous areas and densely built-up locations. It feeds on insects, foraging in open country and over coastal and inland waters. Barn swallows are strongly migratory and their wintering grounds cover much of the southern hemisphere as far south as central Argentina, the Cape Province of South Africa, and northern Australia.

7.10.9.2 Desktop results

Barn swallow has not been previously recorded within the desktop search extent. However, the species was predicted to occur through the Protected Matters Search Tool and is considered to be common and widespread; it is therefore likely to occur regularly within the final rail corridor.

7.10.9.3 Survey results

The barn swallow was not observed during any of the field surveys carried out for the NGBR Project or during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, 2012).

7.10.9.4 Significance of NGBR Project footprint

Whilst the species is likely to be regularly present within the NGBR Project footprint, its presence will be broadly limited to areas of suitable pasture grassland and associated waterbodies. Given its wide-ranging nature and dispersal behaviour, it is unlikely to be regularly present in significant numbers within the footprint and therefore an ecologically significant proportion of the population is not considered to be supported by the final rail corridor. The barn swallow is not at the limit of its range or known to be in decline and the NGBR Project footprint does not represent important habitat for the species.

7.10.9.5 Threatening processes

The principal threats to the barn swallow are habitat loss and the use of pesticides.

7.10.9.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the barn swallow are assessed and discussed in Section 7.10.33 on migratory woodland bird species.

7.10.10 Rainbow bee-eater

7.10.10.1 Species overview

The rainbow bee-eater is listed as marine and migratory under the EPBC Act. This species is generally widespread and abundant across eastern Australia, migrating locally and regionally, such that the majority of individuals are present during the summer months, moving northwards (to northern Australia and beyond) for the winter (Pizzey and Knight 2008). Rainbow bee-eater generally inhabit and favour habitats including eucalypt woodlands, rainforest, damp gullies and coastal scrub, where they will breed, roost and forage on a wide variety of invertebrate prey.

7.10.10.2 Desktop results

The rainbow bee-eater was previously recorded in the desktop search extent (Wildlife Online, Birds Australia). Suitable habitat for this species occurs within the preliminary investigation corridor and the species is likely to occur regularly within this corridor.

7.10.10.3 Survey results

The rainbow bee-eater was not observed during any of the field surveys carried out for the NGBR Project. However, this species has previously been recorded within the preliminary investigation corridor during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, 2012).

7.10.10.4 Significance of NGBR Project footprint

During the BAAM surveys (February and March 2012), rainbow bee-eater was commonly encountered in small flocks in non-remnant and remnant terrestrial habitats alongside to the Caley Valley Wetland, adjacent to the NGBR Project footprint. Whilst the species was not recorded during surveys for the NGBR Project in May and June 2013, it is likely to be present in small numbers within a wide range of similar suitable habitat along the length of the NGBR Project footprint.

The scattering of small numbers of rainbow bee-eater throughout the NGBR Project footprint is not considered to constitute an ecologically significant proportion of the population of the species. None of these areas are known to be of critical importance to the rainbow bee-eater during particular life cycle stages and the species is not at the limit of its range or in decline. The NGBR Project footprint is not considered to represent important habitat for the species.

7.10.10.5 Threatening processes

The only identified threat to the rainbow bee-eater is the introduced cane toad (*Bufo marinus*), which can reduce the breeding success and productivity of the bee-eater by feeding on eggs and nestlings, and occupying nesting burrows.

7.10.10.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the rainbow bee-eater are assessed and discussed in Section 7.10.33 on migratory woodland bird species.

7.10.11 Black-faced monarch

7.10.11.1 Species overview

The black-faced monarch is listed as marine and migratory under the EPBC Act and is found along the entire eastern seaboard of Australia (Pizzey and Knight 2008). This species occurs in a wide range of common habitats including coastal habitats and woodlands.

7.10.11.2 Desktop results

The black-faced monarch was previously recorded within the desktop search extent (Wildlife Online, Birds Australia). Suitable habitat for the black-faced monarch occurs within the preliminary investigation corridor and it is likely to occur occasionally within this corridor, particularly within wooded habitats close to the coast and alongside the Caley Valley Wetland.

7.10.11.3 Survey results

Black-faced monarch was not recorded during NGBR Project surveys in May and June 2013, or during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.11.4 Significance of NGBR Project footprint

The black-faced monarch is most likely to occur, as individuals or in small numbers, within suitable wooded habitats in the northern extent of the NGBR Project footprint. Individuals or small numbers within a restricted part of the final rail corridor are not considered to constitute an ecologically significant proportion of the population of the species and the NGBR Project footprint is not considered to be important habitat for the species.

7.10.11.5 Threatening processes

The only documented threats to black-faced monarch are:

- The risk of collision with man-made structures such as windows and lighthouses
- Predation by feral and or domestic animals, principally cats.

7.10.11.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the black-faced monarch are assessed and discussed in Section 7.10.33 on migratory woodland bird species.

7.10.12 Spectacled monarch

7.10.12.1 Species overview

The spectacled monarch is listed as marine and migratory under the EPBC Act. It is a small flycatcher that is distributed along the east coast of Queensland and New South Wales to north of Sydney (Pizzey and Knight 2008). This species inhabits the understorey of mountain and lowland rainforests, thickly wooded vegetation and riparian vegetation including mangrove forests (Pizzey and Knight 2008). The spectacled monarch migrates to Queensland and New South Wales to breed from Papua New Guinea from September / October to May (Birdlife International 2013). Resident populations of this species occur along the central Queensland coast (Rockhampton) and northern Cape York Peninsula (Birdlife International 2013).

7.10.12.2 Desktop results

The spectacled monarch was previously recorded within the desktop search extent (Wildlife Online, Birds Australia). Suitable habitat for the spectacled monarch occurs within the preliminary investigation corridor and it is likely to occur occasionally within this corridor, particularly within the more dense forested habitats close to the coast and alongside the Caley Valley Wetland.

7.10.12.3 Survey results

Spectacled monarch was not recorded during NGBR Project surveys in May and June 2013, or during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.12.4 Significance of NGBR Project footprint

The spectacled monarch is most likely to occur, as individuals or in small numbers, within suitable forested habitats, particularly in the northern extent of the NGBR Project footprint. Individuals or small numbers within parts of the final rail corridor are not considered to constitute an ecologically significant proportion of the population of the species and the NGBR Project footprint is not considered to be important habitat for the species.

7.10.12.5 Threatening processes

The principal threats to the spectacled monarch are listed as:

- Habitat loss, fragmentation and degradation due to agricultural and housing development

- Predation by rats.

7.10.12.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the spectacled monarch are assessed and discussed in Section 7.10.33 on migratory woodland bird species.

7.10.13 Satin flycatcher

7.10.13.1 Species overview

The satin flycatcher is listed as marine and migratory under the EPBC Act. Satin flycatchers inhabit temperate forests and subtropical or tropical moist lowland forests. The satin flycatcher is an insectivorous woodland bird that is widespread in eastern Australia and vagrant to New Zealand (SEWPaC 2013aa). In central Queensland, the satin flycatcher is most common in coastal areas but is also scattered on the Great Divide and occasionally further west. The satin flycatcher overwinters in northern Australia and Papua New Guinea, returning to south-eastern Australia in the summer (SEWPaC 2013aa). Habitat for this species includes heavily vegetated gullies in forests, taller woodlands, trees in open country and coastal forests along eastern Australia (Pizzey and Knight 2007). The majority of individuals are recorded in wet sclerophyll eucalypt forests near wetlands or watercourses (SEWPaC 2013aa). Satin flycatchers forage in the canopy and sub-canopy of trees where they feed primarily on insects. Breeding occurs during the summer period with nests usually located in a fork on an outer tree branch. Satin flycatchers return to the same locality each year, often nesting in the same tree (SEWPaC 2013aa).

7.10.13.2 Desktop results

The satin flycatcher was previously recorded within the desktop search extent (Wildlife Online, Birds Australia). Suitable habitat for the satin flycatcher occurs within the preliminary investigation corridor and it is likely to occur occasionally within the corridor, particularly within the more wet forested and riparian habitats adjacent to major creek crossings, close to the coast, and alongside the Caley Valley Wetland.

7.10.13.3 Survey results

Satin flycatcher was not recorded during NGBR Project surveys in May and June 2013, or during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.13.4 Significance of NGBR Project footprint

The satin flycatcher is most likely to occur, as individuals or in small numbers, within suitable wet forested and riparian habitats, particularly in the northern extent of the NGBR Project footprint. Individuals or small numbers within a restricted part of the final rail corridor are not considered to constitute an ecologically significant proportion of the population of the species and the NGBR Project footprint is not considered to be important habitat for the species.

7.10.13.5 Threatening processes

The satin flycatcher is under threat from the loss of mature forests through clearing and logging, as the species is generally absent from regrowth vegetation.

7.10.13.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the satin flycatcher are assessed and discussed in Section 7.10.33 on migratory woodland bird species.

7.10.14 Rufous fantail

7.10.14.1 Species overview

The rufous fantail is listed as marine and migratory under the EPBC Act. It mostly inhabits dense, moist habitats, often in damp understorey or mid-stories, gullies and eucalypt forests, but also in rainforests, woodlands, and mangroves in north-east Queensland (Higgins *et al*. 2006). This species is widespread on the east of the Great Dividing Range from Cape York to the New South Wales border, including offshore islands (Higgins *et al*. 2006).

7.10.14.2 Desktop results

The rufous fantail was previously recorded within the desktop search extent (Wildlife Online, Birds Australia). Suitable habitat does occur within the preliminary investigation corridor and it is likely that the species occurs regularly along the length of the final rail corridor.

7.10.14.3 Survey results

Rufous fantail was not recorded during NGBR Project surveys in May and June 2013, or during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.14.4 Significance of NGBR Project footprint

The rufous fantail is likely to occur, as individuals or in small numbers, within a range of wooded habitats throughout much of the NGBR Project footprint. Individuals or small numbers scattered along the length of the final rail corridor are not considered to constitute an ecologically significant proportion of the population of the species and the NGBR Project footprint is not considered to represent important habitat for the species.

7.10.14.5 Threatening processes

The principal threat to rufous fantail is the loss, fragmentation and degradation of moist forested habitats to development (primarily agricultural and residential).

7.10.14.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the rufous fantail are assessed and discussed in Section 7.10.33 on migratory woodland bird species.

7.10.15 Common sandpiper

7.10.15.1 Species overview

The common sandpiper is listed as marine and migratory under the EPBC Act. It is widespread in small numbers along all coastlines of Australia, with habitat areas of national importance in Queensland including the south-eastern Gulf of Carpentaria and Cairns foreshore. The common sandpiper utilises a wide range of wetlands, coastal and inland, estuaries, streams and other water bodies where it forages in shallow water and on bare soft mud at the edges of wetlands. Roosting occurs in roots or branches of mangroves. During the southern migration, populations will arrive in Queensland around August, with the northward migration occurring between February and May (SEWPaC 2013ab).

7.10.15.2 Desktop results

The common sandpiper has not been previously recorded within the desktop search extent, but was predicted to occur through the Protected Matters Search Tool. Suitable habitat for this species is broadly limited to the area of Caley Valley Wetland and the species is likely to occur occasionally in this part of the final rail corridor.

7.10.15.3 Survey results

Common sandpiper was not recorded during surveys for the NGBR Project in May and June 2013, or during BAAM surveys in February and March 2012, but it had been recorded as part of other survey work at Caley Valley Wetland (GHD 2010).

7.10.15.4 Significance of NGBR Project footprint

Individuals or small numbers of common sandpiper are likely to occur on occasion in coastal wetland areas adjacent to the final rail corridor. The NGBR Project footprint is not considered to support an ecologically significant proportion of the population or represent important habitat for the common sandpiper.

7.10.15.5 Threatening processes

In Australia, the principal threats to the common sandpiper are:

- Habitat loss through land clearing, infilling and/or draining
- Habitat degradation, through reductions in water quality (pollution) and quantity (diversions etc.)
- Disturbance through human activities (recreation, tourism) and pets.

7.10.15.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the common sandpiper are assessed and discussed in Section 7.10.33 on migratory shorebird species.

7.10.16 Cattle egret

7.10.16.1 Species overview

The cattle egret is listed as marine and migratory under the EPBC Act and is often found in dry grassy habitats, unlike most herons which are associated with shallow water. It feeds on insects, especially grasshoppers, and is usually found with cattle and other large animals which disturb small creatures which the egrets then catch.

7.10.16.2 Desktop results

The cattle egret was previously recorded within the desktop search extent (Wildlife Online, Birds Australia). Suitable habitat for this species occurs within a range of grassland and wetland habitats within the preliminary investigation corridor and cattle egret are likely to occur, in places in abundance, along the length of the corridor as a whole.

7.10.16.3 Survey results

Cattle egret was recorded in one location during field surveys for the NGBR Project, but outside of the preliminary investigation corridor. Six cattle egrets were recorded in estuarine habitat near Abbot Point on 16th May 2013. Cattle egret has also previously been recorded within the preliminary investigation corridor during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.16.4 Significance of NGBR Project footprint

Cattle egret is likely to occur in a number of locations within the NGBR Project footprint in association with a broad range of pasture (dry and wet) and wetland (freshwater, brackish and coastal) habitats. The most suitable areas of habitat in terms of extent and diversity are likely to be within the area of Caley Valley Wetland, adjacent to the final rail corridor. The Caley Valley Wetland was reported (BAAM, 2012) to support small numbers of cattle egret during surveys at that time.

The species is not at the limit of its range and is not known to be in decline. Given the relative abundance of this species and the wide range of suitable habitats used by the species, the small numbers likely to be present in various areas of the NGBR Project footprint are not likely to constitute an ecologically significant proportion of the population, nor do the habitats present represent important habitat for the cattle egret.

7.10.16.5 Threatening processes

In Australia, the main threats to cattle egret are:

- Habitat loss and degradation, such as the draining of wetlands and conversion of grassland areas to urban development
- Predation by feral and domestic animals, principally cats.

7.10.16.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the cattle egret are assessed and discussed in Section 7.10.33 on migratory wetland bird species.

7.10.17 Sharp-tailed sandpiper

7.10.17.1 Species overview

The sharp-tailed sandpiper is listed as marine and migratory under the EPBC Act. It inhabits the muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation; including lagoons, swamps, lakes and pools near the coast. This species also utilises flooded plains, paddocks and other ephemeral wetlands, but leaves when they dry. The sharp-tailed sandpiper forages around the edge of wetlands or intertidal mudflats, on bare wet mud/sand, in shallow water and among inundated vegetation (Higgins and Davies 1996).

7.10.17.2 Desktop results

The sharp-tailed sandpiper was previously recorded within the desktop search extent (Wildlife Online, Birds Australia). Suitable habitat for this species is limited to the northern extent of the preliminary investigation corridor, near to the coast, and it is likely to occur regularly within that part of this corridor during the non-breeding season (broadly October to March).

7.10.17.3 Survey results

The sharp-tailed sandpiper was not observed during any of the field surveys carried out for the NGBR Project. However, this species has previously been recorded within the preliminary investigation corridor during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.17.4 Significance of NGBR Project footprint

Large numbers of sharp-tailed sandpiper were recorded by BAAM (2012) within parts of (the shallow exposed margins of) the Caley Valley Wetland that lie adjacent to the final rail corridor. These numbers exceeded 0.1% of the flyway population of the species (0.75%), meaning that the wetland met the criteria for classification as a nationally important habitat for the species.

However, the main body of the wetland lies outside of the final rail corridor and no other part of the NGBR Project footprint comprises comparable habitat that will be considered to constitute important habitat for the species, or support an ecologically significant proportion of the population of the species.

7.10.17.5 Threatening processes

In Australia, the principal threats to the sharp-tailed sandpiper are:

- Habitat loss through land clearing, infilling and/or draining
- Habitat degradation, through reductions in water quality (pollution) and quantity (diversions etc.)
- Disturbance through human activities (recreation, tourism) and pets.

7.10.17.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the sharp-tailed sandpiper are assessed and discussed in Section 7.10.33 on migratory shorebird species.

7.10.18 Red-necked stint

7.10.18.1 Species overview

The red-necked stint is listed as marine and migratory under the EPBC Act. It occurs mostly in coastal areas, such as bays, lagoons, estuaries with intertidal mudflats, often near spits and banks, and sometimes on sandy shores. The red-necked stint also occurs in ephemeral or permanent shallow wetlands. Foraging occurs mostly on intertidal mudflats or sandflats. They also forage in wetlands and samphire and roost on sheltered beaches, spits or areas of mud or sand, sometimes in saltmarsh and vegetation (SEWPaC 2013ac). This species is distributed along most of the Australian coastline with large densities on the Victorian and Tasmanian coasts. The red-necked stint has been recorded in all coastal regions, and found inland in all states when conditions are suitable (SEWPaC 2013ac).

7.10.18.2 Desktop results

The red-necked stint was previously recorded within the desktop search extent (Wildlife Online, Birds Australia). Suitable habitat for this species is limited to the northern extent of the preliminary investigation corridor, near to the coast, and it is likely to occur regularly within this part of the corridor during the non-breeding season (broadly October to March).

7.10.18.3 Survey results

The red-necked stint was not observed during any of the field surveys carried out for the NGBR Project. However, this species has previously been recorded within the preliminary investigation corridor during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.18.4 Significance of NGBR Project footprint

Large numbers of red-necked stint were recorded by BAAM (2012) within parts of (the shallow exposed margins of) the Caley Valley Wetland that lie adjacent to the NGBR Project footprint. These numbers exceeded 0.1% of the flyway population of the species (0.38%), meaning that the wetland met the criteria for classification as a nationally important habitat for the species.

However, the main body of the wetland lies outside of the final rail corridor and no other part of the NGBR Project footprint comprises comparable habitat that will be considered to constitute important habitat for the species, or support an ecologically significant proportion of the population of the species.

7.10.18.5 Threatening processes

In Australia, the principal threats to the red-necked stint are:

- Habitat loss through land clearing, infilling and/or draining
- Habitat degradation, through reductions in water quality (pollution) and quantity (diversions etc.)
- Disturbance through human activities (recreation, tourism) and pets.

7.10.18.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the red-necked stint are assessed and discussed in Section 7.10.33 on migratory shorebird species.

7.10.19 Greater sand plover

7.10.19.1 Species overview

The greater sand plover is listed as marine and migratory under the EPBC Act and is a medium sized brown and white plover. This species occurs in coastal areas of all states, with the greatest number of individuals occurring in the north-west of Australia (SEWPaC 2013ad). While in its non-breeding grounds in Australia, the greater sand plover is almost entirely coastal, inhabiting sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks, as well as estuarine lagoons (SEWPaC 2013ad).

7.10.19.2 Desktop results

The greater sand plover was previously recorded within the desktop search extent (Wildlife Online, Birds Australia). Suitable habitat for the greater sand plover is limited to the northern extent of the preliminary investigation corridor, near to the coast, and it is likely to occur regularly within that part of this corridor during the non-breeding season (broadly October to March).

7.10.19.3 Survey results

The greater sand plover was not observed during any of the field surveys carried out for the NGBR Project. However, this species has previously been recorded within the preliminary investigation corridor during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.19.4 Significance of NGBR Project footprint

A single greater sand plover was recorded on one occasion during the surveys carried out by BAAM (2012) along the periphery of the Caley Valley Wetland (specific location not mapped). It is likely that the wetland provides for individuals or small numbers of the species, but greater sand plover may be more likely to be present in numbers in adjoining coastal locations.

No part of the NGBR Project footprint is likely to support an ecologically significant proportion of the population of this species and it is not considered to represent important habitat for the species.

7.10.19.5 Threatening processes

In Australia, the principal threats to the greater sand plover are:

- Habitat loss through land clearing, infilling and/or draining
- Habitat degradation, through reductions in water quality (pollution) and quantity (diversions etc.)
- Disturbance through human activities (recreation, tourism) and pets.

7.10.19.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the greater sand plover are assessed and discussed in Section 7.10.33 on migratory shorebird species.

7.10.20 Lesser sand plover

7.10.20.1 Species overview

The lesser sand plover is listed as marine and migratory under the EPBC Act, is widespread in coastal regions in Australia and has been recorded in all states. In the non-breeding grounds in Australia, this species usually occurs in coastal littoral and estuarine environments. Suitable habitats include large inertial sand flats or mudflats in sheltered bays, harbours and estuaries and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms and rocky outcrops. This species is seldom recorded far from the coast, at the margins of lakes and swamps with associated artesian bores.

7.10.20.2 Desktop results

The lesser sand plover was previously recorded within the desktop search extent (Wildlife Online, Birds Australia). Suitable habitat for the lesser sand plover is limited to the northern extent of the preliminary investigation corridor, near to the coast, and it is likely to occur occasionally within that part of this corridor during the non-breeding season (broadly October to March).

7.10.20.3 Survey results

Lesser sand plover was not recorded during surveys for the NGBR Project in May and June 2013, nor was it recorded during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.20.4 Significance of NGBR Project footprint

Lesser sand plover has not been recorded within the preliminary investigation corridor to date, but is consider likely to occur, as individuals or in small numbers, on occasion, within coastal areas adjacent to the northern extent of the corridor.

No part of the NGBR Project footprint is likely to support an ecologically significant proportion of the population of this species and it is not considered to represent important habitat for the species.

7.10.20.5 Threatening processes

In Australia, the principal threats to the lesser sand plover are:

- Habitat loss through land clearing, infilling and/or draining
- Habitat degradation, through reductions in water quality (pollution) and quantity (diversions etc.)
- Disturbance through human activities (recreation, tourism) and pets.

7.10.20.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the lesser sand plover are assessed and discussed in Section 7.10.33 on migratory shorebird species.

7.10.21 Latham’s snipe

7.10.21.1 Species overview

Latham’s snipe is listed as marine and migratory under the EPBC Act and is a medium sized migratory wader. This species spends the non-breeding season predominately in eastern Australia. Suitable habitat for this species includes shallow freshwater wetlands of various kinds with bare mud or shallow water for feeding, with good nearby vegetation cover for shelter for non-breeding habitat areas. However, this species is also known to inhabit saline or brackish water, artificial habitats and areas close to human activity.

7.10.21.2 Desktop results

The Latham’s snipe was previously recorded within the desktop search extent (Wildlife Online). Suitable habitat for this species occurs within a range of permanent and ephemeral wetlands within the preliminary investigation corridor. The Caley Valley Wetland is the most significant resource for this species along the preliminary investigation corridor, but it may also be present at the larger farm dams, creeks and pools, where suitable vegetated margins occur, or within areas of flooded pasture.

7.10.21.3 Survey results

Latham's snipe was not observed during any of the field surveys carried out for the NGBR Project. However, this species has previously been recorded within the preliminary investigation corridor during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.21.4 Significance of NGBR Project footprint

Large numbers of Latham's snipe were recorded by BAAM (2012) within parts of (the vegetated margins of) the Caley Valley Wetland that lie adjacent to the NGBR Project footprint. These numbers exceeded the trigger of 18 individuals (estimated maximum population of 58) meaning that the wetland met the criteria for classification as a nationally important habitat for the species.

The main body of the wetland lies outside of the final rail corridor. No other part of the NGBR Project footprint comprises habitat of a comparable scale or complexity that will be considered to constitute important habitat for the species, or support an ecologically significant proportion of the population of the species.

7.10.21.5 Threatening processes

In Australia, the principal threats to the Latham's snipe are:

- Habitat loss through land clearing, infilling and/or draining
- Habitat degradation, through reductions in water quality (pollution) and quantity (diversions etc.)
- Disturbance through human activities (recreation, tourism) and pets.

7.10.21.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the Latham's snipe are assessed and discussed in Section 7.10.33 on migratory shorebird species.

7.10.22 Grey-tailed tattler

7.10.22.1 Species overview

Grey-tailed tattler is listed as marine and migratory under the EPBC Act. This species is usually found around shores of rock, shingle, gravel or shells and also on intertidal mudflats. In parts of Queensland, it is most abundant in areas with dense beds of seagrass.

7.10.22.2 Desktop results

The grey-tailed tattler was previously recorded within the desktop search extent (Wildlife Online, Birds Australia). Suitable habitat for this species is limited to the northern extent of the preliminary investigation corridor, near to the coast, and it is likely to occur occasionally within that part of this corridor during the non-breeding season (broadly October to March).

7.10.22.3 Survey results

Grey-tailed tattler was not observed during any of the field surveys carried out for the NGBR Project, or during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.22.4 Significance of NGBR Project footprint

Grey-tailed tattler has not been recorded within the preliminary investigation corridor to date, but is considered likely to occur, as individuals or in small numbers, on occasion, within coastal areas adjacent to the northern extent of this corridor.

No part of the NGBR Project footprint is likely to support an ecologically significant proportion of the population of this species and it is not considered to represent important habitat for the species.

7.10.22.5 Threatening processes

In Australia, the principal threats to the grey-tailed tattler are:

- Habitat loss through land clearing, infilling and/or draining
- Habitat degradation, through reductions in water quality (pollution) and quantity (diversions etc.)
- Disturbance through human activities (recreation, tourism) and pets.

7.10.22.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the grey-tailed tattler are assessed and discussed in Section 7.10.33 on migratory shorebird species.

7.10.23 Bar-tailed godwit

7.10.23.1 Species overview

The bar-tailed godwit is listed as marine and migratory under the EPBC Act and occurs in coastal areas of all Australian states. This species mainly inhabits coastal areas including large intertidal sandflats, banks, estuaries, inlets, harbours, coastal lagoons and bays and forages near the edge of water in the shallow water, mainly in tidal estuaries and harbours.

7.10.23.2 Desktop results

The bar-tailed godwit was previously recorded within the desktop search extent (Wildlife Online, Birds Australia). Suitable habitat for this species is limited to the northern extent of the preliminary investigation corridor, near to the coast, and the species is likely to occur regularly within that part of this corridor during the non-breeding season (broadly October to March).

7.10.23.3 Survey results

Bar-tailed godwit was not observed during any of the field surveys carried out for the NGBR Project, or during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.23.4 Significance of NGBR Project footprint

Bar-tailed godwit has not been recorded within the preliminary investigation corridor to date, but is considered likely to occur regularly in small numbers, primarily within coastal areas adjacent to the northern extent of the corridor.

No part of the NGBR Project footprint is likely to support an ecologically significant proportion of the population of this species and it is not considered to represent important habitat for the species.

7.10.23.5 Threatening processes

In Australia, the principal threats to the bar-tailed godwit are:

- Habitat loss through land clearing, infilling and/or draining
- Habitat degradation, through reductions in water quality (pollution) and quantity (diversions etc.)
- Disturbance through human activities (recreation, tourism) and pets.

7.10.23.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the bar-tailed godwit are assessed and discussed in Section 7.10.33 on migratory shorebird species.

7.10.24 Eastern curlew

7.10.24.1 Species overview

The eastern curlew is listed as marine and migratory under the EPBC Act. The distribution of the eastern curlew within Australia is primarily coastal. Found in all states including Tasmania, this species predominately occurs in the north, east and south-east regions. The eastern curlew is rarely recorded inland with preferred habitat for this species including sheltered coastal areas with large intertidal mudflats or sandflats, often with seagrass beds (Higgins and Davies 1996).

7.10.24.2 Desktop results

The eastern curlew was previously recorded within the desktop search extent (Wildlife Online, Birds Australia). Suitable habitat for this species is limited to the northern extent of the preliminary investigation corridor, near to the coast, and it is likely to occur regularly within that part of this corridor during the non-breeding season (broadly October to March).

7.10.24.3 Survey results

Eastern curlew was not observed during any of the field surveys carried out for the NGBR Project. However, this species has previously been recorded within the preliminary investigation corridor during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.24.4 Significance of NGBR Project footprint

BAAM reported (2012) that relatively small numbers of eastern curlew utilise intertidal saltmarsh and mudflats in the far western portion of the Caley Valley Wetland. This habitat had previously been assessed as important habitat for the species (BAAM, 2012). It is likely that this area, adjacent to the final rail corridor, forms the most significant habitat resource for eastern curlew, along with adjoining coastal habitat areas.

It is not considered that this or any other part of the NGBR Project footprint is likely to support an ecologically significant proportion of the population of this species and it is not considered to represent important habitat for the species.

7.10.24.5 Threatening processes

In Australia, the principal threats to the eastern curlew are:

- Habitat loss through land clearing, infilling and/or draining

- Habitat degradation, through reductions in water quality (pollution) and quantity (diversions etc.)
- Disturbance through human activities (recreation, tourism) and pets.

7.10.24.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the eastern curlew are assessed and discussed in Section 7.10.33 on migratory shorebird species.

7.10.25 Little curlew

7.10.25.1 Species overview

The little curlew is listed as marine and migratory under the EPBC Act. This wading bird is a strongly migratory species, wintering during the non-breeding season in Australasia. In Queensland, the little curlew is generally widespread in coastal regions with some inland records (SEWPaC 2013ae). This species feeds in short, dry grassland and sedge land, including dry floodplains and black soil plains, which have scattered shallow freshwater pools. When resting during the hottest part of the day, this species congregates around shallow pools, river beds and water-filled tidal channels or may also rest in grassy open woodland or sparsely vegetated flood plains.

7.10.25.2 Desktop results

Suitable habitat for this species is broadly limited to the northern extent of the preliminary investigation corridor, near to the coast, and it is likely to occur occasionally within this part of the corridor during the non-breeding season (broadly October to March).

7.10.25.3 Survey results

Little curlew was not observed during any of the field surveys carried out for the NGBR Project. However, this species has previously been recorded within the preliminary investigation corridor during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, March 2012).

7.10.25.4 Significance of NGBR Project footprint

A single little curlew was recorded by BAAM on one occasion in the central area of the Caley Valley Wetland, adjacent to the NGBR Project footprint. Whilst the species is generally widespread, it is most likely to occur as mobile and nomadic individuals that regularly move between sites, particularly following rains.

Within the final rail corridor, little curlew is most likely to be found in areas of short dry grassland, which can include managed pasture, airfields and playing fields, which are not abundant habitat types within the final rail corridor overall. No part of the NGBR Project footprint is likely to support an ecologically significant proportion of the population of this species. It is not considered to represent important habitat for the species.

7.10.25.5 Threatening processes

In Australia, the principal threats to the little curlew are:

- Habitat loss through land clearing, infilling and/or draining

- Habitat degradation, through reductions in water quality (pollution) and quantity (diversions etc.)
- Disturbance through human activities (recreation, tourism) and pets.

7.10.25.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the little curlew are assessed and discussed in Section 7.10.33 on migratory shorebird species.

7.10.26 Whimbrel

7.10.26.1 Species overview

The whimbrel is listed as marine and migratory under the EPBC Act. Whimbrel inhabit intertidal mudflats of sheltered coasts, harbours, lagoons, estuaries and river deltas, preferring mudflats with mangroves and occasionally on sandy beaches, rocky islets, reefs and platforms at low tide. This species is also found in saline grasslands, sewage farms, and infrequently recorded using saline or brackish lakes near coastal areas, coastal dunes and sports grounds. This species forages on intertidal mudflats and along muddy banks of estuaries and coastal lagoons, in non-vegetated areas or among mangroves. Whimbrel regularly roost in mangroves and other structures that flood at high tide including branches of mangroves around mudflats, estuaries and occasionally in tall coastal trees (Higgins and Davies 1996). The whimbrel is found along almost the entire coast of Queensland. This species arrives in northern Australia from August and moves south along the coast, dispersing widely along the coast during the non-breeding period. They begin the return migration from February, with influxes in Queensland from March to April and depart the north coasts by late April. Non-breeding birds also over-winter in Australia (SEWPaC 2013af).

7.10.26.2 Desktop results

Whimbrel was previously recorded within the desktop search extent (Wildlife Online, Birds Australia). Suitable habitat for this species is limited to the northern extent of the preliminary investigation corridor, near to the coast, and it is likely to occur regularly within that part of this corridor during the non-breeding season (broadly October to March).

7.10.26.3 Survey results

Whimbrel was not observed during any of the field surveys carried out for the NGBR Project. However, this species has previously been recorded within the preliminary investigation corridor during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.26.4 Significance of NGBR Project footprint

Very small numbers of whimbrel were recorded by BAAM (2012) within parts of the Caley Valley Wetland, with further small groups of the species noted in adjoining coastal habitats, both of which lie adjacent to the final rail corridor.

No part of the NGBR Project footprint comprises habitat that will be considered to constitute important habitat for the species, or support an ecologically significant proportion of the population of the species.

7.10.26.5 Threatening processes

In Australia, the principal threats to the whimbrel are:

- Habitat loss through land clearing, infilling and/or draining
- Habitat degradation, through reductions in water quality (pollution) and quantity (diversions etc.)
- Disturbance through human activities (recreation, tourism) and pets.

7.10.26.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the whimbrel are assessed and discussed in Section 7.10.33 on migratory shorebird species.

7.10.27 Grey plover

7.10.27.1 Species overview

The grey plover is listed as marine and migratory under the EPBC Act. It is almost entirely a coastal species in Australia, inhabiting sheltered embayments, estuaries, lagoons with mudflats and sandflats, rocky coasts with wave-cut platforms, reef flats or reefs with muddy lagoons. Inhabiting Australia during their non-breeding season, the grey plover forages on large areas of exposed mudflat and beaches of sheltered coastal shores such as inlets, estuaries and lagoons (Pizzey and Knight 2008).

7.10.27.2 Desktop results

Grey plover was not recorded within the desktop search extent, but was predicted to occur by the Protected Matters Search Tool. Suitable habitat for this species is limited to the northern extent of the preliminary investigation corridor, near to the coast, and the species is likely to occur occasionally within this part of the corridor during the non-breeding season (broadly October to March).

7.10.27.3 Survey results

Grey plover was not observed during any of the field surveys carried out for the NGBR Project, or during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.27.4 Significance of NGBR Project footprint

Grey plover has not been recorded within the preliminary investigation corridor to date, but is considered likely to occur, as individuals or in small numbers on occasion, within coastal areas adjacent to the northern extent of this corridor.

No part of the NGBR Project footprint is likely to support an ecologically significant proportion of the population of this species and it is not considered to represent important habitat for the species.

7.10.27.5 Threatening processes

In Australia, the principal threats to the grey plover are:

- Habitat loss through land clearing, infilling and/or draining

- Habitat degradation, through reductions in water quality (pollution) and quantity (diversions etc.)
- Disturbance through human activities (recreation, tourism) and pets.

7.10.27.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the grey plover are assessed and discussed in Section 7.10.33 on migratory shorebird species.

7.10.28 Marsh sandpiper

7.10.28.1 Species overview

The marsh sandpiper is listed as marine and migratory under the EPBC Act. It inhabits coastal and inland wetlands throughout Australia (Pizzey and Knight 2008). This species is widespread in Queensland; however, there are limited records north of Cooktown. This species is migratory, spending the non-breeding season in Australia, Africa or southern Asia and breeding in the northern hemisphere from Eastern Europe to eastern Siberia. This species forages in shallow water at the edge of wetlands where it probes the wet mud of mudflats or feeds among marshy vegetation for insects, molluscs and crustaceans.

7.10.28.2 Desktop results

The marsh sandpiper was previously recorded within the desktop search extent (Wildlife Online, Birds Australia). Suitable habitat for this species is limited to the northern extent of the preliminary investigation corridor, near to the coast, and the species is likely to occur regularly within this part of the corridor during the non-breeding season (broadly October to March).

7.10.28.3 Survey results

Marsh sandpiper was not observed during any of the field surveys carried out for the NGBR Project. However, this species has previously been recorded within the preliminary investigation corridor during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.28.4 Significance of NGBR Project footprint

Individuals or small numbers of marsh sandpiper were recorded (BAAM, 2012) within a number of locations around the peripheries of the Caley Valley Wetland, adjacent to the final rail corridor, including one individual within a survey area crossed by the NGBR Project footprint (easternmost extent of wetland outlet to the coast).

However, the main body of the wetland lies outside of the final rail corridor and no other part of the NGBR Project footprint comprises comparable habitat that will be considered to constitute important habitat for the species, or support an ecologically significant proportion of the population of the species.

7.10.28.5 Threatening processes

In Australia, the principal threats to the marsh sandpiper are:

- Habitat loss through land clearing, infilling and/or draining
- Habitat degradation, through reductions in water quality (pollution) and quantity (diversions etc.)

- Disturbance through human activities (recreation, tourism) and pets.

7.10.28.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the marsh sandpiper are assessed and discussed in Section 7.10.33 on migratory shorebird species.

7.10.29 Terek sandpiper

7.10.29.1 Species overview

The terek sandpiper is listed as marine and migratory under the EPBC Act and has a primarily coastal distribution in Australia, with occasional sightings inland (Pizzey and Knight 2008). This migratory species breeds in northern Europe in countries including Finland, Russia and Estonia and spends the non-breeding season in Africa, Asia, Papua New Guinea, New Zealand and Australia. During the non-breeding season, this species is widespread across coastal Queensland. The terek sandpiper forages in open soft intertidal mudflats or in sheltered estuaries, embayments, harbours or lagoons. This species has also been recorded to utilise islets, mudbanks, sandbanks and pits, mangroves and occasionally samphire.

7.10.29.2 Desktop results

The terek sandpiper was previously recorded within the desktop search extent (Birds Australia). Suitable habitat for this species is limited to the northern extent of the preliminary investigation corridor, near to the coast, and the species is likely to occur occasionally within this part of the corridor during the non-breeding season (broadly October to March).

7.10.29.3 Survey results

Terek sandpiper was not observed during any of the field surveys carried out for the NGBR Project, or during the Co-ordinated Migratory Bird and Water Bird Survey conducted as part of the Abbot Point Cumulative Impact Assessment (BAAM, February and March 2012).

7.10.29.4 Significance of NGBR Project footprint

Terek sandpiper has not been recorded within the preliminary investigation corridor to date, but is considered likely to occur, as individuals or in small numbers on occasion, within coastal areas adjacent to the northern extent of this corridor.

No part of the NGBR Project footprint is likely to support an ecologically significant proportion of the population of this species and it is not considered to represent important habitat for the species.

7.10.29.5 Threatening processes

In Australia, the principal threats to the terek sandpiper are:

- Habitat loss through land clearing, infilling and/or draining
- Habitat degradation, through reductions in water quality (pollution) and quantity (diversions etc.)
- Disturbance through human activities (recreation, tourism) and pets.

7.10.29.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the terek sandpiper are assessed and discussed in Section 7.10.33 on migratory shorebird species.

7.10.30 Dugong

7.10.30.1 Species overview

The dugong is listed as marine and migratory under the EPBC Act. The Great Barrier Reef Region supports globally significant populations of dugong; this being one of the reasons the area was given World Heritage status. In the GBR, the most important areas for dugong are around Hinchinbrook Island, Cleveland Bay and Shoalwater Bay (SEWPaC 2013ag).

7.10.30.2 Desktop results

Dugongs are associated with seagrass meadows and shallow bays. Dugongs are known to occur around Abbot Point (GHD, 2010), which is located between two Dugong Protection Areas: ‘Dugong Sanctuary A’ is located at Upstart Bay (44 km north-west of Abbot Point) and ‘Dugong Sanctuary B’ is located at Edgecumbe Bay (35 km south-east of Abbot Point). Along the Queensland coastline, dugongs mostly occur in large, north facing bays (such as Upstart Bay) that are sheltered from prevailing southeast winds.

7.10.30.3 Survey results

Dugong was not observed during any of the field surveys carried out for the NGBR Project.

7.10.30.4 Significance of NGBR Project footprint

The NGBR Project footprint is entirely terrestrial and hence does not contain potential habitat for dugong. The presence of dugongs adjacent to Abbot Point is likely to be strongly influenced by the abundance and health of seagrass meadows. Seagrass meadows within the Abbot Point area are naturally variable as a result of seasonal and inter-annual changes in environmental factors (i.e. rainfall, cyclonic events and flooding). Abbot Point has previously been identified as an area of low conservation importance for dugongs in the southern Great Barrier Reef (Grech & Marsh 2007). An important population of dugong is not considered to occur at Abbot Point; the location is not of critical importance to the species’ breeding capability and the site is not located at the limit of the species range.

7.10.30.5 Threatening processes

Principal threats to the dugong are considered to be:

- Habitat loss and degradation, particularly to seagrass beds
- Incidental catch through accidental entanglement in fishing nets.

7.10.30.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the dugong are assessed and discussed in Section 7.10.33.

7.10.31 Estuarine crocodile

7.10.31.1 Species overview

The estuarine crocodile is listed as marine and migratory under the EPBC Act. It is the largest species of crocodile in the world, with an average male crocodile measuring five metres long and weighing 450 kg. This species occurs from Rockhampton in Queensland, throughout coastal areas of the Northern Territory to near Broome in Western Australia and inhabits coastal waters, estuaries, freshwater sections of lakes, inland swamps and marshes.

7.10.31.2 Desktop results

The estuarine crocodile has been recorded from the Burdekin River Basin (SEWPaC 2013ah) but has not been previously recorded within the desktop search extent (Wildlife Online).

7.10.31.3 Survey results

Estuarine crocodile was not observed during any of the field surveys carried out for the NGBR Project.

7.10.31.4 Significance of NGBR Project footprint

Estuarine crocodile has not been recorded within the preliminary investigation corridor to date, but is considered likely to occur where large permanent pools of water are present within the major rivers of the Burdekin Basin, including the Bowen and Bogie Rivers and Pelican Creek. This species may also occur within deeper tidal creeks associated with the Caley Valley Wetland, including Splitters and Mount Stuart Creeks.

No part of the NGBR Project footprint is likely to support an ecologically significant proportion of the population of this species and it is not considered to represent important habitat for the species.

7.10.31.5 Threatening processes

The estuarine crocodile is under threat from:

- Habitat loss
- Habitat degradation, through increased drainage of wetlands and loss of vegetation cover
- Incidental catch through accidental entanglement in fishing nets.

7.10.31.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for the estuarine crocodile are assessed and discussed in Section 7.10.33.

7.10.32 Inshore dolphins

7.10.32.1 Species overview

The Australian snubfin dolphin (*Orcaella heinsohni*) and the Indo-Pacific humpback dolphin (*Sousa chinensis*) are listed as marine and migratory under the EPBC Act. They inhabit predominantly shallow coastal waters, close to creek and river mouths and often in proximity to seagrass beds. There are no reliable population estimates for either species within Australian waters.

7.10.32.2 Desktop results

There is little baseline information available on the distribution and abundance of Australian snubfin and Indo-Pacific humpback dolphins with the broader region surrounding Abbot Point. The nearest location for which studies have been undertaken on these species is in Cleveland Bay near Townsville, approximately 150 km north of Abbot Point.

There are no population estimates for either species within the Abbot Point area. Studies of Queensland coastal locations (reported in ELA 2013) including Townsville, Gladstone/Port Alma and the Great Sandy Strait have indicated that:

- Populations of these species are generally small, usually with less than 100 individuals in any one location
- Recent studies indicate that these small populations can be relatively disconnected due to geographic isolation and genetic separation
- Studies indicate that both species show a level of site fidelity, with evidence of female philopatry in Indo-Pacific humpback dolphins
- There is currently very little published information on the scale of movement between habitats and between regions along the coast.

Detailed studies have not been undertaken within the Abbot Point project area to determine whether these population characteristics are also true for the Australian snubfin and Indo-Pacific humpback dolphins observed at Abbot Point.

7.10.32.3 Survey results

No inshore dolphins were observed during any of the field surveys carried out for the NGBR Project.

7.10.32.4 Significance of NGBR Project footprint

The NGBR Project footprint is entirely terrestrial and hence does not contain potential habitat for inshore dolphins. It is not currently known whether the broader Abbot Point area provides important habitat or supports an ecologically significant proportion of the populations of these species (ELA 2012).

7.10.32.5 Threatening processes

Current threats to inshore dolphins include:

- Habitat destruction and degradation
- Incidental capture in nets
- Competition with fisheries
- Pollution of habitat
- Interaction with vessels (vessel strike and increased noise).

7.10.32.6 Potential impacts and avoidance, mitigation and management measures

Potential impacts and mitigation for inshore dolphins are assessed and discussed in Section 7.10.33.

7.10.33 Potential impacts and avoidance, mitigation and management measures

7.10.33.1 Grouping species

The migratory bird species discussed in previous sections have been grouped according to their individual ecologies, life cycles and behaviours. It is predicted that similar threats apply and impacts could occur to each species within a particular group and therefore these have been assessed and discussed collectively, as follows. Potential habitat for these species (or species groups) has not been mapped, but is also discussed, where required.

The groupings are as follows:

- Migratory aerial bird species
- Migratory woodland bird species
- Migratory bird of prey species
- Migratory wetland bird species
- Migratory shorebird species.

Dugong, estuarine crocodile and inshore dolphins are discussed separately.

7.10.33.2 Defining significant impacts

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species
- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

7.10.33.3 Migratory aerial bird species

This section covers the following species that are likely to occur above the area of the NGBR Project footprint: fork-tailed swift and white-throated needletail. These species are defined as aerial because they spend all of their time in the air, only using habitat at ground level when breeding, which they do outside of Australia.

Construction impacts

Direct impacts

The main direct threat to migratory aerial bird species potentially resulting from the construction of infrastructure will relate to collision with overhead wires, or similar new permanent structures. However, this impact is expected to be negligible for the NGBR Project. No broad overhead power line structures are proposed to be constructed for the NGBR Project. The only power lines present will be installed as part of maintenance facilities located in up to three small areas of the NGBR Project footprint. Furthermore, these species generally fly well above the canopy level and therefore are extremely unlikely to be impacted by any other similar NGBR Project (construction) infrastructure, such as fencing along the rail corridor.

Indirect impacts

Habitat loss and degradation resulting from construction of the NGBR Project has the potential to indirectly impact migratory aerial bird species by causing a localised depletion of invertebrate prey food availability. This may occur as a result of vegetation loss, or through localised dust deposition resulting from construction activities. The loss of habitat (and subsequent potential depletions to invertebrate prey sources) needs to be set within the context of the likely value of this particular habitat to these species and the availability of comparable habitat areas across the surrounding landscape. These areas are likely to be used intermittently and transiently by the two aerial species and are not considered to constitute important habitat for the species, which are generally common and widespread across the region. It is therefore considered unlikely that the construction of the NGBR Project will have a significant impact upon migratory aerial bird species.

Operational impacts

Direct impacts

The NGBR Project is unlikely to result in any direct impacts to migratory aerial bird species. Migratory aerial bird species will generally be commuting and foraging at heights above the canopy and will therefore not be at risk of collision with permanent operational infrastructure, such as bridges, fences, or other structures associated with the NGBR Project.

Indirect impacts

The NGBR Project is unlikely to have any indirect impact on migratory aerial bird species. Although the loss of vegetation for the NGBR Project footprint will result in a localised reduction in habitat for invertebrate prey items, this is unlikely to result in a significant reduction in food availability, given the relative abundance of suitable foraging habitat in the environment adjacent to and surrounding the NGBR Project footprint and the rehabilitation (and natural regeneration) of temporarily disturbed areas post-construction.

Avoidance, mitigation and management measures

Avoidance, mitigation and management measures for migratory aerial bird species will be achieved through the implementation of a Species Management Plan, to include the following:

- During construction, where new powerlines are required in association with the maintenance facilities, these lines should be fitted with high visibility markers that enhance their visibility to wildlife. This is particularly applicable to migratory aerial species, where collision risk is considered to be a (minor) threat, but will also serve to minimise the risk and incidence of collision for a range of other fauna species, including non-listed birds of prey that may occur within the NGBR Project footprint.

Conclusion

The NGBR Project will not have significant residual impacts on migratory aerial bird species. These species are predominantly aerial in nature and will not experience measurable direct losses or degradation of habitat as a result of the NGBR Project. While the species could be susceptible to collision with overhead powerlines at three maintenance facilities, the residual risk is likely to be low, particularly if high visibility powerline markers are implemented. Although vegetation clearance could result in localised depletion in invertebrate food availability, the loss is unlikely to have an impact on feeding efficiency, given the mobility and nomadism of the species concerned and the abundance of suitable foraging habitat within the surrounding landscape. An assessment against the Significant Impact Guidelines is provided in Table 7-44.

Table 7-44 Significance of residual impacts on migratory aerial bird species

Impact criteria	Project response
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	Unlikely. These species are predominantly aerial in nature and do not directly utilise habitats impacted during the construction and operation phases of the NGBR Project.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	Unlikely. Migratory aerial bird species rarely roost or venture close to the ground and are therefore not subject to predation from exotic predators such as cats, foxes and dogs.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	Unlikely. Loss and degradation of habitat could have indirect impacts by causing localised depletion of invertebrate food availability. However this impact is likely to be negligible given the abundance of suitable habitat remaining within the surrounding environment adjacent to the NGBR Project.

7.10.33.4 Migratory woodland bird species

This section covers the following species that are likely to occur within the NGBR Project footprint: barn swallow, rainbow bee-eater, black-faced monarch, spectacled monarch, satin flycatcher and rufous fantail.

Construction impacts

Direct impacts

The main direct threat to migratory woodland birds resulting from construction of the NGBR Project is associated with the loss and fragmentation of woodland habitats. Migratory woodland bird species have the potential to occur across a broad range of open country, wooded and forested habitats throughout the length of the corridor, all of which will be subject to clearance for the construction of the NGBR Project footprint. Some of these species, primarily barn swallow and rainbow bee-eater, will occupy disturbed habitats and areas of human habitation including roadside vegetation, quarries and mines (SEWPaC 2011f) and therefore may later readily occupy the operational final rail corridor.

Habitat within the NGBR Project footprint is likely to be used on a temporary or permanent basis by these species. Areas of habitat to be cleared are not considered to constitute important habitat for these birds since all are common, widespread and wide-ranging species that will move throughout the region (particularly along the coast) at different times of the year. Suitable habitat is likely to occur over much of the surrounding landscape. It is highly unlikely that the construction of the NGBR Project will impact upon an ecologically significant proportion of the population of these species.

Indirect impacts

Construction activities for the NGBR Project have the potential to cause indirect impacts on migratory woodland bird species through the degradation of adjacent habitats. This could arise as a result of increased exposure to noise, vibration, light and dust. Disturbance is most likely to affect breeding activity, for example through construction noise reducing birds' abilities to hear the calls and songs of potential mates or competitors. These migratory woodland bird species are relatively abundant and widespread in distribution. The area of habitat impacted is therefore likely to be relatively small compared with the area of available forest habitat that can be utilised by these species, although it is likely that there will be a zone of temporary disturbance surrounding the construction activities for the duration of construction within that area. Standard mitigation measures to control construction noise, lighting and dust are likely to reduce the impacts to migratory woodland bird species alongside retained woodland habitat areas.

Poor waste management procedures in construction camps could also have adverse impacts on these species by increasing the local abundance of and therefore predation by rats, cats and foxes. A Waste Management Plan will be developed and implemented for the NGBR Project and therefore the NGBR Project is unlikely to have a significant indirect impact on migratory woodland birds through increased predation by exotic predators.

Operational impacts

Direct impacts

The main direct impact on migratory woodland birds during the operational phase of the NGBR Project will be direct mortality through collision with trains or permanent infrastructure. However, this threat is considered to be very low, given the relatively slow speed of the trains, high visibility of permanent infrastructure and relatively good eye-sight and manoeuvrability of migratory woodland bird species (these being species that are generally not subject to high mortality from collision).

Indirect impacts

Noise and dust emissions from coal trains, loading facilities and maintenance vehicles represent potential indirect operation-phase impacts on migratory woodland bird species. Whilst these birds may flush and disperse in response to incidences of loud noise, they are also likely to return to such areas after brief flights and/or habituate to such (regular) noise disturbances in the longer-term. As such, these impacts are likely to be localised in nature and are considered unlikely to have a significant impact on the ecology of the species, given their relative abundance and widespread distribution in the surrounding landscape.

Avoidance, mitigation and management measures

Avoidance, mitigation and management measures for migratory woodland bird species will be achieved through the implementation of a Species Management Plan, to include the following:

- During construction, undertake vegetation clearing outside of the breeding season (peak between August and February), wherever possible, to reduce the disruption of breeding and nesting activities and limit impacts to foraging and commuting birds (less sensitive parts of the species' lifecycle)

- During construction, restrict construction noise to general building work hours and monitor noise levels, in particular where adjacent to sensitive receptors (to include the Caley Valley wetland)
- During construction, minimise construction light spill into adjacent retained habitats through the use of directional lighting and shields
- During construction and operation, implement a Weed and Pest Management Plan and a Waste Management Plan to:
  - reduce the risk of invasive plant species that could degrade ground cover and understorey woodland habitats
  - control numbers of exotic predators, such as rats, cats, dogs, foxes and cane toad, which could otherwise increase predation pressures on migratory woodland bird species.
- During operation, restrict operational lighting to the single maintenance depot (the rail corridor itself will not be lit) and buffer that with appropriate landscape planting, as required
- During operation, veneer coal loads, in line with standard industry practice, to minimise dust emissions

Conclusion

Residual impacts on migratory woodland bird species resulting from the NGBR Project are likely to be relatively minimal. Although the NGBR Project will result in the direct loss and degradation of potential habitat for a small number of migratory woodland bird species, the area of habitat impacted represents a small proportion of that available to the species across the wider landscape. The loss and degradation of habitat is therefore unlikely to impact an ecologically significant proportion of the population of these species.

The NGBR Project also has the potential to increase predation pressures on migratory woodland species by increasing the local abundance of exotic predators such as cats, dogs and foxes. However, the impacts will be reduced to low levels through the implementation of Weed and Pest Management Plan and Waste Management Plan. Residual impacts associated with the construction and operation of the NGBR Project are therefore unlikely to result in a significant impact to these species. An assessment against the Significant Impact Guidelines is provided below in Table 7-45.

Table 7-45 Significance of residual impacts on migratory woodland bird species

Impact criteria	Project response
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	Unlikely. These species are relatively abundant and widespread in distribution. Although the NGBR Project will result in localised loss and degradation of habitat, this affects a very small proportion of the total area of habitat available within the region. The NGBR Project will therefore not result in substantial modification, destruction or isolation of important habitat for migratory woodland bird species.

Impact criteria	Project response
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	Unlikely. Although the NGBR Project has the potential to increase local densities of exotic plants and/or predators, a Weed and Pest Management Plan and Waste Management Plan will be implemented to reduce the potential for invasive species incursions into potential habitat for migratory woodland birds.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	Unlikely. Loss and degradation of habitat could cause localised reductions in breeding, nesting and feeding efficiency. However, the area impacted is minor compared with the area of habitat available in the region and will therefore not disrupt the lifecycle of an ecologically significant proportion of these species.

7.10.33.5 Migratory bird of prey species

This section covers the following species that is likely to occur within the NGBR Project footprint: white-bellied sea-eagle.

Construction impacts

Direct impacts

The main direct threats thought to be applicable to the white-bellied sea-eagle with respect to the NGBR Project are the loss of known and potential nest sites through clearing and declines in prey items due to habitat loss or degradation.

Potential breeding territories for this species include areas located near water and mainly in tall open forest or woodland (SEWPaC, 2013). Land clearance has been shown to reduce the amount of suitable habitat available to this species, forcing birds to nest in sub-optimal habitats and subsequently reducing breeding success (SEWPaC, 2013). The NGBR Project will involve the clearance of approximately 2,571 ha of remnant vegetation, which includes open forest or woodland, some of which will be within range of permanent water features.

The loss of potential nesting sites (i.e. tall forest trees) along the NGBR Project footprint is considered likely to occur; however, this is anticipated to impact a small number of territories only and is not expected to have a substantial impact on this species at a regional level.

The white-bellied sea-eagle is also known to forage over terrestrial habitats and the clearing of vegetation is likely to remove potential foraging habitat for this species. Due to the wide-ranging nature and broad habitat requirements of the species, the loss and degradation of foraging habitat is not likely to have a substantial impact on this species at a regional level.

Indirect impacts

Indirect impacts to the white-bellied sea-eagle include the disturbance of known and potential nesting sites through increased anthropogenic activities, particularly during construction. Construction will occur on three fronts with multiple areas of impact at any one time, for a period of two years. The white-bellied sea-eagle is likely to be impacted through noise (people and machinery presence and movements) and light disturbance as a result of construction activities, when and where present.

The white-bellied sea-eagle is known to be sensitive to disturbance when nesting, particularly throughout the early stages of the breeding season, namely May to August in central and northern Australia (SEWPaC, 2013). This species may desert nests and young if confronted by humans or exposed to prolonged disturbance by human activity (SEWPaC, 2013). The disturbance of nesting pairs can subsequently lower breeding success, and has been associated with some localised population declines (SEWPaC, 2013).

Operational impacts

Direct impacts

Direct operational impacts on the white-bellied sea-eagle are not anticipated to occur as a result of the NGBR Project. Mortality via collision with trains does have the potential occur; however, the likelihood of such events occurring is considered to be very low. Species attracted in to feed on carrion alongside the rail infrastructure, namely birds of prey, may be more susceptible to collision. White-bellied sea-eagle is the only listed migratory bird of prey species assessed as being likely to occur within the final rail corridor and this species does feed on carrion; however, its natural occurrence in low numbers across the landscape mean that the risk of collision remains relatively low. The NGBR Project is not likely to have any substantial direct impact on this species throughout the operational phase.

Indirect impacts

Similar indirect impacts are anticipated throughout the operational phase of the NGBR Project to those outlined for the construction phase above. Increased human activity in localised areas, primarily for maintenance activities, is anticipated to lead to potential noise and light disturbances to this species , though the species is likely to habituate the regular operational noise (i.e. the passage of trains) and operational lighting will be limited to the proposed maintenance depot (at one location along the route only).

Avoidance, mitigation and management measures

Avoidance, mitigation and management measures for migratory bird of prey species will be achieved through the implementation of a Species Management Plan, to include the following:

- During construction, avoid active raptor nests identified by a suitably-experienced ecologist (fauna spotter-catcher). If active nests are located, there will be a requirement for the management of areas around those features (such as the use and enforcement of appropriate no-go buffer zones) to minimise the risk of disturbance and/or desertion until such time that the young have fledged and left the area. This buffer zone may be up to 200m from the nest tree. However, a number of studies of eagle species (e.g. Suter & Joness 1981, Petty 1998) have suggested that buffer distances need to be context-specific: individual cases should be assessed separately because stage of breeding, nest site elevation, the extent of territory ‘core’, history of disturbance, ‘line of sight’ to disturbance source and ‘security’ of the nest can contribute to varying buffer requirements. The buffer requirement will need to be determined by the suitably-experienced ecologist, through monitoring of the site, where an active nest is located.

Conclusion

The NGBR Project has the potential to result in the removal of known (formerly occupied) or potential nesting sites, and the degradation of foraging habitat, as well as temporary noise and light disturbances to the species. The management and mitigation measures outlined will minimise these impacts, particularly with respect to the management of potential noise and light disturbances during construction; however, low level residual impacts are likely to remain.

Based on the ecology of this species (i.e. common, widespread, wide-ranging) and the removal of habitat in relation available habitat in the surrounding landscape, the NGBR Project is not likely to remove important habitat for this species. It is highly unlikely that the construction and operation of the NGBR Project will impact upon an ecologically significant proportion of the population of this species.

Residual impacts associated with the construction and operation of the NGBR Project are unlikely to result in a significant impact to this species. An assessment against the Significant Impact Guidelines is provided below in Table 7-46.

Table 7-46 Significance of residual impacts on migratory bird of prey species

Impact criteria	Project response
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	Unlikely. The NGBR Project footprint is not likely to impact an area of 'important habitat' for this species.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	Unlikely. The NGBR Project is not like to result in the establishment of any invasive species that may be harmful to the white-bellied sea-eagle. A Weed and Pest Management Plan with be implemented to manage invasive species incursions into potential white-bellied sea-eagle habitat.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	Unlikely. Loss of potential foraging and nesting habitat is not likely to seriously disrupt an ecologically significant population of this species. Similarly suitable habitats are common throughout the broader landscape. Noise and light disturbance will be managed through an Environmental Management Plan to avoid any serious disruption to this species.

7.10.33.6 Migratory wetland bird species

This section covers the following species confirmed present or likely to occur within the NGBR Project footprint: great egret, Caspian tern, glossy ibis, little tern and cattle egret.

Construction impacts

Direct impacts

Caley Valley Wetland represents an important breeding and nesting habitat for many species of wetland birds, including the migratory wetland species discussed above. Of these species, great egret, cattle egret and Caspian tern were located within the NGBR Project footprint area during the Abbot Point cumulative impact assessment Co-ordinated Migratory Bird and Waterbird

Survey (BAAM 2012); glossy ibis was confirmed present within the preliminary investigation corridor during other surveys (GHD 2013) and both this species and little tern are likely to occur within the NGBR Project footprint itself.

The NGBR Project will involve the removal of wetland habitat including approximately 17.7 ha of wetland protection area, 133.6 ha of wetland protection area trigger areas and 240.8 ha of wetland REs, all of which could be of some value to migratory wetland bird species. Wetlands of high ecological significance in Great Barrier Reef catchments are identified as wetland protection areas. Wetlands in a wetland protection area are derived using rigorous scientific mapping developed by EHP (Aquatic Biodiversity Assessment and Mapping). A wetland protection area includes a surrounding trigger area which includes a local area of hydrologic influence surrounding the wetland. The trigger area is 100 m in urban areas and 500 m outside urban areas.

The clearing of wetland habitats will therefore result in the loss of foraging and nesting habitat for migratory wetland bird species. The removal of approximately 46 ha of wetland habitat within the Caley Valley Wetland is likely to be the primary impact to migratory wetland bird species across the NGBR Project footprint.

Direct mortality as result of clearing activities also has the potential to impact migratory wetland bird species. Clearing of wetland habitat may involve the destruction of active nesting sites, resulting in the loss of eggs or mortality of young.

While the NGBR Project is likely to involve the removal of foraging and nesting habitat and potential mortality of migratory wetland bird species, impacts are not likely to be substantial at a regional scale. Suitable available habitat for these species is likely to be widespread throughout the broader landscape, particularly within the adjacent main body of the Caley Valley Wetland.

Indirect impacts

Indirect impacts throughout the construction phase of the NGBR Project are likely to include noise, light, dust and vibration disturbances, as well as the potential incursion of weed and pest species.

Noise, light, vibration and dust disturbance has the potential to limit the availability of suitable foraging and nesting habitat within the immediate surrounds of construction activities. Although these species are not considered overly-susceptible to disturbance (for example the two egret species are relatively tolerant of human activity), it is likely that construction activities will encourage the temporary dispersal of these species away from areas impacted by construction activities.

Poor waste management procedures in construction camps could also have adverse impacts on these species by increasing the abundance of and therefore localised intensity of predation by rats, cats and foxes. A Waste Management Plan will be developed and implemented for the NGBR Project and therefore the NGBR Project is unlikely to have a significant indirect impact on migratory wetland birds through increased predation by exotic predators.

Operational impacts

Direct impacts

Direct operational impacts on migratory wetland bird species as a result of the NGBR Project are anticipated to be minor. Mortality of wetland birds as a result of collision with operational vehicles does have the potential occur; however, the likelihood of such events occurring is considered to be low. The NGBR Project is not likely to have any substantial direct impact on these species throughout the operational phase.

Indirect impacts

Similar indirect impacts are anticipated throughout the operational phase of the NGBR Project to those outlined for the construction phase above. Increased human activity, particularly for the purposes of maintenance activities, is anticipated to lead to some level of noise and light disturbance to migratory wetland bird species, although the maintenance depot itself is proposed to be located within an area of (generally least concern) open woodland and interactions with wetlands and/or wetland birds will be limited as a result.

The potential for weed and pest species invasions are equally likely during the operational phase of the Project, particularly where weed seeds or pests are incidentally transported along the NGBR Project footprint. The potential introduction of weed and pest species into wetland habitat areas is likely to have a longer-term detrimental impact on migratory wetland bird species. No measurable changes to water quality or flows are expected to occur within any retained wetland habitat areas crossed by the operational NGBR Project infrastructure.

Avoidance, mitigation and management measures

Avoidance, mitigation and management measures for migratory wetland bird species will be achieved through the implementation of a Species Management Plan, to include the following:

- During detailed design, alterations to waterways will be avoided, such that impacts on water quality and downstream flows are minimised to the greatest extent practicable, particularly during the wet season. Management of erosion and sedimentation in and adjacent to cleared areas will be undertaken in accordance with an Erosion and Sediment Control Plan.
- During construction, works alongside the Caley Valley Wetland will be timed to avoid the wet season, when the greatest numbers of migratory wetland bird species are likely to be present, in order to minimise the potential impacts upon these species. The wetland has been identified as the key resource for the majority of migratory wetland bird species of potential relevance to the NGBR Project. These birds (and thus the greatest potential for disturbance and displacement) are likely to be present in the greatest numbers between the months of October and March (depending upon the precise timing of the wet season event in any particular year), although it is acknowledged that some of these species may breed within the wetland area and lesser numbers are therefore potentially present year-round.
- During construction, any watercourse areas crossed will be restored and rehabilitated with measures to improve connectivity and provide enhancements to suitable habitat. Active, targeted management of habitats adjacent to the NGBR Project footprint can improve their quality for migratory species and should particularly be the focus of actions around the area of Caley Valley Wetland. This may include, but not be limited to, improving foraging and roosting and resources, and the management of pest and weed species if already present, to enhance the value of areas adjacent to the footprint.
- During construction, dust generated by clearance will be managed by dust suppression activities, as part of the NGBR Project Environmental Management Plan, to be undertaken where appropriate, including during the stabilisation of disturbed areas as soon as practicable after disturbance.

Conclusion

All of these species are generally widespread and abundant species that are not particularly under threat at this time. They are also species that are not overly-susceptible to disturbance (with the exception of tern species at breeding colonies, of which none are known to occur within the preliminary investigation corridor) and will habituate to some level of disturbance (noise, light, dust, movement, human activity, etc.). Furthermore, they are relatively generalist in their habitat requirements, using a range of different open and closed wetlands across freshwater, brackish and coastal environments, and there is a broad availability of comparable habitats within the wider landscape adjacent to the preliminary investigation corridor.

Given their abundance and wide range across the region, their general tolerance to background disturbance, and the availability of similar habitat within adjacent landscapes, the areas to be subject to clearance within the NGBR Project footprint are not considered to constitute important habitat for these migratory wetland bird species.

Residual impacts associated with construction and operation of the NGBR Project are unlikely to result in a significant impact to migratory wetland species at Caley Valley Wetland, or at other discrete wetland locations (such as large farm dams) along the final rail corridor. An assessment against the Significant Impact Guidelines is provided below in Table 7-47.

Table 7-47 Significance of residual impacts on migratory wetland bird species

Impact criteria	Project response
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	Unlikely. The NGBR Project footprint is not likely to substantially modify, destroy or isolate an area of 'important habitat' for these migratory wetland bird species.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	Unlikely. The NGBR Project is not like to result in the establishment of any invasive species that may be harmful to these migratory wetland bird species. A Weed and Pest Management Plan with be implemented to manage invasive species incursions into adjacent wetland habitat.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	Unlikely. A relatively minor loss of potential foraging and nesting habitat is not likely to seriously disrupt an ecologically significant population of these migratory wetland bird species. Similarly suitable habitats are common throughout the broader landscape. Noise, light, vibration and dust disturbance will be managed through an Environmental Management Plan to avoid any serious disruption to these species.

7.10.33.7 Migratory shorebird species

This section covers the following likely to occur species: common sandpiper, sharp-tailed sandpiper, red-necked stint, greater sand plover, lesser sand plover, Latham's snipe, grey-tailed tattler, bar-tailed godwit, eastern curlew, little curlew, whimbrel, grey plover, marsh sandpiper, and terek sandpiper.

Of these species, common sandpiper, sharp-tailed sandpiper, red-necked stint, Latham's snipe, eastern curlew, whimbrel and marsh sandpiper have been recorded during previous surveys of the broader Caley Valley Wetland (BAAM 2012), the main body of which lies adjacent to the NGBR Project footprint. Not all of these species will necessarily occur within the NGBR Project footprint at the eastern extent of the mapped wetland area. In fact, during the BAAM (2012) surveys, a single marsh sandpiper was the only migratory shorebird species seen within (or directly adjacent to) the NGBR Project footprint.

Construction impacts

Direct impacts

The final rail corridor runs alongside the main body of the Caley Valley Wetland (in the vicinity of Abbot Point), which represents the most significant foraging and roosting habitat resource for migratory shorebirds within the vicinity of the NGBR Project footprint. Nevertheless, there is a minor, but direct, interface with the mapped wetland area, where existing road and rail infrastructure bridges cross wetland habitat south of Abbot Point and may result in the loss of up to approximately 46 ha of wetland vegetation. No other significant areas of wetland habitat of potential value to migratory shorebirds occur within the NGBR Project footprint.

Indirect impacts

Because of its sensitivity, this area is likely to be more susceptible to the adverse impacts of disturbance than other areas within the NGBR Project area, but no permanent diversions of water or changes to the condition of that habitat (quantity of flow etc.) are anticipated to occur.

Whilst construction through this wetland area may temporarily sterilise the habitat immediately surrounding the NGBR Project footprint, this disturbance impact will be limited in extent and short-term, for the duration of construction activities only. The ongoing use of the greater wetland area and adjacent coastline by thousands of shorebirds each year, despite exposure to chronic, low-level industrial noise associated with the operation of existing coal handling facilities at the nearby Abbot Point Coal Terminal 1, suggests a level of habituation to noise (BAAM 2012). Shorebirds have probably also habituated to existing stationary lighting; some shorebird species have in fact been shown to capitalise on artificially lit environments and actively move to illuminated sites at night (Rohweder and Baverstock, 1996) and are therefore unlikely to be negatively impacted by short-term construction lighting.

Given the existing infrastructure crossing the Caley Valley Wetland in the area of proposed impact and the existing levels of indirect disturbance to the wetland as a whole (e.g. ambient industrial noise levels), the additional indirect impact of construction is considered highly unlikely to have a significant impact to migratory shorebird species.

Operational impacts

Direct impacts

Direct operational impacts to migratory shorebirds are anticipated to be low. Any risks of wetland habitat adjacent to the NGBR Project footprint being degraded over time will be managed through operational management and monitoring activities, such that water quality and/or flows will not be compromised, and the risk of pollution events will be negligible.

Collision risk with operational trains is anticipated to be negligible. Migratory shorebird species may cross the NGBR Project footprint if moving between the Caley Valley Wetland and the coastal habitats to its east. However, the surveys carried out by BAAM (2012) will suggest that the beaches to the west of Abbot Point (such as Dingo Beach) are utilised to a far greater extent by migratory shorebirds and that the eastern beaches support a few individuals of a few species only. Furthermore, these flights across the NGBR Project footprint are likely to take place at height, rather than close to ground-level where collision could occur.

Indirect impacts

Disturbance by operational trains is predicted to be low, particularly when compared to the acknowledged disturbance threats to migratory shorebirds from people and pets as part of recreational and tourism activities. Algers *et al.* (1978) shows that birds, in general, tend to adapt to steady state noise levels, even of a relatively high level (in the order of 70 dB(A)) and operational disturbance is likely to be less than that of construction as a result. These disturbances, in the context of existing background noise levels, are not anticipated to have any measurable effect upon migratory shorebirds, particularly given that the perimeter of the main body of the Caley Valley Wetland lies more than 100 m to the west of the NGBR Project footprint and existing operational train movements already occur in this area to service the nearby Abbot Point Coal Terminal 1. If birds are displaced from a zone around the operational infrastructure more permanently, this zone is likely to be narrow and the birds are likely to return to these areas in between the passage of trains.

No lighting impacts are predicted during the operational phase, as no additional lighting is proposed in the vicinity of Caley Valley beyond that which already exists around existing infrastructure and industry.

Avoidance, mitigation and management measures

Avoidance, mitigation and management measures for migratory shorebird species will be achieved through the implementation of a Species Management Plan, to include the following:

- During detailed design, alterations to waterways will be avoided, such that impacts on water quality and downstream flows are minimised to the greatest extent practicable, particularly during the wet season. Management of erosion and sedimentation in and adjacent to cleared areas will be undertaken in accordance with an Erosion and Sediment Control Plan.
- During construction, works alongside the Caley Valley Wetland should be timed to avoid the wet season, when the greatest numbers of migratory shorebird species are likely to be present, in order to minimise the potential impacts upon these species. The wetland has been identified as the key resource for the majority of migratory shorebird species of potential relevance to the NGBR Project. These birds (and thus the greatest potential for disturbance and displacement) are likely to be present between the months of October and March, with the highest numbers of birds generally present between December and February (depending upon the precise timing of the wet season event in any particular year).
- During construction, any watercourse areas crossed will be restored and rehabilitated with measures to improve connectivity and provide enhancements to suitable habitat. Active, targeted management of habitats adjacent to the NGBR Project footprint can improve their quality for migratory species and should particularly be the focus of actions around the area of Caley Valley Wetland. This may include, but not be limited to, improving foraging and roosting and resources, and the management of pest and weed species (via a Weed and Pest Management Plan) if already present, to enhance the value of areas adjacent to the footprint.
- During construction, dust generated by clearance will be managed by dust suppression activities, as part of the NGBR Project Environmental Management Plan, to be

undertaken where appropriate, including during the stabilisation of disturbed areas as soon as practicable after disturbance.

- During construction, noise will be limited to general building work hoursand noise levels monitored, in particular where directly adjacent to sensitive shorebird receptors, namely the Caley Valley wetland.
- During construction, light spill into adjacent retained habitats (particularly adjacent to the Caley Valley wetland) will be minimised through the use of directional lighting and shields.

Conclusion

The construction and operation of the NGBR Project are unlikely to have a significant impact on migratory shorebird species, based on the Significant Impact Guidelines and as outlined in Table 7-48.

Table 7-48 Significance of residual impacts on migratory shorebird species

Impact criteria	Project response
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	Unlikely. The main body of the Caley Valley Wetland (acknowledged as important habitat for sharp-tailed sandpiper, red-necked stint and Latham’s snipe) lies adjacent to, but not within, the NGBR Project footprint. Minimal amounts of potential habitat for shorebirds (up to 46 ha) will be lost to the footprint, the wetland will not be fragmented or isolated beyond its existing condition (other nearby infrastructure already in existence) and, given the implementation of the various construction management plans, the wetland will not be adversely modified.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	Unlikely. The NGBR Project’s EMP and, in particular, Weed and Pest Management Plan will minimise the risk of the establishment of invasive species within the Caley Valley Wetland (important habitat for the aforementioned three shorebird species).
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	Unlikely. Ecologically significant proportions (>0.1%) of the populations of three shorebird species are known to occur across the broader Caley Valley Wetland area. None of these are known to occur within the NGBR Project footprint itself, but may occur in small numbers in directly adjacent areas that could be indirectly impacted by the NGBR Project (construction noise, for example). This level of impact is highly unlikely to constitute a serious disruption to the lifecycle of those species, in terms of feeding, migration or resting behaviour).

7.10.33.8 Dugong

Direct impacts

The NGBR Project will not have any direct impacts on dugong.

Indirect impacts

A decrease in water quality within foraging areas (such as seagrass meadows) of the GBRWHA and GBRMP from runoff of sediments and nutrients could degrade foraging resources for marine fauna species, including dugong. Elevated sediment and nutrient concentrations can negatively affect seagrass beds. Three major factors cause a reduction in light availability (Shepherd *et al.* 1989; Walker and McComb 1992; Abal and Dennison 1996) and consequently cause a reduction in the photosynthetic capability of affected seagrass:

- Chronic increases in dissolved nutrients leading to a proliferation of light absorbing algae including water column phytoplankton, benthic macroalgae or algal epiphytes on seagrass stems and leaves
- Chronic increases in suspended sediments leading to increased water column turbidity
- Pulsed increases in suspended sediments and/or phytoplankton blooms that cause a dramatic reduction of water column light penetration for a limited time.

Large-scale die-off of seagrass is commonly caused by smothering and lack of light as a result of high levels of suspended sediments. Although sedimentation can occur naturally, particularly as a result of cyclones and extreme rainfall events, it has been enhanced by clearing of inland and coastal vegetation, which has increased erosion and therefore the transport of sediments into rivers, estuaries and coastal waters (Green and Short 2003).

The loss of seagrass habitats in the Abbot Bay and Upstart Bay may have an impact on dugongs. As seagrass habitats are prevalent throughout the wider coastal area, and dugongs are highly mobile species, it is possible that a loss of foraging habitat will adversely affect the species at the local level and result in their movement to other areas. However, as described in Section 7.6.3, the proposed mitigation measures and the distance from the Great Barrier Reef including barriers are expected to largely prevent water quality and flow impacts from construction activities having a direct or indirect influence, on the protected values (including seagrass) of the marine environment. It is considered unlikely that the NGBR Project will indirectly impact dugong.

Avoidance, mitigation and management measures

The marine environment within Upstart and Abbot Bays is characterised by a predominantly heterogeneous habitat of soft-sediment, seagrass and algae not unique to the region, with highly variable water depths partitioned by shoals and channels. These communities are well represented across the area at a range of depths, and as found in the previous studies.

Construction and operation of the NGBR Project has a minor potential to increase sediment and nutrient loads if stormwater, wastes and other pollutant sources are not appropriately managed. Environmental control measures proposed for the NGBR Project, including stormwater management measures, will manage this risk. These will be achieved through the implementation of a Species Management Plan.

Conclusion

Impacts associated with the construction and operation of the NGBR Project are unlikely to have a significant impact on dugong, based on the Significant Impact Guidelines and as outlined in Table 7-49.

Table 7-49 Significance of residual impacts on dugong

Impact criteria	Project response
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	Unlikely. The NGBR Project will not directly impact on dugong and the broader Abbot Point area is not considered to be important habitat for dugong.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	Unlikely. The NGBR Project is entirely terrestrial and will not result in the establishment of an invasive marine species. The broader Abbot Point area is not considered to be important habitat for dugong.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	Unlikely. The NGBR Project will not directly impact on dugong and the broader Abbot Point area is not considered to support an ecologically significant proportion of a population of dugong.

7.10.33.9 Estuarine crocodile

Direct impacts

The NGBR Project will not have any direct impacts on estuarine crocodile.

Indirect impacts

Potential impacts on the estuarine crocodile include the degradation of habitat from changes in water quality used by these animals on a seasonal, semi-permanent or permanent basis. Habitat areas that may be of importance include the Caley Valley Wetland. The final rail corridor will not intersect the main body of the Caley Valley Wetland; however, it will still intersect areas designated within the overall wetland boundary. It is considered unlikely that NGBR Project will indirectly impact the estuarine crocodile.

Avoidance, mitigation and management measures

Construction and operation of the NGBR Project has a minor potential to increase sediment and nutrient loads if stormwater, wastes and other pollutant sources are not appropriately managed. Environmental control measures proposed for the NGBR Project, including stormwater management measures, will manage this risk. These will be achieved through the implementation of a Species Management Plan.

Conclusion

Impacts associated with the construction and operation of the NGBR Project are unlikely to have a significant impact on estuarine crocodile, based on the Significant Impact Guidelines and as outlined in Table 7-50.

Table 7-50 Significance of residual impacts on estuarine crocodile

Impact criteria	Project response
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	Unlikely. No part of the NGBR Project footprint is considered to be important habitat for estuarine crocodile.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	Unlikely. The NGBR Project is entirely terrestrial and will not result in the establishment of an invasive marine species. No part of the NGBR Project footprint is considered to be important habitat for estuarine crocodile.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	Unlikely. The NGBR Project will not directly impact on estuarine crocodile and the broader Abbot Point area is not considered to support an ecologically significant proportion of a population of estuarine crocodile.

7.10.33.10 Inshore dolphins

Direct impacts

The NGBR Project will not have any direct impacts on inshore dolphins.

Indirect impacts

A decrease in water quality within foraging areas of the GBRWHA and GBRMP from runoff of sediments and nutrients can degrade foraging resources for dolphin species. The loss of seagrass habitats in the Abbot Bay and Upstart Bay may have an adverse effect on dolphin species at the local level and result in their movement to other areas. However as described above in relation to dugong, the proposed mitigation measures and distance from the GBR including barriers are expected to largely prevent water quality and flow impacts from construction activities having a direct or indirect influence, on the protected values (including seagrass) of the marine environment. It is considered unlikely that the NGBR Project will indirectly impact dolphins.

Avoidance, mitigation and management measures

The marine environment within Upstart and Abbot Bays is characterised by a predominantly heterogeneous habitat of soft-sediment, seagrass and algae not unique to the region, with highly variable water depths partitioned by shoals and channels. These communities are well represented across the area at a range of depths, and as found in the previous studies.

Construction and operation of the NGBR Project has a minor potential to increase sediment and nutrient loads if stormwater, wastes and other pollutant sources are not appropriately managed. Environmental control measures proposed for the NGBR Project, including stormwater management measures, will manage this risk. These will be achieved through the implementation of a Species Management Plan.

Conclusion

Impacts associated with the construction and operation of the NGBR Project are unlikely to have a significant impact on inshore dolphin species, based on the Significant Impact Guidelines and as outlined in Table 7-51.

Table 7-51 Significance of residual impacts on inshore dolphin species

Impact criteria	Project response
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	Unlikely. The proposed mitigation measures as well as the distance from the GBR and physical barriers (dam, weirs, etc.) will reduce water quality and flow impacts due to the preliminary investigation corridor from having an influence, directly or indirectly, on inshore dolphins.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	Unlikely. The NGBR Project is entirely terrestrial and will not result in the establishment of an invasive marine species.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	Unlikely. The proposed mitigation measures as well as the distance from the GBR and physical barriers (dam, weirs, etc.) will reduce water quality and flow impacts due to the NGBR Project from having an influence, directly or indirectly, on inshore dolphins.

7.10.34 Proposed monitoring

Where populations of listed migratory species are found during the development of the NGBR Project, an adaptive management and mitigation approach may be required, involving the collection of monitoring data to inform and improve appropriate levels of management and corrective actions over time.

Monitoring of weed and pest species presence and abundance will need to be undertaken during the construction and operation of the NGBR Project. The Weed and Pest Management Plan should include details relating to the monitoring, management and, where necessary, eradication of problem species. For weeds, this will include the disposal of green waste and vehicle/plant weed wash down protocols.

The NGBR Project will also monitor remnant vegetation communities along the edge of the footprint (with a focus on endangered and of concern REs that are the constituents of TECs) for the presence of weeds, (including buffel grass). Eradication and/or rehabilitation/restoration activities, to prevent the spread of these species into remnant vegetation areas, and the subsequent flow-on effects to listed migratory species, will be carried out as required.

A Fire Management Plan will be developed to document protocols and actions for preventing accidentally-lit fires, and outline how fuel loads will be monitored and maintained across the NGBR Project footprint (and adjacent areas, as necessary).

A Water Quality Management Plan will also be established to monitor changes in the water quality of the Caley Valley Wetland and other major watercourses to minimise the risk of habitat degradation for listed migratory species. This will include, but not be limited to:

- Regular checks, including checks before and after rain events, of erosion and sediment control devices to make sure these are in good working order
- Inspections of streams for scouring and sediment deposition.

7.10.35 Summary

A summary of potential direct and indirect impacts, proposed mitigation measures and residual impact assessment is provided below in Table 7-52.

Table 7-52 Summary of potential impacts, mitigation measures and residual impacts

MNES	Potential direct impacts	Potential indirect impacts	Proposed mitigation measures	Residual impact assessment against the Guidelines	Offsets required?
Migratory aerial bird species	**Construction**: Very low potential for collision with infrastructure.	**Construction:** Localised depletion of invertebrate prey food availability as a result of vegetation clearing.	Any new powerline infrastructure should be fitted with high visibility markings to reduce collision risk to migratory aerial bird species	Unlikely	No
Migratory woodland bird species	**Construction:** Loss and fragmentation of woodland habitats. **Operation:** Very low potential for collision with vehicles or permanent infrastructure.	**Construction:** Disturbance through noise, light, dust and vibration. Increased localised abundance of pest species as a result of poor waste management. **Operation**: Noise and dust disturbance from coal trains, loading facilities and maintenance vehicles.	Undertake vegetation clearing outside of breeding season wherever possible to minimise disruption of breeding and nesting activities. Implement Weed and Pest Management Plan to manage incursion of invasive species and reduce the risk of habitat degradation.	Unlikely	No
Migratory bird of prey species	**Construction:** Loss of nesting sites and foraging habitat. **Operation:** Very low potential for collision with vehicles or permanent infrastructure.	**Construction:** Potential for disturbance through noise, light, dust and vibration to impact nesting activities. **Operation:** Potential for disturbance through noise, light, dust and vibration to impact nesting activities.	Avoidance of active nests during construction and establishment of management areas around such features.	Unlikely	No

MNES	Potential direct impacts	Potential indirect impacts	Proposed mitigation measures	Residual impact assessment against the Guidelines	Offsets required?
Migratory wetland bird species	**Construction:** Loss of foraging and nesting habitat for migratory wetland bird species. Destruction of active nests could lead to loss of eggs or mortality of young. **Operation:** Very low potential for collision with vehicles or permanent infrastructure.	**Construction**: Disturbance through noise, light, dust and vibration. Increased localised abundance of pest species as a result of poor waste management. **Operation**: Disturbance through noise, light, dust and vibration. Increased localised abundance of pest species as a result of poor waste management.	Construction works should be timed to avoid wet season. Alterations to waterways will be avoided, such that impacts on water quality and downstream flows are minimised to the greatest extent practicable. Any watercourse areas crossed will be restored and rehabilitated with measures to improve connectivity and provide enhancements to suitable habitat. Dust generated by vegetation clearing will be managed by dust suppression activities.	Unlikely	No
Migratory shorebird species	**Construction:** Loss of foraging and roosting habitat for migratory shorebird species. **Operation:** Risk of degradation in water quality. Very low potential for collision with vehicles or permanent infrastructure.	**Construction:** Disturbance through noise, light, dust and vibration in a localised area. **Operation**: Low level disturbance through noise and light in a localised area.	Construction works should be timed to avoid wet season. Alterations to waterways will be avoided, such that impacts on water quality and downstream flows are minimised to the greatest extent practicable. Any watercourse areas crossed will be restored and rehabilitated with measures to improve connectivity and provide enhancements to suitable habitat. Dust generated by vegetation clearing will be managed by dust suppression activities.	Unlikely	No

MNES	Potential direct impacts	Potential indirect impacts	Proposed mitigation measures	Residual impact assessment against the Guidelines	Offsets required?
Dugong	No potential direct impact	Degradation of habitat due to water quality impacts from sedimentation or pollution.	Implementation of an Erosion and Sediment Control Plan as outlined in Section 7.14.4.	Unlikely	No
Estuarine crocodile	No potential direct impact	Degradation of habitat due to water quality impacts from sedimentation or pollution.	Implementation of an Erosion and Sediment Control Plan as outlined in Section 7.14.4.	Unlikely	No
Inshore dolphins	No potential direct impact	Degradation of habitat due to water quality impacts from sedimentation or pollution.	Implementation of an Erosion and Sediment Control Plan as outlined in Section 7.14.4.	Unlikely	No

7.11 Commonwealth Marine Area

7.11.1 Overview

The Commonwealth marine area (CMA) is any part of the sea, including the waters, seabed, and airspace, within Australia's exclusive economic zone (EEZ) and/or over the continental shelf of Australia, that is not State or Northern Territory waters (SEWPaC 2013). The CMA stretches from three to 200 nautical miles from the coast and is considered a matter of national environmental significance under the EPBC Act.

Where an action is proposed within the CMA, assessment is required to determine whether the action will result in a significant impact to the CMA. An action will require approval if the:

- Action is taken in a CMA and the action has, will have, or is likely to have a significant impact on the environment or
- Action is taken outside a CMA and the action has, will have, or is likely to have a significant impact on the environment in a CMA.

7.11.2 Existing environmental values

The NGBR Project is wholly terrestrial in nature, and therefore is not located within the boundaries of the CMA, however there is an indirect hydrological connection between the CMA and watercourses crossed by the NGBR Project final rail corridor. Impacts on the hydrology and water quality of these waterways may indirectly impact the existing condition of the CMA.

The CMA encompasses the GBRMP which is considered to be of high conservation value under the EPBC Act. A detailed description of the existing environmental values of the GBRMP is provided in Section 7.7.2. The values of the CMA in proximity to the NGBR Project are generally identical to those of the GBRMP; the primary difference is that all habitat within three nautical miles of the coastline is excluded from the CMA.

Additionally, the The Coral Sea Commonwealth marine reserve has the potential to be indirectly impacted by the construction and operations of the NGBR Project.

The Coral Sea Commonwealth marine reserve

The Coral Sea marine region is a remote ocean ecosystem recognised for its unique physical, ecological and heritage values (DOE 2013). The Coral Sea encompasses a diverse array of natural oceanic formations including coral reefs, sandy cays, deep sea plains and canyons.

The islands within the Coral Sea support critical nesting sites for green turtles and a range of seabird species (DOE 2013).

A management plan has been prepared for the marine reserve and is currently under review; currently, transitional management arrangements have been enforced until the plan comes into effect (DOE 2013). The marine reserve comprises an area of 989,842 km^2 and boasts several management zones including (DOE 2013):

- Marine National Park Zone (IUCN Category II) - 502 626 km^2 or 50.78% of reserve
- Habitat Protection Zone Coral Sea (IUCN Category IV) - 182 564 km^2 or 18.44% of reserve
- Habitat Protection Zone Seamounts (IUCN Category IV) - 85 507 km^2 or 8.64% of reserve

- Conservation Park Zone (IUCN Category IV) - 20 570 km^2 or 2.08% of reserve
- Multiple Use Zone (IUCN Category VI) - 194 233 km^2 or 19.62% of reserve
- General Use Zone (IUCN Category VI) - 4 300 km^2 or 0.43% of reserve.

The key conservation values associated with the Coral Sea Commonwealth marine reserve include (DOE 2013):

- Habitat and important areas for a range of species including:
  - Humpback whales
  - Green turtles;
  - Multiple seabird species
  - White sharks and whale sharks
  - Small fish schools, billfish, tuna and sharks
- The East Australian Current forms in the region and is considered a major pathway for mobile predators such as billfish and tuna
- Heritage values include several historic shipwrecks including three World War II shipwrecks from the Battle of the Coral Sea.
- The reserve represents the full range of seafloor features found in the region
- Six provincial bioregions, 94 depth ranges and 16 seafloor types are represented in the reserve.

It is noted that the potential impacts of the NGBR Project on the conservation values of the reserve and the CMA, are confined to the consequential impacts of increased shipping activity. A comprehensive study of the impacts of shipping activity on the Great Barrier Reef has been undertaken as part of the CIA for Abbot Point (ELA and Open Lines 2012) and is considered outside the scope of this assessment. The existing shipping acitivity currently experienced at the Port of Abbot Point is outlined below.

Existing shipping activity at Abbot Point

Shipping numbers at Abbot Point have experienced a marked increase since 2002 from 119 vessels to 174 recorded in 2012 (ELA and Open Lines 2012). The vessels utilising the port comprise a combination of the following (ELA and Open Lines 2012):

- Handimax (40,000-60,000 Dry Weight Tonnes [DWT], average 52,000 DWT)
- Panamax (60,000-90,000 DWT, average 80,000 DWT)
- Small Capesize (90,000-130,000 DWT, average 100,000 DWT).

The average vessel capacity in the 2011-12 financial year was 78,000 DWT per vessel; it is expected however, that in future years, the capacity of vessels accessing the Port of Abbot Point will increase in accordance with the expansion of the port and subsequent increase in port capacity (ELA and Open Lines 2012).

The type of bulk carriers which access the Port of Abbot Point are generally propelled by a single diesel engine and reach an average cruising speed of around 14 kts to 15 kts (PGM Environment 2012). The existing throughput at the port of approximately 13.5 mtpa generally requires around 174 ship calls; subsequently, the ships have sufficient room to allow for safe anchoring within port waters (ELA and Open Lines 2012).

The vast majority (greater than 80%) of vessels which access the Port of Abbot Point, approach from the north via the Palm Passage (refer to Figure 7-36). The Palm Passage allows for easy navigation through the Great Barrier Reef due to its wide, deep and straight configuration (ELA and Open Lines 2012).

7.11.3 Potential impacts and mitigation

7.11.3.1 Overview

This section discusses the outcomes of the assessment undertaken to determine the significance of the potential impacts of the NGBR Project on the environmental values of the CMA. The assessment has been undertaken in accordance with the criteria outlined in the Significant Impact Guidelines.

These criteria state that an action is likely to have a significant impact on the environment of the CMA if there is a real chance or possibility that the action will:

- Result in a known or potential pest species becoming established in the CMA
- Modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in a CMA results
- Have a substantial adverse effect on a population of a marine species or cetacean including its life cycle and spatial distribution
- Result in a substantial change in air quality or water quality (including temperature) which may adversely impact on biodiversity, ecological integrity; social amenity or human health
- Result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected, or
- Have a substantial adverse impact on heritage values of the CMA, including damage or destruction of an historic shipwreck.

7.11.3.2 Construction and operations phase – potential impacts

The CMA boundary lies three nautical miles off the coast and the final rail corridor therefore does not directly traverse the CMA. It is subsequently expected that the construction and operations activities associated with the NGBR Project (i.e. vegetation clearing, cut and fill activities, train movements and maintenance etc.) will not directly affect the existing environmental values of the CMA.

However, there is the potential for indirect impacts to affect the quality of the marine environment within the CMA; these indirect impacts include:

- Changes in water quality in the CMA
- Increased shipping in the CMA.

Potential impacts – Changes in water quality

There is the potential for indirect impacts such as minor increases in sediment load in runoff or accidental spillages of contaminants at watercourse crossings in upstream catchments, to to degrade downstream water quality and subsequently affect the quality of the marine environment within the CMA. These impacts however are expected to be negligible given the separation distance between the CMA and the waterways potentially affected by the NGBR Project.

Potential impacts – Increased shipping

A review of the existing shipping activity occurring within the Great Barrier Reef was undertaken in 2012 (PGM Environment 2012); the review analysed the current and projected future shipping activity within the Great Barrier Reef, with particular attention placed on the impacts to the values of the GBRWHA. Subsequently, a review of the existing and projected increase in shipping activity at Abbot Point was undertaken in 2012 (ELA and Open Lines 2012) which identified past and current trends in shipping numbers, projected increase to shipping numbers and the associated impacts of the increased shipping on the environmental values of the Great Barrier Reef.

It is anticipated that the number of vessels calling in to the Port of Abbot Point will increase in accordance with the expansion of the port and subsequent increase in port capacity (ELA and Open Lines 2012). Norht Queensland Bulk Porst (NQBP) has provided projected ship forecast data for the Port of Abbot Point which considers the proposed expansion of the port in conjunction with industrial factors; the projections anticipate an annual growth rate of approximately 11% over the 20-year period (2012-2032) with a predicted total of 808 ship calls in 2020 and 1,640 calls in 2032 (ELA and Open Lines 2012).

The NGBR Project is not expected to directly increase the capacity of the Port of Abbot Point however, due to the proposed 100 mtpa capacity of the NGBR Project, the rail line will facilitate the increase in shipping activity by allowing the operations of the port to realise its existing and proposed capacity. In general, an increase in 30 mtpa approximately equates to an additional 240 ship calls per year (ELA and Open Lines 2012); in this regard, the operations of the NGBR Project will indirectly facilitate an additional up to 800 ship movements per year at full capacity (based on current average ship size). It is noted that this number may be reduced where relevant planned and future upgrades to facilities enable larger capacity vessels to access the port.

It is noted however, that the capacity of the existing port coupled with the proposed expansion at Abbot Point, will inherently result in an increase in shipping numbers and the contribution of the NGBR Project to shipping activity in the port will not affect the significance of the impacts already associated with the port development.

The following events have the potential to occur as a result of increased shipping activity in the port (ELA and Open Lines 2012):

- Groundings and collisions
- Oil spills
- Introduction of marine pests
- Underwater radiated noise
- Increased lighting from ships
- Increased number of marine fauna strike incidents.

These events have the potential to result in the following impacts which may affect the marine environment values associated with the CMA (ELA and Open Lines 2012):

- Direct impacts to sensitive areas from ship groundings/collisions e.g. scars on coral reefs from ship grounding

- Direct impacts to sensitive areas from smothering e.g. mangrove forests smothered with oil slicks as a result of oil spills
- Indirect or flow on effects of grounding, collision, oil spills e.g. habitat loss for fauna species, interruptions to nutrient cycling
- Physiological effects to marine species from contact with oil and/or other contaminants
- Habitat damage due to grounding, collision, oil spill
- Direct and indirect impacts from pests
- Accumulation of chemicals and/or heavy metals in the marine environment.

It is anticipated that these events will be appropriately managed under the operational guidelines of NQBP (including the use of accredited marine pilots) and the likelihood of occurrence of these impacts will therefore be greatly reduced. Industry standards mandate regular monitoring of shipping movements and appropriate maintenance of vessels entering the Great Barrier Reef. The projected increase in shipping numbers is expected to stimulate further development and regulation of these standards across the industry (ELA and Open Lines 2012). The implementation of appropriate standards and management plans at the Port of Abbot Point will significantly reduce the risk of shipping incidents related to port activities and the likelihood of occurrence of adverse impacts to MNES will therefore be minimised.

7.11.4 Significance of residual impacts

This section describes and assesses the significance of the residual impacts of the NGBR Project to environmental values associated with the CMA. The residual impacts discussed in this section refer to the expected impact of the NGBR Project once all relevant management and mitigation measures have been implemented.

As outlined in Section 7.16, an action will require approval under the EPBC Act where:

- The action is taken in a CMA and the action has, will have, or is likely to have a significant impact on the environment, or
- The action is taken outside a CMA and the action has, will have, or is likely to have a significant impact on the environment in a CMA.

An action is considered to have a significant impact on the CMA where there is the potential that the action will trigger one or more of the significant impact criteria outlined in the Significant Impact Guidelines. Table 7-53 provides an assessment of the residual impacts of the NGBR Project against these criteria and identifies the likelihood of the project activities resulting in a significant impact to the CMA.

Table 7-53 Residual impact significance – Commonwealth marine area

Significant impact criteria	Residual impact significance
Result in a known or potential pest species becoming established in the CMA	The NGBR Project is entirely terrestrial and does not involve any activities (such as shipping) that could directly result in any known or potential pest species being introduced or established in the CMA. As discussed in Section 7.11, there is the potential for indirect or consequential impacts of the project to result in an increase in shipping activity in the CMA by facilitating an increase in the tonnage of coal being exported from the Port of Abbot Point. It is expected that the implementation of industry standard pest

Significant impact criteria	Residual impact significance
	management measures will minimise the the liklelihood of the introduction of pest species associated with an increase in vessel numbers.
Modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in a CMA results	The boundary of the CMA lies three nautical miles off the coastline and it is not expected that the NGBR Project will result in any residual impacts which will directly affect the existing habitat or ecosystem integrity of the area. Any impacts associated with the marine environment are likely to be confined within the immediate coastal and inshore habitat zone and of a negligible magnitude (refer to Section 7.6.3). It is therefore unlikely that the NGBR Project will adversely affect the health, functioning or integrity of the marine ecosystem within the CMA. The implementation of operational guidelines of NQBP (including the use of accredited marine pilots) will minimise the likelihood of occurrence of any direct impacts to the marine ecosystem as a result of groundings / collisions / oil spills facilitated by increased shipping at the Port of Abbot Point.
Have a substantial adverse effect on a population of a marine species or cetacean including its life cycle and spatial distribution	The NGBR Project is not likely to result in residual impacts on the life cycle or spatial distribution of individual species / cetaceans; this is discussed in further detail in Section 7.10.
Result in a substantial change in air quality or water quality (including temperature) which may adversely impact on biodiversity, ecological integrity; social amenity or human health	A conservative air quality assessment was undertaken for the NGBR Project and it was determined that any change to background air quality will be negligible at all of the identified sensitive receptors. On the basis of this assessment and following the implementation of an appropriate dust management plan, no residual air quality impacts are expected to result from the NGBR Project. The NGBR Project is not expected to result in any residual impacts which will adversely affect water quality; therefore the NGBR Project is not expected to adversely impact on the ecological functions of the CMA.
Result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected, or	A water quality management plan will be developed prior to the commencement of construction activities and implemented throughout the life of the NGBR Project (refer to Section 7.6.3). The boundary of the CMA lies three nautical miles off the coastline and it is not expected that the NGBR Project will result in the accumulation of contaminants in the marine environment within the CMA. Subsequently, no residual impacts on the marine environment within the CMA are anticipated.

Significant impact criteria	Residual impact significance
Have a substantial adverse impact on heritage values of the CMA, including damage or destruction of an historic shipwreck.	The NGBR Project is entirely terrestrial and will not have an impact on the heritage values of the CMA. There are no historic shipwrecks located in the vicinity of the area likely to be affected by the NGBR Project.

7.11.5 Proposed monitoring and reporting

The implementation of the mitigation and management measures discussed in Section 7.11.3 is expected to minimise the potential impacts of the NGBR Project on the CMA. The management plans developed will also incorporate a monitoring program during both the construction and operations phase to ensure that any changes in water quality directly associated with NGBR Project activities is remedied in a timely manner.

The monitoring programs will be incorporated into each management plan as required and conditioned under the approval for the NGBR Project. Each monitoring program will specifically identify the following components which will be finalised prior to commencement of construction activities:

- Monitoring locations
- Frequency of monitoring
- Trigger levels for each contaminant
- Response protocols where trigger levels are exceeded
- Reporting requirements.

Further detail regarding the proposed monitoring and reporting strategies to be implemented during the NGBR Project is provided in Section 7.14.

7.12 Other uses of the study area and nearby areas

The potential impacts of the NGBR Project on other uses within the preliminary investigation corridor have been considered throughout other chapters of the EIS as follows:

- Relevant social, cultural and heritage values for each stage of the NGBR Project are considered within Volume 1 Chapter 16 Social and economic impacts and Volume 1 Chapter 15 Cultural heritage respectively
- Current and projected commercial, recreational and scientific use, including any changes in visitation patterns are considered in Volume 1 Chapter 3 Landuse and tenure, and Volume 1 Chapter 16 Social and economic impacts
- Heritage and social values, including sites of historic or archaeological significance are considered in Volume 1 Chapter 16 Social and economic impacts and Volume 1 Chapter 15 Cultural heritage respectively
- Traditional use activities are considered in Volume 1 Chapter 15 Cultural heritage.

The potential impacts of the NGBR Project on commercial and recreational fishing within or adjacent to the preliminary investigation corridor may include:

- Loss or degradation of fish habitat during construction within or adjacent to water courses
- Degradation of water quality through increased sedimentation or accidental spills or leakages

- Changes to hydrology and hydraulics within watercourses.

The potential impacts of the NGBR Project on fish are discussed in Volume 1 Chapter 8 Nature conservation. The potential impacts of the NGBR Project on water resources within the study area are discussed in Volume 1 Chapter 8 Water resources. Construction and operation of the NGBR Project are not anticipated to impact any existing access tracks to water courses.

7.13 Cumulative and consequential impacts

The section assesses the cumulative impacts of the NGBR Project with those of other proposed projects in the region as they relate specifically to MNES. The scope of this cumulative impact assessment was defined by the following tasks:

- Identification of proposed projects within the public domain
- Review of project descriptions of proposed projects
- Review of residual impacts of NGBR Project on MNES
- Screening of residual impacts for their potential to interact with other impacts
- Review of environmental assessments of proposed projects
- Prediction of the scale and magnitude of cumulative impacts on MNES.

7.13.1 Methodology

7.13.1.1 Study area

The study area for the identification of proposed projects was defined by the regional area of the NGBR Project. Within the study area, a separation distance of approximately five kilometres was applied to identify projects that were directly relevant, and projects that were indirectly relevant (greater than five kilometres away). This study area is shown in Figure 7-35. As spatial extent and duration vary between impacts, this parameter was considered on an impact by impact basis.

7.13.1.2 Data sources

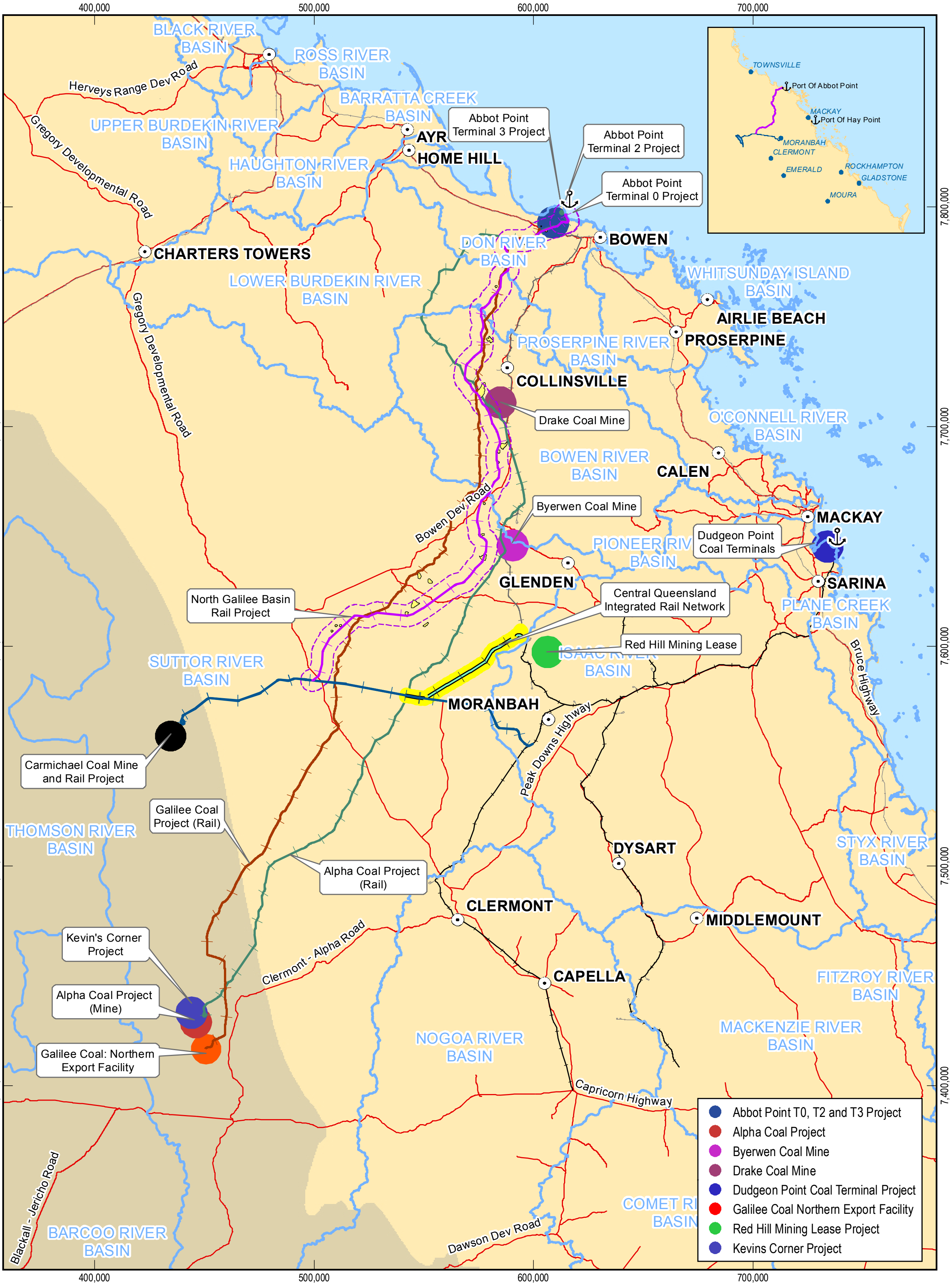
The cumulative impact assessment relied on the following data sources:

- The North Galilee Basin Rail Concept Design Report (Aarvee Associates 2013)
- Coordinated projects map (DSDIP 2013a)
- Queensland's Mineral, Petroleum and Energy Operations and Resources map (State of Queensland 2012)
- Galilee Basin Coal Infrastructure Framework (DSDIP 2013b)
- Publicly available information regarding proposed projects, such as environmental impact statements (EISs) and project websites.

This cumulative impact assessment draws on the findings from other assessments conducted as part of the EIS for the NGBR Project, including:

- Volume 1 Chapter 3 Land use and tenure
- Volume 1 Chapter 4 Scenic amenity and lighting
- Volume 1 Chapter 5 Topography, geology, soils and land contamination

- Volume 1 Chapter 6 Nature conservation
- Volume 1 Chapter 9 Water resources
- Volume 1 Chapter 10 Air quality
- Volume 1 Chapter 12 Noise and vibration
- Volume 1 Chapter 13 Waste
- Volume 1 Chapter 14 Transport
- Volume 1 Chapter 15 Cultural heritage
- Volume 1 Chapter 16 Social and economic impacts
- Volume 1 Chapter 17 Climate and natural hazards
- Volume 1 Chapter 18 Hazard, risk, health and safety.



LEGEND

- Population Centre
- Major Port
- River Basin
- State Road
- Other Rail Network
- Goonyella System
- Newlands System
- Central Queensland Integrated Rail Network
- Alpha Coal Rail
- Galilee Coal Project
- Galilee Basin
- Carmichael Project (Rail)
- North Galilee Basin Rail Project
- North Galilee Basin Rail Project 5km Buffer
- Potential NGBR Project quarry

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:2,500,000 (at A4)

0 25 50 75 100

Kilometres

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

N

GHD adani

Adani Mining Pty Ltd
North Galilee Basin Rail Project

Cumulative impact assessment projects

Job Number	41-26457
Revision	B
Date	12-11-2013

Figure 7-35

G:\41\26457\06 GIS\Maps\MXD\0001_Overview\41_26457_0009_rev_b.mxd Level 9, 145 Ann St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GA: Railway (2007); DNRM: River Basin (2011); DMR: State Roads (2008); DME: EPC1690 (2010), EPC1080 (2011); Adani: Alignment (SP1 & 2) (2013), Quarry (2013); Other Projects (2012/13).
Created by: NR, MS, ES

7.13.1.3 Identification of current and proposed projects

The identification of current and proposed projects included a review of the coordinated projects map (DSDIP 2013a) and Queensland's Mineral, Petroleum and Energy Operations and Resources map (State of Queensland 2012). Discussions have been held with the Coordinator-General's Office during the preparation of this EIS to confirm the appropriate projects to include within this chapter. It is considered that this method will capture direct and indirectly relevant current projects (those for which environmental approval has been granted but not yet commenced works) and proposed projects (those which are undergoing or proposed to undergo environmental assessment) of the scale relevant to cumulative impact assessment.

Publications on proposed projects were reviewed in order to physically describe the projects and their associated activities. The current and proposed projects identified here are listed in Section 7.13.2.

7.13.1.4 Review of residual impacts of NGBR Project

The NGBR Project EIS was reviewed to identify residual impacts. The following factors were considered for each residual impact:

- The spatial extent of the impact
- The duration of the impact
- The intensity of the impact.

Residual impacts were then screened, and any with localised spatial extent, brief duration or minor intensity were not considered further.

7.13.1.5 Review of environmental assessment of proposed projects

Publications on current and proposed projects were reviewed to identify residual impacts of the same type as the residual NGBR Project impacts identified through the review and subsequent screening process. Any previous cumulative impact assessments incorporating projects relevant to this cumulative impact assessment were also considered. The following factors were considered for each residual impact:

- The spatial extent of the impact
- The duration of the impact
- The intensity of the impact.

The data sources reviewed at this stage are listed in Section 7.13.1.2.

7.13.1.6 Prediction of the scale and magnitude of cumulative impacts

Residual impacts identified in the NGBR Project EIS and publications on current and proposed projects were cross checked, to determine whether overlaps will occur in the spatial extent or duration of residual impacts. Any impacts that were not considered to be overlapping were not considered further in the assessment. Where an overlap in the spatial extent or duration of the residual impacts of the NGBR Project and another project was identified, the intensity of each residual impact was considered. Cumulative impacts were then described on this basis.

7.13.1.7 Limitations

The level of detail of the assessment was limited to the information provided in the North Galilee Basin Rail Concept Design Report (Aarvee Associates 2013) and publications on proposed projects. The methodology employed in this cumulative impact assessment considered the residual impacts identified throughout the NGBR Project EIS, in accordance with the final EIS guidelines for the NGBR Project.

7.13.2 Existing and proposed development

7.13.2.1 Overview

This section outlines the existing and proposed projects in the region of the NGBR Project. The location of these projects in relation to the NGBR Project is depicted in Figure 7-35.

The NGBR Project is proposed in accordance with the Galilee Basin Coal Infrastructure Framework (GBCIF) (State of Queensland 2013a) single, north-south, multi-user, common access rail corridor from the Galilee Basin to Abbot Point. The development of a single north-south corridor will effectively promote the minimisation of impacts to landholders and the broader region by confining the impacts to a defined area.

A number of other proposed projects are implicated in this GBCIF, which significantly reduces the likelihood of cumulative impacts occurring between these proposed projects and the NGBR Project where the single rail corridor is developed. The proposed projects potentially affected by the GBCIF are identified in Figure 7-35 and include:

- Central Queensland Integrated Rail Project
- Galilee Coal Project (rail component)
- Alpha Coal Project (rail component)
- Carmichael Coal Mine and Rail Project.

China Stone Coal Project was initially considered, however insufficient information was available at the time of writing to enable inclusion in this cumulative impact assessment.

7.13.2.2 Abbot Point Coal Terminal (APCT) Expansions

North Queensland Bulk Ports (NQBP) is currently facilitating three major expansions at the Port of Abbot Point. These are referred to as Terminal 0, Terminal 2 and Terminal 3:

- Terminal 0 is proposed by Adani and comprises balloon loops, coal stockpiles and handling facilities, out loading facilities and a 2.75 km jetty with two berths. Terminal 0 will have a throughput capacity of 70 mtpa.
- Terminal 2 is proposed by BHP Billiton and comprises a balloon loop, coal stockpiles and handling facilities, out loading facilities and a 3.6 km jetty with two berths. Terminal 2 has a throughput capacity of 60 mtpa.
- Terminal 3 is proposed by GVK Hancock and comprises a balloon loop, coal stockpiles and handling facilities, out loading facilities and a 3.8 km jetty with two berths. Terminal 3 has a throughput capacity of 60 mtpa.

The NGBR Project begins in the north at chainage 3.49 km, in the vicinity of the Adani Terminal 0 balloon loop at the Port of Abbot Point. Adani has prepared an EIS for Terminal 0. Furthermore, Adani, BHP Billiton, GVK Hancock and NQBP – the Abbot Point Working Group –

prepared a cumulative impact assessment of Terminal 0, Terminal 2 and Terminal 3. This report is titled Abbot Point Cumulative Impact Assessment (CIA) Report and is publically available on the NQBP webpage.

7.13.2.3 Central Queensland Integrated Rail Project

The Central Queensland Integrated Rail Project (CQIRP) is proposed by Aurizon and will incorporate a 180 km rail corridor from the Galilee Basin to the existing Newlands system, upgrades and deviation to the Newlands system. As discussed previously, it is anticipated that the CQIRP will be incorporated into the GBCIF.

Aurizon is preparing an EIS for the Central Queensland Integrated Rail Project (State of Queensland 2013d). It is noted that there is limited publically available information available for this project.

7.13.2.4 Carmichael Coal Mine and Rail Project

The Carmichael Coal Mine and Rail Project is proposed by Adani and will incorporate two major components:

- A greenfield coal mine which includes both open cut and underground mining, on mine infrastructure and associated mine processing facilities and offsite infrastructure
- A greenfield rail line connecting the mine to the existing Goonyella rail system to provide for export of coal via the Port of Abbot Point and/or the Port of Hay Point (Dudgeon Point expansion).

The coal mine is proposed within the Galilee Basin, 160 km north-west of Clermont. The proposed railway line will run from the mine to Moranbah, where it will join the existing Goonyella rail system. The Carmichael Coal and Mine and Rail Project is located directly south of the NGBR Project. As discussed previously it is anticipated that the rail component of the Carmichael Coal Mine and Rail Project will be incorporated into the GBCIF.

The Carmichael Coal Mine and Rail Project is a controlled action under the EPBC Act; Adani have prepared an EIS and supplementary EIS for the project. The NGBR Project connects with the Carmichael Project (Rail) infrastructure at chainage 306.9 km, west of the Gregory Developmental Road towards Mistake Creek.

7.13.2.5 Galilee Coal Project

The Galilee Coal Project (Northern Export Facility) – also known as the China First Coal Project – is proposed by Waratah Coal and will incorporate a coal mine, railway and port facility. The railway will run from the mine to the port facility within the Abbot Point State Development Area, shared with the APCT (Waratah Coal 2013a; State of Queensland 2013a). The Galilee Coal Project (Northern Export Facility) rail line crosses the NGBR Project in at least two sections. As discussed previously, it is anticipated that the rail component of the Galilee Coal Project will be incorporated into the GBCIF

The port facility, known as the Waratah Coal Terminal, will incorporate onshore and offshore components, including the Waratah Coal Abbot Point stand-alone jetty, and dredging activities. The Waratah Coal Terminal will have a throughput capacity of 240 mtpa (Waratah Coal 2013b).

Separate environmental assessment processes are being undertaken for the mine and rail, collectively, and the Waratah Coal Terminal. The mine and rail components of the project were approved by the Office of the Coordinator-General on August 2013 (State of Queensland

2013a). Final EIS guidelines have been issued under the EPBC Act for the Waratah Coal Terminal (Waratah Coal 2013b).

7.13.2.6 Byerwen Coal Mine

The Byerwen Coal Mine is proposed by QCoal and will incorporate an open cut coal mine, train loading facilities and connection to an existing rail line to Abbot Point. The mine will produce up to 10 mtpa of coal. The Byerwen Coal Mine Project is located approximately four kilometres to the east of the NGBR Project.

The Bywerwen Coal Mine is a coordinated project under the SDPWO Act and a controlled action under the EPBC Act. QCoal has prepared an EIS for the Byerwen Coal Mine that closed for public comment on 23 July 2013.

7.13.2.7 Red Hill Mining Lease Project

The Red Hill Mining Lease Project is proposed by BHP Billiton Mitsubishi Alliance and will comprise a new underground coal mine plus the expansion of Broadmeadow coal mine and Goonyella Riverside coal mine. The new mine will produce up to 14 mtpa of coal. The Red Hill Mining Lease Project is a coordinated project under the SDPWO Act and a controlled action under the EPBC Act. The draft Terms of Reference for an EIS for the project are under preparation. It is noted that there is limited publically available information for this project.

7.13.2.8 Alpha Coal Project

The Alpha Coal Project is proposed by GVK Hancock and will comprise an open cut coal mine, 495 km of railway and a new port facility at Abbot Point. The Alpha Coal Project crosses the NGBR Project at a number of locations (refer Figure 7-35). As discussed in Section 7.13.2 it is anticipated that the rail component of the Alpha Coal Project will be incorporated into the GBCIF.

The Alpha Coal Project is a coordinated project under the SDPWO Act and a controlled action under the EPBC Act. GVK Hancock prepared an EIS for the Alpha Coal Project, which was subsequently approved by Coordinator-General and Federal Minister. The project is yet to commence construction.

7.13.2.9 Drake Coal Mine

Drake Coal Pty Ltd (a subsidiary of QCoal Pty Ltd) is the proponent for a new open-cut coal mine located 150 km north-west of Mackay in Queensland’s Bowen Basin. The Drake Coal Project will produce up to 10 million tonnes of run-of-mine (ROM) coal per year for up to 26 years (State of Queensland 2013g). The Drake Coal Project is a ‘controlled action’ under the EPBC Act. Drake Coal Pty Ltd has prepared an EIS for the Drake Coal Mine Coal Mine that closed for public comment on 25 June 2012. At the time of preparation of this cumulative impact assessment, the Department of Environment and Heritage Protection website did not provide a publicly available copy of the EIS (DEHP 2013).

7.13.2.10 Kevin’s Corner Project

The Kevin’s Corner Project is proposed by Hancock Galilee and consists of three underground mine areas, two open-cut coal mines, a light industrial area, on-site accommodation, on-site airstrip and all associated mining infrastructure. The Kevin’s Corner Project is expected to have a combined production capacity of 30 mtpa (State of Queensland 2013e). The project was deemed a ‘controlled action’ in late 2009, with the Coordinator-General’s report on EIS released in May 2013. This project will utilise the Alpha Coal Project rail line.

7.13.3 Regional impacts

In general the development of the NGBR Project will result in regional impacts to socio-economic conditions including:

- Impacts to existing social and economic values in the region
- Intensification of industry in the region.

These are discussed below.

7.13.3.1 Social and economic impacts

The construction and operation of the NGBR Project has the potential to generate benefits as well as adverse impacts to the local and regional study areas. Through the implementation of the management strategies it is anticipated that the potential benefits will be enhanced and the potential residual impacts on landholders, communities and social infrastructure services and facilities will be minimised.

It is anticipated that with the implementation of a Local Content Strategy, the NGBR Project will leverage a range of economic and social benefits for the regional study area through increased employment and business development opportunities. The Local Content Strategy seeks to ensure procurement from local suppliers as a preference and aims to maximise local investment on the NGBR Project where it is capable and competitive.

Construction will commence in late 2014 with 775 workers, before ramping up to reach a peak workforce of 1,700 workers in 2015 and concluding in 2016. Operations will commence with a workforce of 66 persons in 2016 and will gradually increase to 254 workers in 2021 to cater for the 60 million tonne per annum (mtpa) output from the proposed Carmichael Coal Mine and Rail Project. The ultimate capacity of the NGBR Project is expected to reach up to 100 mtpa in 2026. Therefore, it is anticipated that the operations workforce will increase concurrently with coal production, and gradually increase to a peak of 369 workers in 2026.

The staff requirements of other projects in the region will vary depending on the scale of the project and the commencement date for construction. As a worst-case scenario, where a few major projects commence construction simultaneously, the cumulative impacts are likely to result in the following issues:

- Increased demand in the local and regional labour market resulting in increased labour costs
- The potential for short term skill shortages regionally in the construction sector
- Localised inflation in the housing market in towns which house the workforce, driven by high demand for short term accommodation for fly-in-fly-out (FIFO) and drive-in-drive-out (DIDO) workers
- Localised in inflation in the commercial and industrial property markets
- Increased burden on local and regional infrastructure to support the booming industry.

Social and economic cumulative impacts resulting from the development of multiple rail corridors may include:

- Land fragmentation impacts

- Land access impacts
- Impacts relating to workers camps
- Impacts on social infrastructure
- Housing affordability and shortages.

Potential adverse impacts on landholders will be minimised through the implementation of a range of NGBR Project design elements, for example occupational crossings and design features to minimise impacts of land fragmentation, land access protocols, negotiation and compensation mechanisms. Any residual impacts will be monitored and addressed through appropriate landholder engagement and monitoring mechanisms.

Additionally, it is anticipated that these cumulative impacts will be significantly reduced through the implementation of the GBCIF which aims to provide a single north-south rail corridor from the Galilee Basin to Abbot Point. The GBCIF, where implemented, will effectively minimise the impacts of land fragmentation by confining the impacts to a single rail corridor.

It is estimated that at a regional level, the NGBR Project in conjunction with other development of the resource industry, is expected to generate a significant and positive economic impact in the larger Mackay, Isaac and Whitsunday region. Local employment opportunities are also likely to be generated as a result of the NGBR Project, according to modelled workforce profiles. In terms of impacts to landholders, the number of properties to be traversed by the NGBR Project presents the potential for property management issues, particularly in relation to access to various parts of the properties, and movement of stock and equipment across and between properties. Other potential impacts to landholders include alteration to the economic viability of the land, the spread of weeds, and impacts to lifestyle, amenity and livestock; it is expected however, that these issues will be able to be appropriately mitigated through the implementation of relevant management plans and regular liaison with the affected parties.

7.13.3.2 Intensification of industry

The development of the NGBR Project will provide a direct route from the Galilee Basin to the Port of Abbot Point in accordance with the State Government's policy for a single north-south and multi-user common access rail corridor. The intended capacity of the final rail corridor (100 mpta) will effectively increase the potential for extraction of coal from the Galilee Basin. This opportunity is expected to increase the development of mining infrastructure in the region and will facilitate the expansion of the resource industry.

7.13.4 Cumulative impacts

7.13.4.1 Overview

This section describes the predicted cumulative impacts of the NGBR Project and the other existing and proposed projects in the region (as outlined in Section 7.13.2). To be considered a cumulative impact, the project must be considered to have an impact greater than will otherwise occur due to its interaction with other projects.

Cumulative impacts are discussed in this section as they relate specifically to the environmental values of MNES. Based on the assessment of the residual impacts associated with the NGBR Project, the following were considered to be of relevance cumulatively with other projects:

- Loss of habitat for TECs, and threatened and migratory species
- Increased levels of noise on migratory birds in the Caley Valley wetland.

Each of the impacts listed above is discussed in greater detail in the following sections; the discussion outlines the effects of each impact on the relevant MNES values and discusses the significance of the NGBR Project's contribution to each cumulative effect. Additionally, a summary table is provided at the end of each section to assess the significance of the impact on each MNES controlling provision.

All other residual impacts associated with the NGBR Project were considered to be negligible and not assessed further; this decision was made based on one or a combination of the following:

- The spatial separation between relevant projects does not yield a cumulative impact of any significance
- The significance of the residual impacts are considered negligible and unlikely to have a significant cumulative effect on any MNES values
- The duration of the residual impacts are temporary and will be successfully rehabilitated / mitigated upon cessation of the relevant activity.

7.13.4.2 Cumulative impacts – habitat loss

The cumulative impacts of vegetation clearing associated with the NGBR Project and other projects (as outlined in Section 7.13.2), have the potential to result in the fragmentation and loss of habitat for TECs and threatened species in the region. The residual impacts of the vegetation clearing associated with the proposed and existing projects in the region were assessed to identify any likely impacts to MNES values.

The following MNES values are predicted to be affected (prior to offsetting) as a result of the cumulative residual effects of the relevant projects:

- Clearing of two listed TECs as confirmed present in the final rail corridor:
  - Brigalow
  - Semi-evergreen Vine Thicket.
- Clearing of potential habitat for six listed threatened species:
  - Black ironbox (confirmed present)
  - Squatter pigeon (southern) (confirmed present)
  - Australian painted snipe (likely to occur)
  - Black-throated finch (southern) (likely to occur)
  - Ornamental snake (likely to occur)
  - Koala (likely to occur).

Further field verification of these areas is expected to reduce the predicted impact area for each of the listed values.

Threatened ecological communities

Table 7-54 provides an overview of the expected area (in hectares) of each TEC to be cleared for each proposed project in the region.

Table 7-54 Cumulative impacts to TECs

Project	Brigalow TEC	Natural Grasslands TEC	SEVT TEC
NGBR Project	*100 ha*	*0 ha*	*35 ha*
APCT Expansions CIA	-	-	-
Abbot Point Terminal 0 Project	-	-	20 ha (indirect impacts only)
Carmichael Coal Mine and Rail Project	276 ha	-	-
Byerwen Coal Mine	316 ha	84 ha	18 ha
Alpha Coal Project (Rail)	110 ha	108 ha	14 ha
Kevin's Corner Project	-	22 ha	-
Galilee Coal Project (Northern Export Facility)	Unknown	Unknown	Unknown

It should be noted that the areas proposed for many of these projects, including the NGBR Project, are for mapped constituent regional ecosystems (REs) and are likely to represent an over-estimation of actual extents of the communities which meet the criteria for classification as TECs.

Cumulative impacts on TECs from the development of multiple rail corridors will be reduced where GBCIF is implemented in the region and a single north-south rail corridor is developed. The development of the GBCIF will significantly reduce the requirement for clearing in the region by confining the impacts to within a single rail corridor. Each proponent will be required to offset the residual impacts on TECs, such that an overall improvement in biodiversity values is achieved.

Following the adoption and implementation of the GBCIF and the development of a single north-south rail corridor in the region, and when combined with the net gains from offsetting requirements, the cumulative impacts of vegetation clearing of TECs associated with the NGBR Project are considered to be negligible.

Threatened species

Table 7-55 outlines the areas of potential habitat for each threatened species to be cleared cumulatively for the construction of the NGBR Project and other projects in the region.

Table 7-55 Cumulative impacts to listed threatened species (potential habitat)

Project	*Black ironbox*	Australian painted snipe	Black-throated finch (southern)	Koala	Ornamental snake	Squatter pigeon (southern)
NGBR	*64 ha*	*45 ha*	*2,143 ha*	*2,390 ha*	*246 ha*	*1,788 ha*
APCT Expansions	-	-	-	-	-	-

Project	*Black ironbox*	Australian painted snipe	Black-throated finch (southern)	Koala	Ornamental snake	Squatter pigeon (southern)
Abbot Point Terminal 0 Project	-	-	-	-	-	-
Carmichael Coal Mine and Rail Project	-	-	10,396 ha (direct) 6,147 ha (indirect)	10,807 ha (direct) 5,566 ha (indirect)	1,227 ha (direct) 3 ha (indirect)	11,778 ha (direct) 6,176 ha (indirect)
Byerwen Coal Mine	-	8 ha	651 ha	-	637 ha	1,047 ha
Alpha Coal Project (Mine and Rail)	Few individuals	Habitat may be impacted	7,932 ha (direct, high potential) 3,746 ha (direct, low potential)	-	1,794 ha of (direct, high potential) 739 ha (direct, low potential)	13,180 ha (direct, remnant vegetation)
Galilee Coal Project (Northern Export Facility)	-	-	2,789 ha (direct, primary) 2,053 ha (direct, secondary) 8,758 ha (indirect, primary) 667 ha (indirect, secondary)	4,742 ha (direct, primary) 10,390 ha (indirect, primary) 1,303 ha (indirect, secondary)	33.7 ha (direct, primary) 878 ha (direct, secondary) 12 ha (indirect, primary) 1,100 ha (indirect, secondary)	2,789 ha (direct, primary) 2,053 ha (direct, secondary) 8,758 ha (indirect, primary) 667 ha (indirect, secondary)
Kevin's Corner Project	-	-	730 ha (direct) 270 ha (indirect)	619 ha (direct) 148 ha (indirect)	602 ha (direct) 242 ha (indirect)	882 ha (direct) 276 ha (indirect)

It should be noted that the areas listed in Table 7-55 are generally potential habitat for those species and the actual areas of occupation by these species will be significantly lower. For example, populations of koala are known to occur across Queensland in scattered, low densities, rather than across all suitable habitat areas and it is potentially suitable habitat areas that have been measured here. Furthermore, only one of the five threatened fauna species listed (i.e. squatter pigeon (southern)) have been confirmed present within the NGBR Project footprint at the time of writing.

Cumulative impacts on threatened species from the development of multiple rail corridors will be reduced where GBCIF is implemented in the region and a single north-south rail corridor is developed. The development of the GBCIF will significantly reduce the requirement for clearing in the region by confining the impacts to within a single rail corridor and subsequently reduce the requirement for the loss of such habitats in the region. It is also likely that combined regional management strategies to address habitat losses to key priority species, such as black-throated finch, will be required and that proponents may contribute to such strategies where significant impacts are predicted as a result of those projects.

Each proponent will be required to offset the residual impacts on threatened species, such that an overall improvement in biodiversity values is achieved.

Following the adoption and implementation of the GBCIF and the development of a single north-south rail corridor in the region, and when combined with the net gains from offsetting requirements, the cumulative impacts of loss of potential habitat for threatened species is considered to be negligible.

Table 7-56 summarises the relevance of the cumulative impacts of habitat loss associated with the NGBR Project on MNES values.

Table 7-56 Significance of cumulative impacts of habitat loss on MNES

MNES value	Significance of cumulative impacts of habitat loss
Great Barrier Reef World Heritage Area and National Heritage Place	Cumulative impacts of habitat loss associated with NGBR Project will not affect marine habitat.
Listed threatened species and communities	Impacts will be minimised through the adoption of single corridor policy and residual impacts will be offset to achieve an overall gain in biodiversity.
Listed migratory species	Impacts will be minimised through the adoption of single corridor policy and residual impacts will be offset to achieve an overall gain in biodiversity.
Commonwealth Marine Areas	Cumulative impacts of habitat loss associated with NGBR Project will not affect marine habitat.
Great Barrier Reef Marine Park	Cumulative impacts of habitat loss associated with NGBR Project will not affect marine habitat.

7.13.4.3 Cumulative impacts – Noise impacts

Noise can have a range of adverse impacts on native fauna. Noise can adversely affect wildlife by interfering with communication, masking the sounds of predators and prey and causing stress or avoidance reactions that may increase the risk of injury or predation, or reduce the efficiency of normal behaviours (i.e. feeding, breeding, nesting, sleeping) (Fletcher and Busnel 1978). Noise exposure, particularly if it endures, can have physiological and behavioural impacts on fauna. The nature and intensity of these impacts can vary between species and between individuals of a given species depending on the individuals' age, sex and prior exposure to noise (Fletcher and Busnel 1978). Disruption of wildlife behaviour is most ecologically damaging when it affects critical behaviours (i.e. nesting or breeding) in areas of high ecological importance (e.g. breeding colonies).

Noise impacts on wildlife will also vary depending on the nature and frequency of the noise. Studies have shown that some animals can habituate to loud noises that do not have a direct adverse outcome for the individual (Larkin *et al.* 1996). Attempts at using noise to deliberately scare birds away from an area, for example to protect farming crops, have been shown to grow less effective over time as birds habituate to the noise. Larkin suggests that keeping the noise as consistent as possible both in the sound produced and the frequency with which it occurs may also help mitigate its effects on birds. Algers *et al.* (1978) shows that birds tend to adapt to steady state noise levels, even of a relatively high level (in the order of 70 dB(A)). Trains will pass all sections of the NGBR Project final rail corridor several times each day. As such, the potential for wildlife to habituate to noise is relatively high.

It is recognised that sudden noise has the potential to startle or upset domestic livestock and pets. Heggies Pty Ltd conducted a literature review as part of their assessment of blasting noise impacts on livestock for the proposed Caval Ridge Coal Mine Project (Heggies 2009). Heggies cites results from a study on the response of farm animals to sonic booms, which indicated that reactions of sheep, horses and cattle to sonic booms (125 dB to 136 dB) were considered slight to mild.

The Caley Valley Wetland near Abbot Point represents an important breeding and nesting habitat for many species of wetland birds. This area is likely to be more susceptible to adverse impacts to wildlife disturbance than other areas within the NGBR Project footprint. However, ongoing successful breeding and nesting of thousands of waterbirds, despite exposure to chronic, low-level industrial noise associated with the operation of existing coal handling facilities, including associated rail infrastructure, at the nearby Abbot Point Coal Terminal 1 suggests a level of habituation to noise.

A noise and vibration assessment was undertaken for the NGBR Project to assess the potential impacts of the construction and operation of the final rail corridor on sensitive receptors. The assessment determined that with the implementation of appropriate mitigation measures the residual impacts of the NGBR Project are considered negligible. The NGBR Project is most likely to have a cumulative impact to MNES values in the vicinity of the Caley Valley Wetland at Abbot Point; the abundance of migratory bird populations makes the area particularly sensitive to increased noise levels.

The impacts during the life of the NGBR Project of noise on marine fauna were considered negligible as no construction activities will occur within the marine environment; subsequently, only the impacts of construction and operational noise on terrestrial ecosystems were considered in this cumulative impact assessment. Further, the proposed rolling stock maintenance facility is considered to be the most likely source of significant noise impacts during the operations phase and is located at chainage 28 km to 35 km (approximately 20 km south west of the Caley Valley Wetland). Due to the distance of the facility from the wetland it is not anticipated that the operations of this facility will result in significant noise impacts to any MNES.

An assessment of the cumulative impacts of construction and operational noise as a result of existing and proposed development at Abbot Point was undertaken in 2012 (SLR 2012a, SLR 2012b). The objective of the assessments was to identify whether the cumulative impacts from land based construction and operational noise might affect the habitat value of the Caley Valley Wetland and adjoining terrestrial areas; the Caley Valley Wetland is a known breeding and nesting area for migratory bird populations (refer to Section 7.10) and thus a good indicator of the likely impacts of the proposed port expansion on MNES values.

The cumulative assessment of noise impacts at Abbot Point determined that during both the construction and operations of the port, the impacts of noise resulting in alarm or flight responses from terrestrial fauna are predicted to be negligible. The modelled exceedance of noise criteria is expected only over a maximum of 7% of the wetland area under a worst case scenario for both phases of the expansion (SLR 2012a, SLR 2012b). The modelling presents a worst case scenario and assumes that no habituation of fauna is occurring; in reality, the fauna will become acclimatised to the noise over time and the impacts realised to the behaviour will be reduced.

The cumulative contribution of the NGBR Project to the predicted noise levels during construction and operations is not expected to significantly increase the results of the CIA report. Subsequently, the cumulative impacts of noise generation of the NGBR Project and other existing and proposed projects in the region, on MNES values are considered to be negligible.

Table 7-57 summarises the relevance of the cumulative impacts of noise associated with the NGBR Project on MNES values.

Table 7-57 Significance of cumulative impacts of noise on MNES

MNES value	Significance of cumulative impacts of noise
Great Barrier Reef World Heritage Area and National Heritage Place	The cumulative noise impacts of the NGBR Project will not impact the ecological values of the marine environment.
Listed threatened species and communities	The cumulative impacts of noise (construction / operations) will have minimal impact on the behaviour of terrestrial fauna in the Caley Valley Wetland or elsewhere in the NGBR Project footprint; fauna have a high likelihood of habituation to low level noise.
Listed migratory species	The cumulative impacts of noise (construction / operations) will have minimal impact on the behaviour of terrestrial fauna in the Caley Valley Wetland; fauna have a high likelihood of habituation to low level noise.
Commonwealth marine areas	The cumulative noise impacts of the NGBR Project will not impact the ecological values of the marine environment.
Great Barrier Reef Marine Park	The cumulative noise impacts of the NGBR Project will not impact the ecological values of the marine environment.

7.13.5 Consequential impacts

7.13.5.1 Overview

This section describes the predicted consequential impacts of the NGBR Project and the other existing and proposed projects in the region (as outlined in Section 7.13.2). Consequential impacts were considered to be those arising from third-party activities that will occur as a result of commissioning and operation of the NGBR Project.

Consequential impacts are discussed in this section as they relate specifically to the environmental values of MNES. The following consequential impacts were considered relevant to the MNES values associated with the NGBR Project:

- Lighting impacts on fauna behaviour
- Increased coal dust lift off from trains and stockpiles at Abbot Point
- Increase in shipping activity through the Great Barrier Reef and CMA.

This is discussed in more detail below.

7.13.5.2 Consequential impacts – lighting

The cumulative residual impacts of lighting on MNES associated with the construction and operations of the NGBR Project are likely to be most significant in the vicinity of Abbot Point.

The construction of the final rail corridor will result in temporary lighting impacts to MNES further inland and it is anticipated that residual impacts during the operations phase will be appropriately managed through design parameters and light spillages controls.

The proposed rolling stock maintenance facility is considered to be the most likely source of significant light impacts during the operations phase and is located at chainage 28 km to 35 km (approximately 20 km south west of the Caley Valley Wetland). The facility will be designed to minimise light spillage through the implementation of light control devices and it is therefore not anticipated that the operations of this facility will result in significant impacts to any MNES.

An assessment of the artificial lighting associated with the existing and proposed port expansion development at the Port of Abbot Point was undertaken in 2012 as part of the cumulative impact assessment (CIA) for Abbot Point (GHD 2012). The study assessed the potential impacts of the increased levels of lighting on marine and terrestrial fauna behaviour in the marine environment at Abbot Point and along Abbot beach.

The assessment determined that while the lighting from the existing Terminal 1 generally complies with Australian standards, there will be an increase in light spillover into the marine environment during the construction and operation of the proposed port expansion (GHD 2012). Notably, during the construction of additional jetties, wharves and other infrastructure, the cumulative light spill is projected to increase from 71 ha to 76 ha in the marine environment. During operations the cumulative light spill is projected to increase from 188 ha to 1,021 ha with 689 ha of marine habitat impacted.

The increased levels of lighting are expected to impact on localised marine fauna populations by attracting species of fish, hatching turtles, dolphins and other invertebrates (GHD 2012). Light spill onto beaches may result in the disorientation of breeding turtles and hatchlings. It is noted however, that there are more significant breeding habitats elsewhere in the region and the beaches at Abbot Point are not frequently used by breeding turtles (ELA and Openlines 2012).

The development of the NGBR Project will result in an increase in light spillage at Abbot Point during the construction phase. These impacts however, are likely to be minor and temporary and are not expected to result in a significant impact to any MNES. During operations, the contribution of increased light spillage of the NGBR Project into the marine environment will be relatively minor compared to that resulting from the proposed port expansion projects.

The cumulative impacts of lighting on MNES along the NGBR final rail corridor are considered to be negligible.

Table 7-58 summarises the relevance of the cumulative impacts of lighting associated with the NGBR Project on MNES values.

Table 7-58 Significance of cumulative impacts of lighting on MNES

MNES value	Significance of cumulative impacts of lighting
Great Barrier Reef World Heritage Area and National Heritage Place	The anticipated increase in light spillage into the marine environment as a result of the NGBR Project is considered to be negligible in comparison to the existing and proposed activities at Abbot Point. Increases attributable to the NGBR Project will be unlikely, short duration, infrequent and only applicable during the construction phase.
Listed threatened species and communities	Light spill may affect nesting turtles and hatchlings however the beaches at Abbot Point are not frequently used by breeding turtles and there are other significant breeding

MNES value	Significance of cumulative impacts of lighting
	habitats elsewhere in the region; no significant increase in cumulative lighting impacts will occur as a result of the NGBR Project.
Listed migratory species	Impacts expected to marine fauna and migratory birds are expected to be localised within the vicinity of Abbot Point; no significant increase in cumulative lighting impacts as a result of the NGBR Project.
Commonwealth Marine Areas	Lighting impacts will not affect the CMA.
Great Barrier Reef Marine Park	Lighting impacts will not affect the ecological integrity of the marine environment.

7.13.5.3 Consequential impacts – coal dust lift off

An environmental evaluation, commissioned by Queensland Rail, reviewed the available literature for the impacts of coal dust on flora and fauna, crops and livestock. Connell Hatch (2008) concluded that a dust deposition rate of 500 mg/m²/day can be used as a suitable threshold for negative impacts on crops, livestock and vegetation.

With respect to deposition distance adjacent to the final rail corridor centreline, modelling indicates that the highest coal deposition rates, of about 90 mg/m²/day, are likely to occur within the final rail corridor with rates dropping rapidly as distance from the tracks increases (i.e. 30 mg/m²/day at 10 metres from the tracks) (Connell Hatch 2008). These modelled values are substantially lower than the values noted in literature as being likely to have an impact on crops and livestock along the final rail corridor. No recent literature has been found that measures such impacts on native vegetation and fauna; however, it is likely that the same conclusions will be achieved.

Subsequently, the residual impacts of the NGBR Project on MNES values along the final rail corridor are considered to be negligible. It is anticipated however that at the proposed coal unloading facilities at the Port of Abbot Point, there is the potential for the NGBR Project to contribute to the cumulative impacts of coal dust lift off on flora and fauna in the vicinity of the port.

A study was undertaken in 2012 to assess the cumulative impacts of coal dust deposition in the marine environment as a result of the existing and proposed development at the Port of Abbot Point (Toki et al. 2012). The study provides an assessment of the consequences and likelihood of coal dust impacts to the ecological values of marine waters adjacent to the port; the study assessed the likely impacts on the following components of the marine environment:

- Marine pelagic environments and plankton communities
- Seagrass meadows
- Rocky shores, reefs and coral communities
- Beaches and dunes
- Marine sub tidal soft habitat
- Mangrove forests
- Shorebirds and seabirds
- Fish, dugongs and marine turtles
- Whales and dolphins.

In general, the assessment determined that the potential residual impacts of the existing and proposed development at the port on marine ecosystems were negligible and unlikely to significantly impact its ecological integrity and functions.

As discussed previously, the direct impacts of the NGBR Project on coal dust lift off and subsequent impacts on MNES along the final rail corridor is considered negligible; the indirect impacts however, of the unloading of the coal trains at the rail loops and subsequent movement of the coal product within the Port of Abbot Point, has the potential to result in an increase in coal dust lift off and deposition into the marine environment. These impacts are not considered to be significant given the scale of the existing and proposed development at the Port of Abbot Point and in a relative context, the contribution of the NGBR Project to the cumulative deposition of coal dust in the marine environment is considered negligible.

The cumulative impacts of coal dust lift off on MNES values is therefore considered negligible.

Table 7-59 summarises the relevance of the cumulative impacts of coal dust lift off associated with the NGBR Project on MNES values.

Table 7-59 Significance of cumulative impacts of coal dust lift off on MNES

MNES value	Significance of cumulative impacts of coal dust lift off
Great Barrier Reef World Heritage Area and National Heritage Place	Modelled values of coal dust deposition associated with NGBR Project and Abbot Point expansion (i.e. T0, T1 expansion, T2, T3) are well below that considered to have a significant impact.
Listed threatened species and communities	
Listed migratory species	
Commonwealth Marine Areas	
Great Barrier Reef Marine Park	

7.13.5.4 Consequential impacts – increased shipping

A review of the existing shipping activity occurring within the Great Barrier Reef was undertaken in 2012 (PGM Environment 2012); the review analysed the current and projected future shipping activity within the Great Barrier Reef, with particular attention placed on the impacts to the values of the GBRWHA. Subsequently, a review of the existing and projected increase in shipping activity at Abbot Point was undertaken in 2012 (ELA and Open Lines 2012) which identified past and current trends in shipping numbers, projected increase to shipping numbers and the associated impacts of the increased shipping on the environmental values of the Great Barrier Reef.

Existing shipping activity at Abbot Point

Shipping numbers at Abbot Point have experienced a marked increase since 2002 from 119 vessels to 174 recorded in 2012 (ELA and Open Lines 2012). The vessels utilising the port comprise a combination of the following (ELA and Open Lines 2012):

- Handimax (40,000-60,000 Dry Weight Tonnes [DWT], average 52,000 DWT)
- Panamax (60,000-90,000 DWT, average 80,000 DWT)
- Small Capesize (90,000-130,000 DWT, average 100,000 DWT).

The average vessel capacity in the 2011-12 financial year was 78,000 DWT per vessel; it is expected however, that in future years, the capacity of vessels accessing the Port of Abbot

Point will increase in accordance with the expansion of the port and subsequent increase in port capacity (ELA and Open Lines 2012).

The type of bulk carriers which access the Port of Abbot Point are generally propelled by a single diesel engine and reach an average cruising speed of around 14 kts to 15 kts (PGM Environment 2012). The existing throughput at the port of approximately 13.5 mtpa generally requires around 174 ship calls; subsequently, the ships have sufficient room to allow for safe anchoring within port waters (ELA and Open Lines 2012).

The vast majority (greater than 80%) of vessels which access the Port of Abbot Point, approach from the north via the Palm Passage (refer to Figure 7-36). The Palm Passage allows for easy navigation through the Great Barrier Reef due to its wide, deep and straight configuration (ELA and Open Lines 2012).

The Coral Sea Commonwealth marine reserve

The Coral Sea marine region is a remote ocean ecosystem recognised for its unique physical, ecological and heritage values (DOE 2013). The Coral Sea encompasses a diverse array of natural oceanic formations including coral reefs, sandy cays, deep sea plains and canyons.

The islands within the Coral Sea support critical nesting sites for green turtles and a range of seabird species (DOE 2013).

A management plan has been prepared for the marine reserve and is currently under review; currently, transitional management arrangements have been enforced until the plan comes into effect (DOE 2013). The marine reserve comprises an area of 989,842 km^2 and boasts several management zones including (DOE 2013):

- Marine National Park Zone (IUCN Category II) - 502 626 km^2 or 50.78% of reserve
- Habitat Protection Zone Coral Sea (IUCN Category IV) - 182 564 km^2 or 18.44% of reserve
- Habitat Protection Zone Seamounts (IUCN Category IV) - 85 507 km^2 or 8.64% of reserve
- Conservation Park Zone (IUCN Category IV) - 20 570 km^2 or 2.08% of reserve
- Multiple Use Zone (IUCN Category VI) - 194 233 km^2 or 19.62% of reserve
- General Use Zone (IUCN Category VI) - 4 300 km^2 or 0.43% of reserve.

The key conservation values associated with the Coral Sea Commonwealth marine reserve include (DOE 2013):

- Habitat and important areas for a range of species including:
  - Humpback whales
  - Green turtles;
  - Multiple seabird species
  - White sharks and whale sharks
  - Small fish schools, billfish, tuna and sharks
- The East Australian Current forms in the region and is considered a major pathway for mobile predators such as billfish and tuna
- Heritage values include several historic shipwrecks including three World War II shipwrecks from the Battle of the Coral Sea.

- The reserve represents the full range of seafloor features found in the region
- Six provincial bioregions, 94 depth ranges and 16 seafloor types are represented in the reserve.

It is noted that the potential cumulative and consequential impacts of the NGBR Project and other projects in the region on the conservation values of the reserve, are confined to the impacts of increased shipping activity. A comprehensive study of the impacts of shipping activity on the Great Barrier Reef has been undertaken as part of the CIA for Abbot Point (ELA and Open Lines 2012) and is considered outside the scope of this assessment.

Projected future shipping activity at Abbot Point

It is anticipated that the number of vessels calling in to the Port of Abbot Point will increase in accordance with the expansion of the port and subsequent increase in port capacity (ELA and Open Lines 2012). NQBP has provided projected ship forecast data for the Port of Abbot Point which considers the proposed expansion of the port in conjunction with industrial factors; the projections anticipate an annual growth rate of approximately 11% over the 20-year period (2012-2032) with a predicted total of 808 ship calls in 2020 and 1,640 calls in 2032 (ELA and Open Lines 2012).

This growth in shipping numbers will require an increased capacity of anchorages at the port to accommodate vessels waiting to load as required. In this regard, a multi-criteria analysis was undertaken as recommended in the PGM Environment (2012) report, to help determine suitable anchorage locations (ELA and Open Lines 2012). The analysis identified two potential anchorages comprising a northern and southern area for vessels outside the limits of the Port of Abbot Point (ELA and Open Lines 2012). The proposed anchorages are located in relatively open waters, with a depth of not less than 20 m, over 40 km away from the nearest offshore reef and are notably clear of known seagrass areas (ELA and Open Lines 2012). The proposed anchorage areas therefore pose no risk to either coral reefs or seagrass meadows in the vicinity of the Port of Abbot Point (ELA and Open Lines 2012).

The NGBR Project is not expected to directly increase the capacity of the Port of Abbot Point however, due to the proposed 100 mtpa capacity of the NGBR Project, the rail line will facilitate the increase in shipping activity by allowing the operations of the port to realise its existing and proposed capacity. In general, an increase in 30 mtpa approximately equates to an additional 240 ship calls per year (ELA and Open Lines 2012); in this regard, the operations of the NGBR Project will indirectly facilitate an additional up to 800 ship movements per year at full capacity (based on current average ship size). It is noted that this number may be reduced where relevant upgrades to facilities enable larger capacity vessels to access the port.

It is noted however, that the capacity of the existing port coupled with the proposed expansion at Abbot Point, will inherently result in an increase in shipping numbers and the contribution of the NGBR Project to shipping activity in the port will not affect the significance of the impacts already associated with the port development.

A summary of the likely impacts of an increase in shipping activity on MNES values is outlined below.

Impacts of increased shipping on MNES values

The relevant MNES values likely to be impacted by an increase in shipping activity at the Port of Abbot Point include:

- The listed threatened and/or migratory marine fauna species (refer Section 7.9 and Section 7.10 respectively)
- Outstanding universal values of the GBRWHA (refer Section 7.6)
- The marine environment of the GBRMP and the Commonwealth Marine Area (refer Section 7.6 and 7.11).

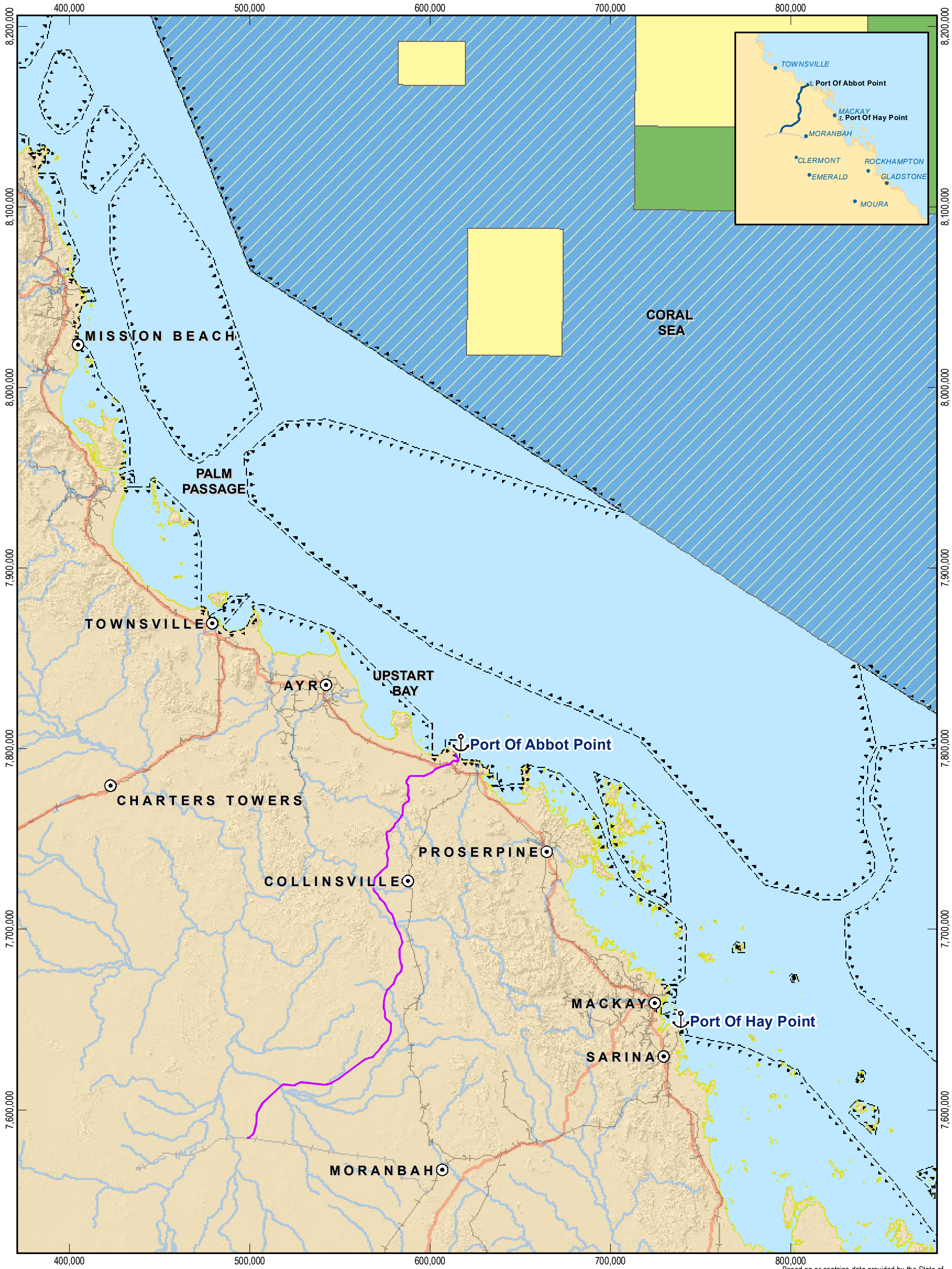
The following events have the potential to occur as a result of increased shipping activity in the port (ELA and Open Lines 2012):

- Groundings and collisions
- Oil spills
- Introduction of marine pests
- Underwater radiated noise
- Increased lighting from ships
- Increased number of marine fauna strike incidents.

These events have the potential to result in the following impacts which may affect the marine environment and MNES values (ELA and Open Lines 2012):

- Direct impacts to sensitive areas from ship groundings/collisions e.g. scars on coral reefs from ship grounding
- Direct impacts to sensitive areas from smothering e.g. mangrove forests smothered with oil slicks as a result of oil spills
- Indirect or flow on effects of grounding, collision, oil spills e.g. habitat loss for fauna species, interruptions to nutrient cycling
- Physiological effects to marine species from contact with oil and/or other contaminants
- Habitat damage due to grounding, collision, oil spill
- Direct and indirect impacts from pests
- Accumulation of chemicals and/or heavy metals in the marine environment.

It is anticipated that these events will be appropriately managed under the operational guidelines of NQBP (including the use of accredited marine pilots) and the likelihood of occurrence of these impacts will therefore be greatly reduced. Industry standards mandate regular monitoring of shipping movements and appropriate maintenance of vessels entering the Great Barrier Reef. The projected increase in shipping numbers is expected to stimulate further development and regulation of these standards across the industry (ELA and Open Lines 2012). The implementation of appropriate standards and management plans at the Port of Abbot Point will significantly reduce the risk of shipping incidents related to port activities and the likelihood of occurrence of adverse impacts to MNES will therefore be minimised.



LEGEND

- Population Centres
- Major Port
- Highway
- Carmichael Mine Project Rail
- Railway
- Watercourse (Major)
- Designated Shipping Areas
- Commonwealth Marine Reserves
- Sanctuary, Benthic Sanctuary and Marine National Park Zones
- Habitat Protection and Conservation Park Zones
- Habitat Protection Zone (Coral Sea)
- North Galilee Basin Rail 100m Corridor

1:3,000,000 Paper Size A4
0 25 50 100
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd
North Galilee Basin Rail Project

Job Number	41-26457
Revision	B
Date	12 Nov 2013

Shipping channels -
Great barrier reef

Figure 7-36

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Level 9, 145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012;
DNRM: Roads/2010; DSEWPaC: Marine Reserves/2013; GBRMPA: Shipping Channels/2011. Created by:MS

7.14 Environmental management

7.14.1 Environmental design

During detailed design, further surveys will be undertaken to refine broad-scale potential habitat mapping. The findings of these surveys will allow micro-scale adjustments to clearing footprints, further avoiding and minimising impacts to TECs and potential habitat for threatened species. Refinement of broad-scale potential habitat mapping will also inform development of the Construction Flora and Fauna Management Plan, Species Management Plans and the Offsets Strategy.

7.14.2 Environmental management of Controlling Provisions

All mitigation and management measures identified within this chapter will be managed in accordance with a project-specific environmental management system (EMS). The EMS will provide provisions for identifying roles and responsibilities, staff training, monitoring and internal auditing, and will guide the development of the NGBR Project environmental management plans (EMPs). Each phase of the NGBR Project will be managed in accordance with a specific EMP as follows:

- Planning and design – Project EMP
- Construction – Construction EMP
- Operational phase – Operation EMP.

Each environmental management plan will include a series of sub-plans that target specific environmental management issues. These sub-plans include:

- Species Management Plan
- Construction flora and fauna management plan
- Water quality management plan
- Erosion and sediment control plan
- Emergency management plan (including Fire management plan and Emergency spill response plan)
- Acid sulfate soils management plan
- Weed and pest management plan
- Waste management plan
- Dust management plan
- Coal dust management plan
- Decommissioning and rehabilitation plan

Further information regarding the content of these environmental management plans is provided in Volume 2 Appendix P Environmental management plan framework.Table 7-60 provides a cross reference of how MNES mitigation and management measures will be implemented and managed through these management plans.

Table 7-60 Environmental management plans and controlling provisions

	World Heritage properties and Natural Heritage places	Great Barrier Reef Marine Park	Listed threatened species	Threatened ecological communities	Listed migratory species	Commonwealth Marine Areas
Species Management Plan			✓	✓	✓	
Construction flora and fauna management plan			✓	✓	✓	
Water quality management plan	✓	✓	✓	✓	✓	✓
Erosion and sediment control plan	✓	✓		✓		✓
Emergency management plan (including fire management plan and emergency spill response plan)	✓	✓	✓	✓	✓	✓
Acid sulfate soils management plan	✓	✓				✓
Weed and pest management plan	✓	✓	✓	✓	✓	✓
Waste management plan						
Dust management plan	✓	✓	✓	✓	✓	✓
Coal dust management plan	✓	✓	✓	✓	✓	✓
Decommissioning and rehabilitation plan	✓	✓	✓	✓	✓	✓

Each management plan includes monitoring requirements and corrective actions. These environmental monitoring requirements and corrective actions will demonstrate compliance with EIS commitments, as well as approval, permit and licensing conditions. Table 7-61 provides an overview of the structure and content of each environmental management plan.

Table 7-61 Structure of management plans

Element	Description of content
Existing environmental values and potential impacts	A description of the environmental values likely to be affected by the NGBR Project during the construction and operational phases.
Management objective(s)	The overarching objective to be achieved for the environmental value likely to be affected by the NGBR Project.
Performance criteria	Measurable outcomes or indicators prescribed to gauge whether the management objectives are being met.
Management and mitigation measures	The strategies, tasks or methods proposed to achieve the performance criteria. This section provides the measures relevant to design, construction and operation.
Monitoring requirements and corrective actions	The proposed monitoring activities to measure the performance criteria against relevant thresholds or trigger values. And the corrective actions to be implemented where certain performance criteria are not met.

7.14.3 Water quality monitoring

Upstream and downstream water quality monitoring (flow dependent) will be conducted during construction. Allowable threshold levels for downstream results will be determined in consultation with the Department of Natural Resources and Mines (DNRM) prior to construction commencing, and will be outlined in the NGBR Project conditions of approval. Allowable threshold levels will include a maximum acceptable per cent increase above upstream background levels as well as an acceptable maximum duration for changes to any water quality parameter.

Any noticeable changes in water quality, increased turbidity or sedimentation of waterways will be immediately investigated to determine the likely cause of the change. Where degradation of water quality is a direct result of the operations of the NGBR Project, appropriate measures will be implemented to remedy the cause of the problem.

Any exceedance of water quality trigger values will be recorded and reported to the regulator in accordance with any approval conditions.

Water quality monitoring for the NGBR Project EIS was undertaken at 15 sites (refer Table 7-62).

Table 7-62 Water quality sampling sites

Site number	Basin/catchment	Watercourse
1	Don River Basin	Saltwater Creek
2		Six Mile Creek (dry)
3		Maria Creek (dry)
4		Tabletop Creek
5		Splitters Creek
6		Unnamed tributary off Finley Creek (dry)
7	Lower Burdekin River Catchment	Bogie River
8		Sandy Creek
9	Bowen River Catchment	Pelican Creek
10		Bowen River
11	Suttor River Catchment	Suttor River (upper crossing)
12		Lily Creek (dry)
13		Rockingham Creek
14		Gunn Creek
15		Suttor River (lower crossing)

Sampling at these sites was undertaken in accordance with Monitoring and Sampling Manual 2009 (DERM 2009) and ANZECC Guidelines (ANZECC and ARMCANZ 2000). Water quality was sampled in-situ using a hand held water quality meter that measured:

- Temperature (°C)
- Electrical conductivity (EC) (μS/cm)
- Total dissolved solids (TDS) (mg/L)
- Dissolved oxygen (DO) (per cent saturation)
- pH
- Reduction-oxidation potential (Redox).

7.14.4 Erosion and sediment control monitoring

During construction and operation of the NGBR Project, all erosion and sediment controls will be inspected and maintained regularly. Deficiencies including drain blockages, damage to sediment controls and signs of erosion will be recorded and rectified.

During construction, visual inspections will be undertaken at watercourses and drainage lines that intersect construction areas to identify areas of scouring or erosion that require additional erosion and sediment control measureas. Visual monitoring will be undertaken after periods of high rain fall.

7.14.5 Weed and pest monitoring

Weed levels will be monitored in areas adjacent to construction activities, in areas subject to potential vegetative change, in any areas that are rehabilitated after construction and within undisturbed or 'control' areas within the NGBR Project footprint. Monitoring will be undertaken annually during construction and operation, with results to be considered in terms of baseline information (collected prior to construction) and with reference to appropriate control (reference) sites. If significant infestations of any weeds occur, or if new infestations of WONS or Class 1 or 2 weeds declared under the Land Protection (Pest and Stock Route Management) Act 2002 are identified, weed control measures will be implemented. Weed control measures will be based on Queensland Department of Agriculture, Forestry and Fisheries (DAFF) and Regional Councils advice. Ongoing monitoring of weed infestations associated with construction activities will occur through implementation of the Weed and Pest Management Plan.

7.15 Environmental offsets

The term 'environmental offsets' refers to measures that are intended to compensate for the residual adverse impacts of an action on the environment. Offsets provide environmental benefits to counterbalance the impacts that remain after avoidance and mitigation measures have been implemented. These remaining, unavoidable impacts are termed 'residual impacts'.

The NGBR Project will involve the removal of vegetation and the loss of species' habitat, which will be partially mitigated through the sensitive design, construction and operation of the NGBR Project. Nevertheless, there may be unavoidable residual impacts that cannot be fully mitigated in this way, which will then require the provision and implementation of environmental offsets.

The overarching objectives of this section are to:

- Review offset requirements under the EPBC Act *Environmental Offsets Policy* (EOP) (2012)
- Identify options for availability of potential offsets
- Propose an approach for offset delivery.

The specific aim is to determine whether 'no net loss' of ecological values can be delivered for the NGBR Project through provision of offsets that are of a size and scale proportionate to the residual impacts on the protected matter, in line with the requirements of the EOP.

7.15.1 Introduction

The EOP came into effect on 2 October 2012 and outlines the Australian Government's approach to the use of environmental offsets. It provides transparency around how the suitability of offsets is determined. This policy relates to offsetting impacts to the following types of protected matters:

- World heritage properties
- National heritage places
- Wetlands of international importance (listed under the Ramsar Convention)
- Listed threatened species and ecological communities
- Migratory species protected under international agreements
- Commonwealth marine areas

- The Great Barrier Reef Marine Park
- The environment, where nuclear actions are involved
- The environment, where actions proposed are on, or will affect Commonwealth land and the environment
- The environment, where Commonwealth agencies are proposing to take an action.

The EOP has a list of eight 'offset principles' that must be considered when determining suitable offsets for MNES. The offset principles specify that suitable offsets must:

1. Deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed development
2. Be built around direct offsets but may include indirect offsets or other compensatory measures
3. Be in proportion to the level of statutory protection that applies to the affected species or community
4. Be of a size and scale proportionate to the residual impacts being offset
5. Effectively manage the risks of the offset not succeeding
6. Be additional to what is already required or agreed to
7. Be efficient, effective, transparent, proportionate, scientifically robust and reasonable
8. Have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.

For assessments under the EPBC Act, offsets under the EOP are only required if residual impacts are significant. In order to determine whether an impact is significant or not, an assessment is required to be undertaken against the criteria set out within the relevant sections of the Significant Impact Guidelines (DEWHA, 2009).

The EOP will apply to the NGBR Project, as residual impacts to MNES have the potential to constitute significant impacts. The NGBR Project requires the clearance of REs listed as components of TECs and habitat for threatened species listed under the EPBC Act. The offset requirements have been quantified in Section 7.8 for listed threatened species and Section 7.9 for TECs.

7.15.2 Methodology

7.15.2.1 Offset assessment area

For the purposes of the offset assessment, the area for the offset availability analysis was limited to the identified conservation priority areas within the Galilee Basin Offsets Strategy. The Galilee Basin Offset Strategy was developed to provide spatial resources that guide proponents to locate offset sites in strategic conservation hubs and corridors and assist decision makers in the assessment of development activities in the Galilee Basin.

The Galilee Basin Offset Strategy identifies a strategic footprint within the Brigalow Belt and Desert Uplands bioregions that determines where to locate land based offsets for the best biodiversity conservation outcomes. The strategic footprint identifies two types of priority areas, these being:

- Priority 1 areas: identification of conservations hubs that are areas of high conservation value and where there are limited mining interests
- Priority 2 areas: key north-south and east-west corridors that link to adjacent bioregions.

The offset availability analysis considered both priority 1 and priority 2 areas of the Galilee Basin Offset Strategy.

Data sources

Data sources directly used in the offsets assessment are outlined below:

- Remnant Vegetation Cover Version 6.1 (Queensland Herbarium, 2013)
- High Value Regrowth Vegetation Version 2.1 (Queensland Herbarium, 2013)
- Survey and Mapping of Pre-clearing Vegetation Communities and Regional Ecosystems Version 6.1 (Queensland Herbarium, 2013)
- Essential Habitat Version 3.1 (DNRM, 2013)
- Essential Regrowth Habitat Version 3.1 (DNRM, 2013)
- Great Barrier Reef Wetland Protection Area – High Ecological Significance Wetlands (DEHP, 2013)
- Protected Areas of Queensland (DNPRSR, 2013)
- Queensland Digital Cadastral Database (DNRM, 2013)
- Galilee Basin Offset Strategy (State of Queensland, 2012)

Geospatial analysis

The first step of the geospatial analysis involved quantification of potential impacts in terms of calculating the area of each MNES within the preliminary investigation corridor.

Subsequently, for each of the impacts to MNES identified, an analysis of suitable locations for offsetting was undertaken in order to determine the potential availability of offset sites across the region.

Offset priority areas identified by the Galilee Basin Offset Strategy formed the basis of the offset availability analysis. The suitability of areas for use as potential offset sites for the NGBR Project was assessed in accordance with the following criteria:

- Lot size greater than two hectares
- Lot tenure is lands lease or freehold (using the Queensland Digital Cadastral Database)
- Areas mapped as non-remnant, compliant high value regrowth (HVR) vegetation or category X on a property map of assessable vegetation in line with Queensland Government offset policies
- Areas mapped as remnant, HVR and/or non-remnant in line with the EOP
- Areas mapped with foliage projective cover (FPC) greater than or equal to six per cent (where applicable)
- Areas containing suitable mapped environmental values as per the relevant policy criteria.

To determine suitability in terms of environmental values, the geospatial analysis used aerial imagery together with relevant mapping layers such as vegetation, geology, topography, essential habitat, and flora and fauna species records.

Potential offset areas excluded from the analysis were:

- Lots mapped as Queensland estate and other lands including protected areas and strategic cropping trigger areas
- Parts of lots containing mining leases
- Parts of lots declared as nature refuges
- Lots which contain potential offset areas (for a given environmental value) smaller than one hectare.

Offset suitability for threatened flora and fauna was determined using a combination of resources including REs listed in the relevant essential habitat database record (version 3.1) and species information gathered from literature and previous experience within the region.

Offset suitability for TECs was determined using REs listed in Commonwealth Government listing advice.

7.15.2.2 EPBC Act offsets assessment

An indicative use of the EPBC Act offsets assessments guide was undertaken to estimate future offset requirements under the EOP using this guide, noting that limited field verified data was available for input. As such, the results for this assessment presented herein do not represent final values or proposed offsets, but rather present a potential offset quantification based on a conservative assessment of residual impacts. This exercise will be refined at a later stage in the offsets process using refined information.

7.15.2.3 Consultation

Consultation involving key regulators and relevant stakeholders will be undertaken during later stages of the EIS process to confirm the approach to offsets as well as the type and quantum of offsets being proposed.

7.15.2.4 Limitations

Whilst it has been possible to incorporate some technical data from recent ecological field surveys of the preliminary investigation corridor, the desktop assessment and geospatial analysis have been largely reliant upon mapped vegetation layers. These mapped layers have not yet been ground-truthed in entirety, and as such, a field-verified RE map is not available at this stage of the NGBR Project. Nevertheless, once this information does become available, this report can be revisited and the quantification of offset requirements updated accordingly. Furthermore, should the NGBR Project footprint change, residual impact calculations will need to be refined.

7.15.2.5 World Heritage Area and National Heritage Place

The NGBR Project is not anticipated to have a significant residual impact on either the GBRWHA or the GBRNHP (see Section 7.6) hence offsets are not required for these values.

7.15.2.6 Threatened ecological communities

Field surveys conducted as part of the EIS process confirmed the presence or potential presence of three TECs within the preliminary investigation corridor (refer Section 7.9). Quantification of potential impacts to these TECs within the NGBR Project footprint are presented in Table 7-63.

Potential offset areas were identified within priority 1 and 2 areas of the Galilee Basin Offset Strategy for all TECs requiring offsetting in association with the NGBR Project (refer Table 7-63).

7.15.2.7 Listed threatened species

Two EPBC Act listed threatened species were confirmed present during field surveys within the preliminary investigation corridor, these being black ironbox (*Eucalyptus raveretiana*) and squatter pigeon (southern) (*Geophaps scripta scripta*), with an additional four EPBC Act listed threatened species were considered likely to occur within the preliminary investigation corridor (refer Section 7.8). Quantification of potential impacts to EPBC Act listed threatened species' habitat within the NGBR Project footprint are provided in Table 7-63.

Large quantities of potential offset areas were identified within priority 1 and 2 areas of the Galilee Basin Offset Strategy for all EPBC Act listed species requiring offsetting in association with the NGBR Project (refer Table 7-63).

Large quantities of potential offset areas were identified within priority 1 and 2 areas of the Galilee Basin Offset Strategy for all EPBC Act listed species requiring offsetting in association with the NGBR Project (refer Table 7-63).

7.15.2.8 Listed migratory species

The NGBR Project is not anticipated to have a significant residual impact on listed migratory species (see Section 7.10) hence offsets are not required for this value.

7.15.2.9 Commonwealth marine area

The NGBR Project is not anticipated to have a significant residual impact on the Commonwealth marine area (see Section 7.11) hence offsets are not required for this value.

7.15.2.10 Great Barrier Reef Marine Park

The NGBR Project is not anticipated to have a significant residual impact on the Great Barrier Reef Marine Park (see Section 7.7) hence offsets are not required for this value.

Table 7-63 Summary of offset potential within priority areas identified by the Galilee Basin Offset Strategy

MNES	Species/community	Clearing area (ha) – final rail corridor	Clearing area (ha) – ancillary infrastructure	Total impact area (ha)	Potential compliant offset area (ha)	Maximum offset multiplier
TECs	Brigalow (*Acacia harpophylla*) dominant and co-dominant	94.3	6.0	100.3	31,260.8	311.7
	Natural grasslands of the Queensland central highlands and the northern Fitzroy Basin	100.4	16.7	0[1]	2,824.1	n/a
	Semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar regions	35.8	0	35.8	520.0	14.5
Threatened species	Black ironbox	64.2	0.4	64.6	40,590.5	628.3
	Australian painted snipe	39.9	5.7	45.6	226,580.8	4,968.9
	Black-throated finch (southern)	1,793.7	349.7	2,143.4	545,476.8	254.5
	Koala	1,913.2	476.9	2,390.1	558,704.7	233.8
	Ornamental snake	212.3	34.3	246.6	63,484.5	257.4
	Squatter pigeon (southern)	1,412.1	375.9	1,788.1	444,547.7	248.6

[1] As discussed in Section 7.9.4, no direct impacts on natural grasslands are anticipated however not all properties with mapped occurrences of this TEC were surveyed due to private property access restrictions. Adjacent properties with mapped occurrences of the TEC were found not to support this community. Remaining properties will be surveyed when access becomes available.

7.15.1 Offset Availability

7.15.1.1 Availability in the Galilee Basin

The offset availability analysis identified that 'no net loss' of environmental values can be achieved by the NGBR Project, with sufficient potential offset sites available within the priority 1 and priority 2 areas of the Galilee Basin Offset Strategy.

7.15.1.2 Availability elsewhere

Although large areas of potentially compliant offset areas were found for MNES likely to be impacted by the NGBR Project, it is recognised that one the values has a low potential compliant offset area ratio or maximum offset multiplier (refer Table 7-63). Specifically, the semi-evergreen vine thicket community had an offset multiplier of 14.5. A low offset multiplier is indicative of the relatively scarce availability of offsets for this value within the search area, such that there may be potential difficulties in securing sufficient appropriate offset sites. Nevertheless, it is relevant to acknowledge that the offset availability analysis presented herein was restricted analysis to the areas within the Galilee Basin Offsets Strategy. Where the potential compliant offset area may be limited, additional analysis will be undertaken prior to commencement of construction within 10 km from the centreline of the final rail corridor or elsewhere within the wider Brigalow Belt Bioregion.

7.15.2 Offset delivery

7.15.2.1 Offset delivery options

Offset packages typically require the delivery of either direct or indirect offsets, or a combination of the two.

Direct or 'in-kind' offsets aim to provide similar values, function, habitat and other attributes to those being lost or impacted by the adverse activity. Under the EOP, direct offsets should form a minimum 90 per cent of the offset requirement. The offset ratio required under the EOP is determined by the results of an ecological field assessment that considers the ecological condition of the impact site as well as the offset site. Therefore, surveys for the NGBR Project will subsequently be undertaken in accordance with the BioCondition method (Eyre *et al*. 2011) with the aim of determining the size of offsets required to offset the residual impacts of the NGBR Project, as well as to further determine the suitability of potential offset sites.

Indirect offset options should be considered to supplement direct offset delivery. Indirect offsets or 'compensatory measures' refer to offsetting activities that come in the form of either management, research, or financial contributions and are aimed at promoting gains for those values lost as a result of the impacting activity. Under the EOP, indirect offsets may satisfy up to a maximum of 10 per cent of the total offset requirement. Indirect offsets under the EOP may include the following:

- Implementing priority actions outlined in relevant recovery plans
- Enhancing habitat quality or reducing threats to the protected matter on a site that is not part of a direct offset
- Contributing to relevant research or education programs.

7.15.2.2 Offset co-location

Delivery of offsets under the *Queensland Environmental Offsets Policy* (2008) and the subordinate specific-issue policies will also be required for the NGBR Project. As such, in delivering offsets for the NGBR Project, offset values that occur within the same area will be co-located where possible. For example, where an RE type has been identified as habitat for a threatened species, the offset for this RE can potentially also be used as an offset for this threatened species. The potential for collocation for each of the MNES offset values is indicated in Table 7-65.

7.15.2.3 Proposed approach to offset delivery

It is anticipated that a combination of both direct and indirect methods of offset delivery will be selected for the NGBR Project.

While the NGBR Project's preference is to offset impacts using direct offsets, it is possible that indirect offsets may be included. As part of the final offsets package, landholder engagement and ecological surveys to confirm the suitability and ecological equivalence of the preferred package option will be conducted. Following this, the offsets package will be refined and confirmed. This may include the use of indirect offsets, which are likely to be in the form of contributions to species-specific management plans and targeted recovery actions.

The final offsets package will be developed to finalise the proposed approach to offset delivery and to address the requirements of the EOP. The final offsets package will include:

- Updated offset requirements based on offset requirements at the time of preparation (if applicable)
- Refined impact data (if applicable)
- The results of ecological equivalence assessments to determine 'quality' or BioCondition scores at impact and potential offset sites
- Final details regarding the delivery approach of direct and indirect offsets or offset payments and transfers within the offsets package
- Detail regarding the compliance of the offsets package with the relevant offset policies
- Proposed legally binding mechanisms to secure direct offsets
- A schedule of future tasks and timeframes to secure offsets
- A framework for the management of offset areas.

EPBC Act offsets assessment

An indicative use of the EPBC Act offsets assessments guide was undertaken to estimate future offset requirements under the EOP using this guide, noting that limited field verified data was available for input. A summary of the values used in this assessment are provided below in Table 7-64. The indicative calculations using the EPBC Act offsets assessments guide showed that potential offset availability greatly exceeded the direct offset requirements that are anticipated for TECs as well as threatened species (refer Table 7-64), noting the limitations discussed in Section 7.15.2.

The values presented in do not represent final values or proposed offsets. This exercise will be refined at a later stage in the offsets process using refined information, including a property map of assessable vegetation certified by the Queensland Herbarium.

The indicative calculations using the EPBC Act offsets assessments guide showed that potential offset availability greatly exceeded the direct offset requirements that are anticipated (refer Table 7-64), noting the limitations discussed in Section 7.15.2.

Table 7-64 Indicative use of the EPBC Act offsets assessment guide to determine whether direct offset requirements can be met

MNES	Quality of impacted area*	Quantum of impact (ha)**	Proposed offset (ha)	Risk related time horizon (years)	Time until ecological benefit (years)	Start quality	Risk of loss	Future quality of offset site without offset	Future quality of offset site with offset	Confidence	Percentage of impact that will be offset by area stated in column 4	Minimum (90%) of direct offset requirement met?	Potential compliant offset area available in Galilee basin Offset Strategy area (ha)
Brigalow (*Acacia harpophylla*) dominant and co-dominant	6	60	**200**	10	10	1	50	3	8	75	90.09%	Yes	31,260.8
Natural grasslands of the Queensland central highlands and the northern Fitzroy Basin	2	23.4	**80**	10	10	1	50	3	8	75	91.03%	Yes	2,824.1
Semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar regions	7	25.2	**86**	10	10	1	50	3	8	75	90.87%	Yes	678.5
Black ironbox	5	32.5	**100**	10	10	1	50	3	8	75	90.48%	Yes	40,590.5
Australian painted snipe	3	13.7	**47**	10	10	1	50	3	8	75	91.48%	Yes	226,580.8
Black-throated finch	7	1,500.4	**5,075**	10	10	1	50	3	8	75	90.06%	Yes	545,476.8
Koala	7	1,673.1	**5,125**	10	10	1	50	3	8	75	90.08%	Yes	558,704.7
Ornamental snake	6	148.0	**453**	10	10	1	50	3	8	75	90.03%	Yes	63,484.5
Squatter pigeon	8	1430.5	**4,380**	10	10	1	50	3	8	75	90.04%	Yes	444,547.7

*Habitat quality scores were estimated based on discussions with the field survey team, noting that habitat quality has not yet been formally assessed for the NGBR Project.
**Quantum of impact = (Proposed impact area X Quality)/10

Table 7-65 Potential for offset co-location

Environmental value	Species/community	Potential for offset co-location
TECs	Brigalow (*Acacia harpophylla*) dominant and co-dominant	RE 11.12.21, RE 11.9.1, RE 11.4.8, RE 11.4.9, RE 11.3.1
	Natural grasslands of the Queensland central highlands and the northern Fitzroy Basin	RE 11.9.12, RE 11.4.11, RE 11.4.4, RE 11.9.3
	Semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar regions	RE 11.11.18, RE 11.2.3
Threatened species	*Eucalyptus raveretiana*	State offset requirement for this species, RE 11.3.25, RE 11.3.37
	Australian painted snipe	State offset requirement for this species, wetland protection areas
	Black-throated finch (southern)	State offset requirement for this species, RE 11.3.2, RE 11.3.3, RE 11.3.4, RE 11.3.33, RE 11.4.2, RE 11.4.8, RE 11.4.11, RE 11.9.1, RE 11.12.10, RE 11.12.14, wetland RE
	Koala	State offset requirement for this species, RE 11.3.2, RE 11.3.3, RE 11.3.4, RE 11.3.33, RE 11.3.34, RE 11.4.2, RE 11.9.1, RE 11.9.10, RE 11.12.10, RE 11.12.14, wetland RE
	Ornamental snake	State offset requirement for this species, RE 11.3.3, RE 11.4.6, RE 11.4.8, RE 11.4.9, RE 11.4.11, RE 11.9.1, RE 11.9.12
	Squatter pigeon (southern)	State offset requirement for this species, RE 11.3.1, RE 11.3.2, RE 11.3.3, RE 11.3.4, RE 11.3.34, RE 11.4.2, RE 11.4.5, RE 11.4.6, RE 11.4.8, RE 11.4.9, wetland RE

7.15.3 Offset acquisition and security

All offsets must be secured by a legally binding mechanism. The appropriate mechanism for each offset will be determined through negotiation with regulators, Adani and the landholder.

Legally binding mechanisms may include conservation agreements under the EPBC Act. This involves an agreement between the Australian Government Environment Minister and another person for the protection and conservation of biodiversity in an area of land or sea. A conservation agreement may provide for:

- activities that promote the protection and conservation of the following:
  - biodiversity
  - the world heritage values of declared World Heritage properties
  - the National Heritage values of National Heritage places
  - the Commonwealth Heritage values of Commonwealth Heritage places
  - the ecological character of a declared Ramsar wetland
  - the environment, in respect of the impact of a nuclear action
  - the environment in a Commonwealth marine area
  - the environment on Commonwealth land
- financial, technical or other assistance from the Commonwealth
- monitoring compliance with the agreement

7.15.3.1 Outstanding and ongoing actions

A number of remaining tasks are required to be undertaken to advance the offsets process for the NGBR Project. In summary, such tasks include:

- Confirmation of offset requirements once additional field verification of mapped values has been completed (i.e. in areas where private property access was previously a constraint)
- Identification of large-scale strategic offset sites to focus further investigations and offset site selection
- Field assessment of potential impact sites to gain ‘quality’ or BioCondition scores for impacted values
- Field assessment of potential offset sites to verify that the values identified through desktop assessments are present and that they are ecologically equivalent to the impact sites.

Further refinement of threatened species habitat mapping is recommended to produce a more accurate indication of potential impacts to threatened species habitat. The mapping process used to determine the potential impact to MNES does not take into account localised features, previous disturbance (other than remnant vegetation current extent), relationships with introduced species, local habitat condition or current land use. It takes key habitat features at a regional scale that can be spatially represented to describe potential habitat. For this reason, the mapping outputs of potential habitat do not reflect current distribution or predict occurrence of a species and indeed provides an overestimate of where species actually occur, and therefore an overestimate of unavoidable impact to MNES. Further field investigations and threatened species habitat modelling could produce more accurate threatened species habitat mapping and therefore minimise overestimation of these values.

The indicative timeframes for key ongoing actions and offset delivery are provided in Table 7-66.

Table 7-66 Indicative timeframes for key ongoing actions and offset delivery

Task	Relevant phase
Confirmation of offset requirements	Design
Identification of specific potential offset sites	Design
Submission of offsets package	Design
In principle support of the Environmental Offset Package received from regulators	Design
If applicable, the provision of offset payments to the Balance the Earth Trust and the provision of indirect offsets	Pre-construction
If applicable, the establishment of offset transfer arrangements for initial stage of offsets	Pre-construction
If required, landholder engagement and negotiation with the owners of the identified properties	Pre-construction
Ecological equivalence assessments of the offset sites required for the initial stage of offsets to verify that the values identified through desktop assessments are present, and that they are ecologically equivalent to the impact sites. Preparation of final Offset Assessment Guides for Australian Government offsets	Pre-construction
Development of Offset Area Management Plans for the initial stage of offsets in accordance with the requirements of the relevant offset policies	Pre-construction
Application of a legally binding mechanism to secure the environmental values of the offset area in perpetuity	Pre-construction
Implementation of the Offset Area Management Plan including ongoing monitoring and reporting	Construction
Review of impacts of NGBR Project to identify any oversupply of offsets	Operation
Submission of a Revised Environmental Offset Package to regulators for approval	Operation

7.15.3.2 Consultation

Adani will undertake consultation with government agencies to discuss offsets for the NGBR Project. This consultation will provide an indication of further actions that need to be undertaken and additional offset areas that will be required to satisfy offset obligations.

Offsets brokers may also be engaged to assist with securing offsets, as they have established relationships with landholders and have knowledge of those interested in being involved in securing offsets for major projects in the region.

7.15.4 Conclusions

The NGBR Project will require delivery of environmental offsets under the EOP. The analysis of conservation priority areas identified by the Galilee Basin Offset Strategy indicates substantial availability of potentially suitable offset sites for all TECs and EPBC Act listed threatened species.

In finalising the offset approach for the NGBR Project, subsequent actions that will be undertaken will include the following:

- Preparation of field-verified ecological mapping and corresponding refinement of impact quantification
- Field assessment of impact sites to gain BioCondition scores and quantification of the size of offset requirements
- Identification of strategic offset sites to focus offset site selection, including BioCondition assessments to confirm suitability of potential offset sites
- Consultation with government agencies to confirm offset requirements and the approach to offset delivery
- Preparation of an Offsets Package to finalise the proposed approach to offset delivery and to address the requirements of National and State offset policies.

In conclusion, the results of this assessment indicate that it will be possible for the NGBR Project to achieve 'no net loss' of ecological values through a combination of direct and indirect offsets, in accordance with the ambitions of the EOP and the NGBR Project's EIS Guidelines. Delivery of direct offsets will be broadly achievable within the priority 1 and priority 2 areas of the Galilee Basin Offset Strategy.

7.16 Approvals and conditions

A range of legislation and approvals are applicable to the NGBR Project at the Commonwealth, State and local government level. The purpose of this section is to discuss the overarching legislative approval pathway, as well as identify legislation, planning instruments and polices that will apply to individual development aspects of the NGBR Project.

This section identifies assessable development triggers coordinated under, or outside of, Queensland's principal planning statute, the *Sustainable Planning Act 2009* (SP Act); and provides an assessment of State, regional and local government planning polices and schemes applicable to the NGBR Project. The chapter also identifies all approvals sought to be coordinated and conditionally approved by the Coordinator-General in assessing the NGBR Project EIS, in accordance with the *State Development and Public Works Organisation Act 1971* (SDPWO Act).

A summary of the approvals required for components of the NGBR Project and when these approvals will be sought is provided in Section 7.16.7.

7.16.1 Commonwealth legislation and policies

7.16.1.1 Environment Protection and Biodiversity Conservation Act 1999

A referral under the EPBC Act was lodged for the NGBR Project, in May 2013. The purpose of the referral was to provide the department administering the EPBC Act (then SEWPaC, now DotE) with sufficient information to make a controlled action decision under the EPBC Act. In

June 2013, SEWPaC issued a referral decision determining the NGBR Project to be a controlled action due to potential impacts on a number of controlling provisions. SEWPaC subsequently advised that the NGBR Project will require assessment via EIS under the EPBC Act, in parallel to the EIS assessment process being undertaken by the Queensland Coordinator-General under the SDPWO Act (i.e. the bilateral agreement between the State and Commonwealth does not apply to assessment of the NGBR Project EIS).

Final EIS Guidelines for the North Galilee Basin Rail Project (EPBC 2013/6885) were developed by SEWPaC and released on 1 August 2013. The EIS Guidelines require that direct and indirect impacts on matters covered by the controlling provisions must be assessed by the EIS.

The controlling provisions determined to be of relevance to the NGBR Project are:

- World Heritage properties (section 12 and 15A)
- National Heritage places (sections 15B and 15C)
- Listed threatened species and communities (sections 18 and 18A)
- Listed migratory species (sections 20 and 20A)
- Commonwealth marine areas (sections 23 and 24A)
- Great Barrier Reef Marine Park (section 24B and 24C).

The NGBR Project EIS requires approval from the Minister who administers the EPBC Act; the assessment will be carried under the requirements of Division 6 of the EPBC Act.

7.16.1.2 EPBC Act Environmental Offsets Policy

The purpose of the EPBC Act Environmental Offsets Policy (the EPBC offsets policy) is to outline the Australian government's position on the use of environmental offsets to compensate for residual adverse impacts on MNES protected by the EPBC Act.

Under the EPBC Act, environmental offsets can be used to maintain or enhance the health, diversity and productivity of the environment as it relates to MNES. However, environmental offsets do not apply where the impacts of a development are considered to be minor in nature or could reasonably be mitigated.

As the NGBR Project is a controlled action under the EPBC Act, the EPBC offsets policy applies to the NGBR Project and its activities, to the extent that residual impacts on MNES are unavoidable. Clearing for the NGBR Project that will require offset obligations under the EPBC offsets policy and the quantity of offsets required is discussed in Section 7.15.

7.16.1.3 Native Title Act 1993

The *Native Title Act 1993* (NT Act) recognises the rights and interests of Indigenous people in respect of land on which they historically resided. The NT Act provides for the determination of Native Title claims, the treatment of future acts that may impact Native Title rights and the requirement for consultation and/or notification to relevant claimants where future acts are involved.

A Native Title assessment was undertaken for the NGBR Project (refer to Volume 1 Chapter 15 Cultural heritage).

7.16.1.4 Aboriginal and Torres Strait Islander Heritage Protection Act 1984

The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (ATSIHP Act) protects areas and objects in Australia of particular significance to living Aboriginal people in accordance with Aboriginal tradition. The ATSIHP Act does not protect areas and objects of scientific or historical interest, such as rock art, archaeological sites or areas of past Aboriginal occupation, nor wildlife or biodiversity as natural heritage or intangible forms of heritage; Aboriginal remains are, however, protected (SEWPAC 2010).

An assessment was undertaken for the NGBR Project to identify any declared 'significant Aboriginal area' or 'object' (refer to Volume 1 Chapter 15 Cultural heritage).

Adani has a responsibility under the ATSIHP Act to report the discovery of anything reasonably suspected to be Aboriginal remains to the Minister who administers the ATSIHP Act. The specific requirements relating to the management and mitigation of unearthing an item or place of cultural heritage significance is detailed in the Cultural Heritage Management Plan (CHMP) prepared for the NGBR Project.

7.16.2 State legislation and policies

7.16.2.1 State Development and Public Works Organisation Act 1971

The SDPWO Act facilitates coordinated infrastructure planning and development to support economic and social progress; and provides for the appointment of a Coordinator-General (CG) as a corporation sole, representing the Crown.

The NGBR Project requires assessment under the SDPWO Act as a coordinated project requiring an EIS. In addition to this, the CG may designate the NGBR Project final rail corridor as a state development area or a private infrastructure facility. These are discussed in more detail below.

Coordinated project

In accordance with the SDPWO Act, an initial advice statement (IAS) was lodged with the CG for the NGBR Project, in May 2013. The purpose of the IAS was to provide the CG with sufficient information to make a 'coordinated project' declaration under Section 26(1)(a) of the SDPWO Act. In June 2013, the CG declared the NGBR Project to be a coordinated project requiring an EIS. Following consultation between SEWPaC and the CG, it was agreed that the EIS under the SDPWO Act is to be prepared in parallel to the EIS prepared under the EPBC Act and assessed separately (i.e. the bilateral agreement between the Commonwealth and State does not apply to the assessment of the NGBR Project EIS).

Under Section 35 of the SDPWO Act, once the CG has reviewed the EIS, the CG must prepare an evaluation report. The CG can coordinate subsequent approvals within this report by preparing the relevant conditions for various aspects of the NGBR Project. This will reduce the regulatory burden on the relevant assessing agencies and the proponent and streamline the public notification requirements which will otherwise be required for separate development permits. This EIS aims to provide the CG with sufficient information regarding subsequent approvals to enable the CG to prepare conditions for the NGBR Project. A summary of the approvals sought for the components of the NGBR Project is provided in Table 7-69.

State development areas

In accordance with Section 77 of the SDPWO Act the Governor in Council may designate land as a state development area (SDA) to facilitate future development. The CG then establishes a development scheme for each SDA, which allows proponents to lodge a 'material change of use' application for any proposed development within that area. The CG may, via the Governor in Council to the extent lawfully able to do so, compulsorily acquire land (or easements) and/or extinguish Native Title in land the subject of an SDA should voluntary negotiations be unsuccessful.

The CG declared the Abbot Point State Development Area (APSDA) in 2008, including later publication of the APSDA Development Scheme in 2012, to facilitate large-scale industrial development of regional, state and national significance in the vicinity of the Port of Abbot Point (Queensland Government 2012). The NGBR Project traverses the APSDA on approach to Abbot Point, and will therefore require a material change of use application for development approval by the CG in accordance with the APSDA Development Scheme.

The *Galilee Basin Coal Infrastructure Framework 2013* (DSDIP 2013) supports the development of a south-north infrastructure corridor from the Galilee Basin to Abbot Point in order to assist in the establishment of this corridor; the government will consider use of SDA powers under the SDPWO Act.

Should an SDA be declared for the NGBR Project, Adani will seek a development approval for a material change of use in accordance with the associated development scheme.

Private infrastructure facility

Under Section 153AC of the SDPWO Act a private infrastructure facility (PIF) is a facility assessed by the CG and approved by the Governor in Council as being of significance economically or socially to Australia, Queensland or the region in which the facility is to be constructed.

Under the SDPWO Act, the sorts of infrastructure facilities that may qualify for consideration as a PIF include (but are not limited to):

- A road, railway, bridge or other transport facility
- Electricity generation, transmission or distribution facilities
- Oil or gas storage, distribution or transmission facilities.

In accordance with the SDPWO Act, when considering whether to declare a PIF, the CG must also consider the potential for the facility to contribute to community wellbeing and economic growth or employment levels as well as the contribution the PIF makes to agriculture, industrial, resource or technological development in Australia, Queensland or the relevant region. A PIF designation represents the first step in a process under which the CG may, to the extent lawfully able to do so, compulsorily acquire land (or easements) prescribed in the *Acquisition of Land Act 1967* and/or extinguish Native Title for the facility should voluntary negotiations be unsuccessful. Under Section 125 of the SDPWOA, the Coordinator-General is authorised to take land for certain purposes, including a PIF.

A PIF has not yet been applied for or obtained for the NGBR Project. However, should an application be progressed and a PIF declared, relevant negotiations with Native Title parties and landowners will continue to be undertaken prior to commencement of any compulsory acquisition process.

PIF investigators authority

Under Section 141 of the SDPWO Act, the CG may authorise entry onto private properties to investigate the land's potential and suitability for the development of a PIF. This investigators authority may be granted, subject to conditions, before the land acquisition powers under Section 125 of the Act are exercised.

Successful engagement with 21 land holders has been undertaken and has resulted in the implementation of negotiated and signed access agreements for the purposes of investigating the NGBR Project. This amounts to approximately 80 per cent of the total land access requirements for the final rail corridor. Should it be considered that all reasonable community consultation obligations and commercial options with affected landholders who are not satisfied to grant such access has been exhausted, an application under Section 141 of the Act for an investigators authority may be submitted. A draft application for a PIF investigators authority was lodged with the CG's office in July 2013, and the CG has since commenced consultation with the affected parties.

7.16.2.2 Sustainable Planning Act 2009

The *Sustainable Planning Act 2009* (SP Act) is the principal planning legislation administered by the Queensland Government. SP Act seeks to achieve sustainable planning outcomes through management of the process by which development takes place, the effects of development on the environment and the coordination and integration of local, regional and state planning schemes and policies. Section 231(1) of the SP Act identifies the relevant categories of development which include exempt development, self-assessable development, development requiring compliance assessment, assessable development or prohibited development.

Schedule 3 of the SP Act lists development that is 'assessable development'. Chapter 6 of the SP Act establishes an Integrated Development Assessment System (IDAS) under which 'assessable development' is assessed. Activities undertaken as part of the NGBR Project that are considered assessable development will require a development permit under the SP Act for that activity.

The SP Act aims to coordinate all assessable development under other acts to minimise the legislative burden on regulatory agencies. The legislation managed under the SP Act is discussed in further detail in Section 7.16.3.

Community infrastructure designation

The approval pathway for the NGBR Project may include a designation by the Minister for Transport and Main Roads or local government as a Community Infrastructure Designation (CID) in accordance with Chapter 5 of the SP Act. In order for this process to be undertaken, the development must satisfy a public benefit test and be defined as 'Community Infrastructure' within the *Sustainable Planning Regulation 2009* (Qld) (SP Regulation). Rail transport infrastructure has been defined as Community Infrastructure in Schedule 2 of the SP Regulation.

The CID assessment process will be supported by the EIS. If the NGBR Project is granted a CID, the development will not require approval under the local planning schemes regulating land use in the area nor need to meet any scheme requirements. Under Section 206 of the SP Act, the CID must be identified in the local planning scheme; and subsequently, land uses inconsistent with the CID will be prohibited through the provisions of the planning scheme. In general, this process facilitates the efficient provision of community infrastructure at the time work needs to commence. Notwithstanding, regulatory requirements continue to apply, including building and environmental management legislation. Where Adani does not submit an application for a CID, an alternative approval pathway may involve the submission of a development application for a material change of use for a railway activity under an SDA.

Material change of use under local planning scheme

Alternatively, the NGBR Project may be approved as a ‘material change of use’ under a local planning scheme. Under the SP Act a material change of use refers to the start of a new and materially different activity on the premises or an increase in the scale and / or intensity of an existing use.

Applications for a material change of use are assessed against the relevant local planning schemes within the NGBR Project footprint and include the Whitsunday Regional Council regulated by the Bowen Shire Planning Scheme (2006), the Isaac Regional Council area regulated by the Belyando Shire Planning Scheme (2008). The Abbot Point State Development Area Development Scheme 2012 and the Port of Abbot Point Land Use Plan 2010 will also be applicable for a material change of use application within the APSDA.

Further detail regarding the assessment of the NGBR Project against aspects of these planning documents is provided in Section 7.16.6.

The requirements for material change of use applications are based on the relevant activities to be undertaken for a project and the associated planning scheme zoning for the affected areas.

The NGBR Project comprises a range of activities across multiple planning instruments, and therefore it is the preferred option to have the NGBR Project designated as a CID, SDA and/or PIF, which will coordinate and simplify matters associated with acquisition of contiguous land tenure, Native Title, development approvals and planning for consistent future development. Where one or more of these designations are not granted, approval will be sought under the relevant local planning schemes and will subsequently require several different applications for each component of the NGBR Project (generally on lot-by-lot basis). This approach will significantly increase the regulatory burden on the relevant assessment managers.

7.16.3 Legislation coordinated under the SP Act

The SP Act makes provisions for the governance of assessable development through the IDAS. Schedule 3 of the SP Regulation includes provisions for IDAS to govern assessable development under a number of Queensland Acts, including:

- Acquisition of Land Act 1967
- Building Act 1975
- Coastal Protection and Management Act 1995
- Environmental Protection Act 1994
- Fisheries Act 1994
- Land Act 1994
- Plumbing and Drainage Act 2002
- Queensland Heritage Act 1992
- Transport Infrastructure Act 1994
- Vegetation Management Act 1999

- Water Act 2000.

All applications are required to be lodged through the State Assessment and Referral Agency (SARA) which will coordinate the referral of the application to other relevant agencies as required. SARA will comprise the single point of contact for proponents and will incorporate feedback from the relevant agencies in approval conditions.

The activities associated with the NGBR Project are subject to development assessment under the SP Act; assessable development is likely to include a material change of use under the relevant local planning schemes (code or impact assessable), building works, reconfiguration of a lot and operational works including excavating or filling that materially affects a premise or its use (bulk earthworks, road works) and clearing vegetation.

7.16.4 Other applicable legislation

7.16.4.1 Aboriginal Cultural Heritage Act 2003 (Qld)

The *Aboriginal Cultural Heritage Act 2003* (ACH Act) regulates the management and protection of Aboriginal cultural heritage. The ACH Act imposes a 'duty of care' on the proponent of a development to take all reasonable and practicable measures to ensure they do not harm or, to the extent that harm cannot be avoided, minimise harm to Aboriginal cultural heritage. This applies whether or not such places are recorded in the Department of Aboriginal and Torres Strait Islanders and Multicultural Affairs (DATSIMA) Cultural Heritage Database and Register. Under Part 7 of the ACH Act, a CHMP is required as part of an EIS.

An Indigenous cultural heritage assessment was undertaken for the NGBR Project (refer to Volume 1 Chapter 15 Cultural heritage).

Consultation with relevant Aboriginal parties and development of CHMPs for the NGBR Project is currently being undertaken by Adani.

7.16.4.2 Energy Efficiency Opportunities Act 2006 (Cth)

The Energy Efficiency Opportunities program requires businesses to identify, evaluate and publicly report cost effective energy saving opportunities. Participation in Energy Efficiency Opportunities is mandatory for corporations that use more than 0.5 PJ of energy per year.

Should the NGBR Project operations surpass this threshold, it will be mandatory to report under the Energy Efficiency Opportunities program. Participation will need to be assessed based on actual energy consumption to determine the first year the threshold is exceeded.

7.16.4.3 Explosives Act 1999 (Qld)

Explosives in Queensland are controlled through the *Explosives Act 1999* (Explosives Act) and the *Explosives Regulation 2003*. The Queensland Government regulates who may make, own, use, store, transport and dispose of explosives through a dedicated explosives inventory.

The NGBR Project may require the use of regulated explosives during the construction of the final rail corridor, particularly in areas of difficult terrain where significant cutting is required via blasting. Permits will be required for the storage, transport and use of these explosives under the Explosives Act.

7.16.4.4 Forestry Act 1959 (Qld)

The purpose of the *Forestry Act 1959* (Forestry Act) is to provide for forest reservations; the management, silvicultural treatment and protection of State forests; and the sale and disposal of forest products and quarry material, the property of the State forests, timber reserves and on other lands; and for other purposes.

All forest products and quarry materials on all State lands are the property of the State. In accordance with Section 45 of the Forestry Act, all forest products or quarry material on land that is under a lease or other entitlement granted is also the property of the State.

A sales permit may be required for use of forest products or quarry material taken for the NGBR Project. It is noted that a Sales Permit cannot be issued until an ILUA has been agreed in accordance with the NT Act.

7.16.4.5 Land Protection (Pest and Stock Route Management) Act 2002 (Qld)

The *Land Protection (Pest and Stock Route Management) Act 2002* provides the framework for the management of pest species and the management of Queensland's stock route network. Under the Act, certain declared pest species carry a responsibility for owners of land where those species are present.

Where the activities associated with a project have the potential to introduce or exacerbate the spread of weeds and pests, a specific weed and pest management plan may be required for the project. This plan will outline how the proponent will seek to manage the spread or introduction of weeds and pests during the life of the project.

Where a project impacts on existing stock routes, negotiations with the relevant state / local regulatory authority will be required in conjunction with affected stakeholders to determine the requirements for appropriate crossings and other relevant infrastructure.

The ecological assessment (refer to Volume 1 Chapter 6 Nature conservation) undertaken for the NGBR Project identified a number of declared pest species. A weed and pest management plan will be developed for the NGBR Project and implemented throughout construction and operation.

The NGBR Project will have an impact upon nine gazetted stock routes. Where the NGBR Project intersects these stock route networks, mitigation and management measures will be developed in consultation with relevant State and local government agencies to protect its inherent values and to ensure it is available to serve its intended purpose.

7.16.4.6 Local Government Act 2009 (Qld)

The *Local Government Act 2009* (LG Act) empowers local governments to make local laws that are suitable to their particular needs and resources, and that achieve the purpose and principles of local government, without unnecessary administrative red tape.

The NGBR Project is located within two local government areas, namely the Whitsunday Regional Council and the Isaac Regional Council. The following local laws are applicable to the NGBR Project.

Whitsunday Regional Council

- Local Government Facilities and Areas Local Law 2011
- Nuisances and Pests Local Law 2011
- Roads Local Law 2011.

Isaac Regional Council

- Local Law No. 3 (Community and Environmental Management) 2011
- Local Law No. 4 (Local Government Controlled Areas, Facilities and Roads) 2011.

7.16.4.7 National Greenhouse and Energy Reporting Act 2007 (Cth)

The *National Greenhouse and Energy Reporting Act 2007* (NGER Act) establishes the National Greenhouse and Energy Reporting Scheme under which liable entities are required to report on their greenhouse gas (GHG) emissions. Under the NGER Act, companies with GHG emissions, energy use, or energy consumption greater than specified thresholds are obliged to report their emissions, energy use and energy production.

GHG emissions associated with the NGBR Project may need to be reported under the National Greenhouse and Energy Reporting Scheme; a detailed assessment of GHG emissions associated with the NGBR Project is provided in Volume 1 Chapter 11 Greenhouse gas.

7.16.4.8 Native Title (Queensland) Act 1993 (Qld)

The purpose of the *Native Title (Queensland) Act 1993* is to validate past acts of the Queensland government in response to the recognition of Native Title by the High Court of Australia in 1992. For example, under Section 17 of the Act, the ownership of natural resources by the Queensland government is validated.

Native Title claims and determinations and ILUAs are controlled under the *Native Title Act 1993 (Cth)* (refer to Section 7.16.1). A Native Title assessment of the NGBR Project is provided in Volume 1 Chapter 15 Cultural heritage.

7.16.4.9 Nature Conservation Act 1992 (Qld)

The *Nature Conservation Act 1992* (NC Act) is the framework for the establishment and management of protected areas, native flora and native fauna. In accordance with the definitions sets out in Part 5, Division 2 of the NC Act, wildlife, including native flora and fauna, may be prescribed under the NC Act as extinct in the wild, endangered, vulnerable, near threatened or least concern – all of which are considered protected wildlife. Under Section 62 of the NC Act, a person must not take, use, keep or interfere with a cultural or natural resource of a protected area, including protected flora and fauna. Furthermore it is an offence under Sections 88 and 89 of the NC Act to take protected flora and fauna that are outside of a protected area, without a licence, permit or other authority.

The NGBR Project requires the clearing of areas of vegetation protected under the NC Act. Subsequent permits and an approved species management plan will therefore be required for the NGBR Project.

7.16.4.10 Strategic Cropping Land Act 2011 (Qld)

Strategic cropping land (SCL) is a finite resource that is subject to competing land uses in agriculture, mining and urban development. The *Strategic Cropping Land Act 2011* (SCL Act) intends to control development in relation to SCL in order to maintain the long-term viability of the food and fibre industry and support economic growth for regional communities.

Where a proposed development will result in a permanent impact on area of SCL, the proposal will need to comply with the requirements of State Planning Policy 1/12: Protection of

Queensland's strategic cropping land. Approval will be required under the SP Act to permanently impact any areas of SCL.

The NGBR Project traverses some areas of SCL (trigger area) (refer to Volume 1 Chapter 5 Topography, geology, soils and land contamination). An initial multi criteria analysis undertaken for the NGBR Project sought to minimise any potential impacts of the alignment on areas of SCL. Where the NGBR Project will unavoidably have a permanent impact on areas confirmed to be SCL, an approval will be required under the SP Act in accordance with SPP 1/12 Protection of Queensland's Strategic Cropping Land.

7.16.4.11 Transport (Rail Safety Act) 2010 (Qld)

The *Transport (Rail Safety Act) 2010* was enacted to regulate entities involved in rail operations to ensure that model national rail safety standards are achieved so far as is reasonably practicable. The aim of the legislation is to provide for improvement of the safe carrying out of railway operations including the management of risks associated with railway operations and promote public confidence in the safety of transport of persons or freight by rail.

Rail infrastructure managers and rolling stock operators must be accredited to operate in accordance with Rail Safety Act. This accreditation is required when controlling rail facilities including (but not limited to) railway track, associated track structures, signalling systems, depots and when operating rolling stock on a railway.

Adani have obtained a rail safety accreditation as rail infrastructure manager and rolling stock operator as part of the Carmichael Coal Mine Project. This accreditation was approved by the Department of Transport and Main Roads on 31 July 2012. An application for variation to the accreditation for inclusion of rail operations associated with the NGBR Project was submitted on 24 July 2013 and is currently being considered by the Department of Transport and Main Roads.

7.16.4.12 Work Health and Safety Act 2011 (Qld)

The *Work Health and Safety Act 2011* (WHS Act) regulates dangerous goods and major hazard facilities within Queensland. A licence for storage and handling of hazardous materials, particularly dangerous goods and combustible liquids may be required where the storage of hazardous materials on-site exceeds the relevant thresholds outlined in the WHS Act

During construction and operation of the NGBR Project a number of hazardous substances will be used. Volume 1 Chapter 18 Hazard, risk, health and safety provides an indicative list of the hazardous substances that will be used, the likely quantities that will be stored on site and the purpose for the substance. Where these quantities exceed the relevant thresholds under the WHS Act, relevant permits / licences will be required.

7.16.4.13 Waste Reduction and Recycling Act 2011 (Qld)

The *Waste Reduction and Recycling Act 2011* (WRR Act) establishes a framework which modernises waste management and resource recovery practices in Queensland. The WRR Act promotes waste avoidance and reduction and encourages resource recovery and efficiency.

The WRR Act defines a waste management hierarchy, as the preferred order in which waste and resource management options should be considered. The waste management hierarchy is as follows.

- Avoid unnecessary resource consumption

- Reduce waste generation and disposal
- Re-use waste resources without further manufacturing
- Recycle waste resources to make the same or different products
- Recover waste resources, including the recovery of energy
- Treat waste before disposal, including reducing the hazardous nature of waste
- Dispose of waste only if there is no viable alternative.

The waste management hierarchy has been considered in the development of the waste management strategy for the NGBR Project (refer to Volume 1 Chapter 13 Waste).

7.16.5 State and regional planning policies

7.16.5.1 State planning policies

State planning policies (SPPs) are created under Part 4 of the SP Act and enforced through local planning schemes. A local planning scheme must reflect the elements outlined in an SPP. Where the provisions of a local planning scheme and an SPP are inconsistent, the SPP overrides the planning scheme. As such, SPPs also provide guidance on assessment decisions under a local planning scheme. Additionally, SPPs inform the overall policy direction of regional plans.

The Queensland government intends to replace the various existing SPPs with a consolidated SPP. A draft SPP was released for public comment which was completed on 12 June 2013 (this is discussed in more detail below). The draft SPP comprises a consolidation of the existing SPPs; however, until the consolidated draft SPP comes into effect, the Queensland's government's interests are outlined by the current state planning policies as outlined below.

7.16.5.2 Temporary SPP 2/12 Planning for Prosperity

Temporary SPP 2/12 Planning for Prosperity (SPP 2/12) sets out the Queensland government's interests in development of agriculture; tourism projects; mining and extractive resource industries; and residential, commercial and industrial activities. The intent of the policy is to remove regulatory barriers to these types of development in areas that are appropriately zoned or otherwise suitable.

It is considered that the NGBR Project is consistent with the provisions of SP2/12 as the NGBR Project seeks to bolster the mining and extractive resource industries by providing a solution to coal transport in the Galilee Basin. The provisions within SP2/12 relating to the protection of good quality agricultural land is dealt with under SPP 1/92 Development and the Conservation of Agricultural Land 1.0 and the soil assessment for the NGBR Project (refer to Volume 1 Chapter 5 Topography, geology, soils and land contamination).

7.16.5.3 SPP 1/12 Protection of Queensland's Strategic Cropping Land

SPP 1/12 Protection of Queensland's Strategic Cropping Land (SPP 1/12) forms part of the legislative and planning framework for protecting SCL, in conjunction with the SCL Act (refer to Section 7.16.4). Under Section 2 of SPP 1/12*,* it has effect when development applications are assessed by the department administering the SCL Act. The policy principles to be applied by SPP 1/12 are consistent with the principles of the SCL Act.

It is considered that by seeking a compliance certificate or, alternatively, a protection decision under the SCL Act, the NGBR Project will be consistent with the principles of SPP 1/12.

7.16.5.4 SPP 4/11 Protecting Wetlands of High Ecological Significance in Great Barrier Reef Catchments

The intent of SPP 4/11 Protecting wetlands of high ecological significance in Great Barrier Reef catchments (SPP 4/11) is to maintain ecological processes of wetlands of catchments adjoining the Great Barrier Reef lagoon. These wetlands are mapped under SPP 4/11 as wetland protection areas within a large geographical extent. SPP 4/11 applies to assessable development under the SP Act.

Wetland protection areas traversed by the NGBR Project were identified in the course of the ecological assessment (refer to Volume 1 Chapters 6 Nature conservation).

7.16.5.5 SPP 5/10 Air, Noise and Hazardous Materials

The intent of SPP 5/10 Air, Noise and Hazardous Materials (SPP 5/10) is to protect sensitive land uses from the effects of industrial land uses, and to ensure industrial land uses are protected from encroachment by sensitive land uses. Sensitive land uses under SPP 5/10 are typically residential dwellings or care facilities. Acceptable outcomes for developments that are sensitive land uses under SPP 5/10 protect human health while not compromising future or existing industrial development. SPP 5/10 applies to assessable development under the SP Act.

7.16.5.6 SPP 4/10 Healthy Waters

The intent of SPP 4/10 Healthy Waters (SPP 4/10) is to ensure that developments for urban purposes are designed and operated to protect the environmental values defined in the Environmental Protection Policy (EPP) Water. Urban purposes under SPP 4/10 have their meaning derived from the SP Regulation and include residential and industrial purposes. SPP 4/10 applies to assessable development under the SP Act.

Ancillary features of the NGBR Project that are assessable development under the SP Act, such as construction camps, may be assessed in accordance with SPP 4/10.

7.16.5.7 SPP 3/10 Acceleration of Compliance Assessment

SPP 3/10 Acceleration of compliance assessment (SPP 3/10) applies to subdivision of a lot where that development requires compliance assessment under the SP Act. Under SPP 3/10 a proponent may apply for a compliance permit for the development.

Features of the NGBR Project that are assessable development under the SP Act, such as construction camps, may be eligible to apply for a compliance permit under SPP 3/10.

7.16.5.8 SPP 1/07 Housing and Residential Development including Guideline 1.0

The intent of SPP 1/07 Housing and Residential Development including Guideline 1.0 (SPP 1/07) is to guide the development of a planning scheme prepared by a local government. SPP 1/07 requires local governments to account for and facilitate development to meet the housing needs of their community.

Features of the NGBR Project that are assessable development under the SP Act, such as construction camps may be assessable under SPP 1/07.

7.16.5.9 SPP 1/03 Mitigating the Adverse Impacts of Flood, Bushfire and Landslide 1.0

SPP 1/03 Mitigating the Adverse Impacts of Flood, Bushfire and Landslide 1.0 (SPP 1/03) sets out the Queensland government’s interest in ensuring that flood, bushfire and landslide are adequately assessed when decisions are made on a development. SPP 1/03 implements this by creating natural hazard management areas for flood, bushfire and landslide. Under SPP 1/03 a planning scheme should identify these areas in accordance with the guidelines included in SPP 1/03. The application of SPP 1/03 for bushfire and landslide is limited to local government areas listed in SPP 1/03. SPP 1/03 applies to assessable development under the SP Act.

This policy applies to a material change of use or reconfiguration of a lot in 'natural hazard management areas. Features of the NGBR Project that are assessable development under the SP Regulation such as construction camps may be assessed in accordance with SPP 1/03.

7.16.5.10 SPP 2/02 Planning and Managing Development Involving Acid Sulfate Soils 1.0

SPP 2/02 Planning and Managing Development Involving Acid Sulfate Soils 1.0 (SPP 2/02) sets out the Queensland government's interest in development involving acid sulfate soils in coastal areas. SPP 2/02 applies to all land, soil and sediment at or below 5 m Australian Height Datum (AHD) where the natural ground level is less than 20 m AHD.

Two areas along the NGBR Project alignment have the potential to disturb areas of acid sulphate soils (refer to Volume 1 Chapter 5 Topography, geology, soils and land contamination). SPP 2/02 will only apply where the proposed activities in these areas involves the excavation or removal to 100 m^3 or more of soil or filling of land involving 500 m^3 or more of material with an average depth of 0.5 metres or greater.

7.16.5.11 SPP 1/92 Development and the Conservation of Agricultural Land 1.0

The intent of SPP 1/92 Development and the Conservation of Agricultural Land 1.0 (SPP 1/92) is to provide guidance to local authorities on the conservation of good quality agricultural land (GQAL). Guideline 1 for SPP 1/92 The Identification of Good Quality Agricultural Land 1.0 defines four categories of land from an agricultural perspective, as follows:

- Class A, crop land
- Class B, limited crop land
- Class C, pasture land
- Class D, non-agricultural land.

All class A land and some class B and class C land could be considered GQAL.

SPP 1/92 provides guidance that any development on GQAL should be done in consideration of the policy principles. The policy principles broadly prevent development on GQAL unless there is an overriding need to do so. SPP 1/92 is implemented through the development of local planning schemes.

A land suitability assessment determined that approximately 315 ha of class A, 670 ha of class B and 130 ha of class C GQAL is present within the proposed final rail corridor for the NGBR Project (refer to Volume 1 Chapter 5 Topography, geology, soils and land contamination). SPP 1/92 is therefore applicable to the NGBR Project.

Draft State Planning Policy (consolidated)

The Queensland government intends to replace the various existing SPPs with a consolidated SPP. A draft SPP was released for public comment which was completed on 12 June 2013. The draft SPP sets out the state interests and related policies that local government must take into account in preparing or amending local planning instruments and in preparing and amending regional plans.

The draft SPP prescribes the development assessment requirements for certain applications and sets out the matters that must be considered by a Minister before designating land for community infrastructure.

The draft SPP is currently under review subject to public consultation and is scheduled to be in effect in late-2013.

7.16.5.12 Queensland Coastal Plan

The Queensland Coastal Plan has been prepared under the *Coastal Protection and Management Act 1995* (the Coastal Act) and commenced on 3 February 2012. The Queensland Coastal Plan comprises two parts:

- State Policy for Coastal Management
- State Planning Policy 3/11: Coastal Protection (SPP 3/11).

In April 2013, the Coastal Protection State Planning Regulatory Provision was implemented and suspended the operation of the State Planning Policy 3/11.

These provisions are discussed further below.

State policy for coastal management

The State Policy for Coastal Management is prepared under the Coastal Act. The policy provides direction and guidance about the management of coastal land in Queensland to achieve the objectives of the Coastal Act.

The State Policy for Coastal Management applies to management planning, activities, decisions and works that are not assessable development under the SP Act and therefore not subject to the State Planning Policy 3/11: Coastal Protection.

The State Policy for Coastal Management applies to coastal land and its resources within the coastal zone including:

- Land under tidal waters
- Erosion prone areas
- Land at risk from storm tide inundation or permanent inundation due to sea level rise (i.e. coastal hazard areas)
- Coastal roads and esplanades
- Reserves and unallocated State land
- Other parcels of land adjacent to the foreshore.

Coastal resources under this policy relate to the natural and physical features, processes, places or objects of the coastal zone that have ecological, economic or social value. This includes areas of high ecological significance. Development assessable under the State Policy for Coastal Management must consider the outcomes of the management policies provided.

Where the NGBR Project falls within the coastal zone and does not comprise assessable development under the SP Act, the NGBR Project will need to comply with the management policies outlined in the State Policy for Coastal Management.

Coastal protection state planning regulatory provision

The Coastal Protection State Planning Regulatory Provision (Coastal Protection SPRP) applies to all local government areas in Queensland that include land within the coastal zone and outlines the requirements for development in these areas. Since being implemented in April 2013, the Coastal Protection SPRP effectively suspends the operation of the State planning policy 3/11: Coastal Protection and the coastal management requirements of the Mackay, Isaac and Whitsunday Regional Plan.

Part 2 of the Coastal Protection SPRP makes provisions for the management of the coastal zone where making a designation for community infrastructure under the SP Act (refer to Section 7.16.2). In this regard, any community infrastructure designation over coastal lands must comply with the requirements of this SPRP. The general requirements are outlined in Table 7-67 below.

Table 7-67 Coastal SPRP general requirements for community infrastructure

Coastal Protection SPRP requirements	NGBR Project response
Land use planning The coastal zone is to be conserved in its natural or non-urban state outside of existing urban areas and new development is to be undertaken so as to avoid or minimise adverse impacts on coastal resources and their values.	The NGBR Project will be contained within or in close proximity to an existing railway corridor in areas subject to erosion as a result of tidal inundation, storm impacts and long term sediment loss. The NGBR Project will therefore minimise impacts to existing coastal resources.
Coastal hazards New development on the coast must consider the likely impacts of coastal hazards on the development. Development must consider the hierarchy of management approaches of: avoid, planned retreat, accommodate, protect.	The NGBR Project has been designed to accommodate any potential risk of coastal erosion. The NGBR Project will be contained within or in close proximity to an existing railway corridor in areas subject to erosion as a result of tidal inundation, storm impacts and long term sediment loss. The NGBR Project will therefore minimise impacts to existing coastal resources. A comprehensive risk assessment has been undertaken for the NGBR Project (refer to Volume 1 Chapter 18 Hazard, risk, health and safety) as well as an assessment of the likely impacts of climate change and the associated increase in natural hazard events on the NGBR Project (refer Volume 1 Chapter 17 Climate and natural hazards).
Provision for coastal-dependent land uses In areas adjoining the foreshore, adequate provision needs to be made for coastal-dependent land uses; planning for the location and design of new coastal-dependent land uses outside of existing coastal townships must be undertaken so as to avoid or minimise adverse impacts on coastal resources and their values.	The NGBR Project does not propose new coastal-dependent development; it is not expected that the NGBR Project will have an adverse impact on existing coastal dependent development.
Areas of high ecological significance Urban development is located outside areas of high ecological significance in any coastal	The NGBR Project has been designed to minimise impacts to ecological values within the study area. A comprehensive ecological

Coastal Protection SPRP requirements	NGBR Project response
management district	assessment has been undertaken for the NGBR Project and is provided in Volume 1 Chapter 6 Nature conservation.

Part 3 of the Coastal Protection State Planning Regulatory Provision makes provisions for assessment of development applications where:

- The development is in the coastal management district if:
  - The application requires impact assessment, or
  - The jurisdiction of a referral agency for the application is defined in the Coastal Act.
- The Chief Executive administering the Coastal Act is the assessment manager for the application.

Development applications to which this part applies must be assessed against the criteria in the SPRP. The general requirements for this section of the SPRP are outlined in Table 7-68 with a description of how the NGBR Project complies with the outcomes of the policy.

Table 7-68 Coastal SPRP general requirements for other development

Specific policy outcome	NGBR Project response
Coastal hazards Communities and development are protected from adverse coastal hazard impacts, taking into account the projected effects of climate change, the protective function of the natural environment and the preference for allowing the natural fluctuation of the foreshore and foreshore ecosystems to continue, including, in response to rising sea levels **Development in an erosion prone area** Any future development of the land must not be at a greater intensity than the existing development unless it can be clearly demonstrated that the development will not compromise coastal management outcomes and principles.	The NGBR Project will be contained within or in close proximity to an existing railway corridor in areas subject to erosion as a result of tidal inundation, storm impacts and long term sediment loss. The NGBR Project will therefore minimise the risk of coastal hazards. A comprehensive risk assessment has been undertaken for the NGBR Project (refer to Volume 1 Chapter 18 Hazard, risk, health and safety) as well as an assessment of the likely impacts of climate change and the associated increase in natural hazard events on the NGBR Project (refer Volume 1 Chapter 17 Climate and natural hazards).
Nature conservation Areas of high ecological significance are protected and areas of general ecological significance on land and other ecological values are conserved.	The NGBR Project has been designed to minimise impacts to ecological values within the study area. A comprehensive ecological assessment has been undertaken for the NGBR Project and is provided in Volume 1 Chapter 6 Nature conservation.
Areas of high ecological significance Urban development is located outside areas of high ecological significance in any coastal management district	The NGBR Project has been designed to minimise impacts to ecological values within the study area. A comprehensive ecological assessment has been undertaken for the NGBR Project and is provided in Volume 1 Chapter 6 Nature conservation.
Public access Public access to the coast is maintained and enhanced for current and future generations.	The NGBR Project is not expected to restrict existing public access to the coast.

Specific policy outcome	NGBR Project response
Coastal dependent development Protect and maintain opportunities for sustainable coastal dependent development in a manner that avoids impacts on coastal resources.	The NGBR Project does not propose new coastal-dependent development; it is not expected that the NGBR Project will have an adverse impact on existing coastal dependent development.
Canals and dry land marinas Coastal resources are protected from canal or dry land marina development.	The NGBR Project does not comprise the development of canals or dry land marinas.

7.16.5.13 Mackay, Isaac and Whitsunday regional plan

The NGBR Project final rail corridor is located entirely within the boundaries of the Mackay, Isaac and Whitsunday Regional Plan (MIWRP) and subsequently needs to consider the relevant provisions throughout project design. The MIWRP is a statutory plan that establishes a vision and direction for the region to 2031, provides certainty about where the region is heading and provides a framework to respond to challenges and opportunities that may arise.

The MIWRP seeks to achieve its purpose through a series of desired regional outcomes (DROs). The DROs articulate the preferred direction for proposed development and land use outcomes in the region, and include specific policies and programs to manage the growth of the region to 2031.

The MIWRP plan also provides regional narratives for the three areas of Mackay, Isaac and Whitsunday. The Whitsunday narrative provides information on the key communities of Proserpine, Bowen, Airlie Beach, Cannonvale, Collinsville and the coastal towns and islands. The Isaac narrative provides information on the key communities of Moranbah, Clermont, Middlemount, Dysart and Glenden, Coppabella, Nebo and the coastal towns. The narratives also outline key opportunities and challenges regarding rural settlements, economy and employment, residential, community services, and infrastructure.

The overarching principles for each DRO have been incorporated throughout development of the NGBR.

7.16.6 Local planning instruments

7.16.6.1 Overview

The following section demonstrates the compliance of the NGBR Project against relevant planning schemes in order to identify permits required for construction and operation of the NGBR Project. The majority of the properties immediately affected by the NGBR Project are zoned as rural, and are located within the jurisdictions of the following planning schemes:

- Properties within the Abbot Point State Development Area (NGBR Project chainage 3.49 km to chainage 21 km) regulated by the *Abbot Point State Development Area Development Scheme 2012* and the *Port of Abbot Point Land Use Plan 2010*
- Properties within the Whitsunday Regional Council area (chainage 21 km to chainage 271 km) regulated by the *Bowen Shire Planning Scheme 2006*
- Properties within the Isaac Regional Council area (chainage 271 km to chainage 306.9 km) regulated by the *Belyando Shire Planning Scheme 2008.*

A summary of key development intents for each zone in accordance with the relevant planning scheme has been provided in the sections below.

7.16.6.2 Abbot Point State Development Area Development Scheme 2012

All proposals for material change of use developments within the Abbot Point State Development Area (APSDA) must comply with the objectives of the *Abbot Point State Development Area Development Scheme 2012* (APSDA Development Scheme) and the intents of the relevant land use precincts. Alternately, the CG may use discretionary powers to approve certain types of development inconsistent with the development scheme.

The NGBR Project falls within the following land use precincts under the APSDA Development Scheme:

- Environmental management/materials transportation precinct
- Industry precinct
- Restricted development precinct
- Infrastructure and corridors precinct.

The NGBR Project constitutes an 'infrastructure facility' under the Development Scheme and is considered to be a use that 'may meet the purpose of the land use designation'. As such it is therefore considered a consistent use in the above precincts.

Port of Abbot Point Land Use Plan 2010

The *Port of Abbot Point Land Use Plan 2010* has been prepared in accordance with the statutory provisions of the Transport Infrastructure Act 1994. It sets out the planning and development intent of North Queensland Bulk Ports (NQBP) for the strategic port land at the Port of Abbot Point. The Port of Abbot Point Land Use Plan is the principal tool used by NQBP as the assessment manager for assessing development on strategic port land at the Port of Abbot Point.

The northern extent of the NGBR Project final rail corridor lies within the boundaries of the Port of Abbot Point Land Use Plan and this section of the NGBR Project and any proposed infrastructure within the jurisdiction of the plan will therefore require an application for a material change of use. Where NQBP determine that part or all of the NGBR Project within the bounds of the Port of Abbot Point Land Use Plan is exempt development or otherwise removes itself from being the assessment manager, a material change of use application under SDPWO Act may be required.

7.16.6.3 Whitsunday Regional Council Community Plan 2011-2021: Our Conversation with our Community

The Whitsunday Regional Council Community Plan 2011-2021: Our Conversation with our Community (WRCCP) is a long term planning document prioritising the emerging opportunities and challenges identified by the community. The community plan is based on five key themes:

- Economy (growth and diversification of our economy, tourism, agriculture)
- Infrastructure (water and sewerage, roads and transport, parks and gardens, social and community infrastructure)
- Planning our community (strategic planning, built environment)
- Natural environment (environmental sustainability, protection and conservation), and
- Community (people culture and lifestyle; sport and recreation).

Under these key themes, the Community Plan outlines future opportunities and challenges identified by the Whitsunday community and proposed actions and goals for the future. Some key goals of relevance to the NGBR Project social impact assessment and the formulation of relevant mitigation strategies include:

- Advocating the Whitsundays as the region to live, work, play and invest
- Promoting economic growth and stimulus in the region by both the private sector and all spheres of government
- Promote economic and employment opportunities whilst at the same time promoting our quality of life
- Advocating and promoting mining and industrial developments to house permanent workforces in the Whitsunday region
- Advocating for alternative modes of transport for freight and logistics other than the Bruce Highway.

7.16.6.4 Isaac Regional Council Isaac Region 2020 Vision 2009 – 2019 (Community Plan)

The Isaac Region 2020 Vision (Isaac Region Community Plan) is a long-term, strategic planning document prepared under the *Local Government Act 2009*. The Isaac Region Community Plan identifies values, existing assets and resources and prioritises opportunities and challenges the Isaac region community has identified as important. The following list is a sub-set of actions identified as priorities in the Isaac Region Community Plan to be considered when formulating social impact management strategies for the NGBR Project:

- Affordable and available housing
- Safe roads and transport (including signage, impact of heavy industry on Peak Downs Highway and other local roads)
- Maintaining a safe community, especially for children, youth and the aged
- Conserving natural environment and build places for recreation
- Minimising cumulative impacts of coal mining (including improved monitoring and management by proponents)
- Managing integration of FIFO workforce and camps into local communities or supporting local migration into the communities
- Raise awareness and plan for the impact of industry related activities on infrastructure
- Integrating mine closure planning into decision making about community relations investments and implementation of social impact management strategies (to contribute to town sustainability when mining industry or project changes or is impacted by factors such as global markets)
- Provision of transport and power supply infrastructure (IRC, 2009).

7.16.6.5 Bowen Shire Planning Scheme 2006

Land use activities on properties within the Whitsunday Regional Council area, particularly from approximately chainage 21 km to chainage 271 km are regulated by the *Bowen Shire Planning Scheme 2006*.

The NGBR Project is primarily located within the Rural Zone of the *Bowen Shire Planning Scheme 2006*. The proposed uses associated with the development of the NGBR Project best conform to the definitions of 'Major Utilities', 'Accommodation Building' and 'General Industry' under Schedule 1 of the planning scheme. The development of 'Major Utilities', 'Accommodation Building' and 'General Industry' are all identified as impact assessable within the Rural Zone pursuant to Part 3 of the scheme. Therefore, the NGBR Project will require a material change of use application to be lodged with Whitsunday Regional Council for assessment against the relevant codes set out in the planning scheme.

7.16.6.6 Belyando Shire Planning Scheme 2008

Land use activities on properties located within the Isaac Regional Council area, particularly properties extending from chainage 271 km to chainage 306.9 km along the final rail corridor are regulated by the *Belyando Shire Planning Scheme 2008*.

The NGBR Project is primarily located within the Rural Zone. The proposed uses associated with the development of the NGBR Project best conform to the definitions of 'Railway Activities', 'Accommodation Building' and 'Public Utilities' under Part 2 of the planning scheme. The development of 'Accommodation Buildings', 'Railway Activities' and 'Public Utilities' are all identified as impact assessable within the Rural Zone pursuant to Part 4 of the scheme. Therefore, the NGBR Project will require a material change of use application to be lodged with Isaac Regional Council for assessment against the relevant codes set out in the planning scheme.

7.16.7 Summary of approvals required

Table 7-69 outlines the approvals required for the NGBR Project based on the relevant activities proposed and indicates the anticipated timing of attaining each approval.

This EIS seeks to obtain endorsement, via stated conditions within the final CG's evaluation report, of a significant number of the State and local government approvals identified above as part of the coordinated project approval process administered by the CG under the SDPWO Act.

It is acknowledged that aspects, the subject of the EIS, which are also deemed assessable development under schedule 3 of the Sustainable Planning Act 2009, a regulation, a local planning scheme or local by-laws will be supported by further information (in the form of detailed site layout designs and final site-based management material) prior to lodgement of a development application with the assessment manager. This process is not expected to commence until after the CG has issued an evaluation report under the SDPWO Act.

The timing presented in Table 7-69 relates to the preparation of development applications and supporting information however appropriate conditions are sought from the Coordinator-General through the current EIS process.

Table 7-69 Project approvals register

Legislation	Approval / permit required	Comments	Timing – preparation of application material	Project wide[1]	Site preparation / civil works[2]	100 m corridor including rail line and passing loops	Accommodation camps[3]	Rail depot (storage and manufacturing yard)	Rolling stock maintenance depot	Concrete batching plants	Temporary lay down areas (track and road crossings)	Temporary lay down areas (waterway crossings)	Water way crossings	Turning circles	Water supply[4]	Haulage and transport of plant / materials during construction and operations	Quarries and borrow pits	Ongoing railway operation and maintenance[5]	Road crossings	Rail crossings	Stock route crossings
Commonwealth approval requirements																					
Environment Protection and Biodiversity Conservation Act 1999	Controlled action assessment via Environmental Impact Statement	Assessment in parallel with State assessment under SDPWO Act	In progress	X																	
Native Title Act 1993	Indigenous land use agreement	Being undertaken as a concurrent process	In progress	X																	
Aboriginal and Torres Strait Islander Heritage Protection Act 1984	General duty of care	Proponent has a responsibility under the Act to report the discovery of anything reasonably suspected to be Aboriginal remains.	Draft EIS CHMP development in progress	X																	
State approval requirements																					
State Development and Public Works Organisation Act 1971	Coordinated Project assessment via Environmental Impact Statement	Assessment by CG in parallel with EPBC Act assessment	Draft EIS	X																	
	Development approval under the APSDA Development Scheme	Within the APSDA	Draft EIS	X																	
	Declaration of a new NGBR State Development Area (SDA)	Remainder of NGBR Project not located within APSDA or on strategic port land	Post draft EIS	X																	
	Material change of use under a potential NGBR SDA Development Scheme	Remainder of NGBR Project not located within APSDA or on strategic port land	Post draft EIS	X																	
	Declaration as a Private Infrastructure Facility (PIF)	Remainder of NGBR Project not located within APSDA or on strategic port land or new SDA	Post draft EIS	X																	

Legislation	Approval / permit required	Comments	Timing – preparation of application material	Project wide[1]	Site preparation / civil works[2]	100 m corridor including rail line and passing loops	Accommodation camps[3]	Rail depot (storage and manufacturing yard)	Rolling stock maintenance depot	Concrete batching plants	Temporary lay down areas (track and road crossings)	Temporary lay down areas (waterway crossings)	Water way crossings	Turning circles	Water supply[4]	Haulage and transport of plant / materials during construction and operations	Quarries and borrow pits	Ongoing railway operation and maintenance[5]	Road crossings	Rail crossings	Stock route crossings
State approval requirements																					
Sustainable Planning Act 2009 (SP Act)	Community Infrastructure designation (CID)	This may apply across the entire NGBR Project footprint within or not within APSDA, SPL or a new SDA.	Post draft EIS	X																	
	Material change of use under Belyando Shire Planning Scheme (including ERAs)	Lodged as an application under the IDAS process; assessed by the Isaac Regional Council	Post draft EIS			X	X	X	X								X				
	Material change of use under Bowen Shire Planning Scheme (including ERAs)	Lodged as an application under the IDAS process; assessed by the Whitsunday Regional Council	Post draft EIS			X	X	X	X								X				
	Development permit for reconfiguration of a lot under Belyando Shire Planning Scheme	Lodged as an application under the IDAS process; assessed by the Isaac Regional Council	Post draft EIS			X	X		X								X				
	Development permit for reconfiguration of a lot under Bowen Shire Planning Scheme	Lodged as an application under the IDAS process; assessed by the Whitsunday Regional Council	Post draft EIS			X	X		X								X				
	Development permit for operational works under Belyando Shire Planning Scheme	Lodged as an application under the IDAS process; assessed by the Isaac Regional Council	Post draft EIS		X							X	X				X				
	Development permit for operational works under Bowen Shire Planning Scheme	Lodged as an application under the IDAS process; assessed by the Whitsunday Regional Council	Post draft EIS		X							X	X				X				

Legislation	Approval / permit required	Comments	Timing – preparation of application material	Project wide[1]	Site preparation / civil works[2]	100 m corridor including rail line and passing loops	Accommodation camps[3]	Rail depot (storage and manufacturing yard)	Rolling stock maintenance depot	Concrete batching plants	Temporary lay down areas (track and road crossings)	Temporary lay down areas (waterway crossings)	Water way crossings	Turning circles	Water supply[4]	Haulage and transport of plant / materials during construction and operations	Quarries and borrow pits	Ongoing railway operation and maintenance[5]	Road crossings	Rail crossings	Stock route crossings
State Approval requirements coordinated under the Sustainable Planning Act 2009																					
Aboriginal Cultural Heritage Act 2003	General duty of care and CHMP with each relevant Indigenous group	Being undertaken concurrently.	Draft EIS and CHMP development in progress	X																	
Coastal Protection and Management Act 1995	Works within tidal waters	Only required where the NGBR Project is developed within tidal waters	Post draft EIS			X						X	X								
Environmental Protection Act 1994	ERA 16 Extractive and screening activities	Extracting, other than by dredging, a total of 5000 tonnes or more of material, in a year, from an area or screening 5000 tonnes or more of material in a year	Post draft EIS		X												X				
	ERA 33 Crushing, milling, grinding or screening	Crushing, grinding, milling or screening more than 5000 tonnes of material in a year	Post draft EIS														X				
	ERA 63 Sewage treatment	Operating 1 or more sewage treatment works at a site that has a total daily peak design capacity of at least 21 EP.	Post draft EIS				X		X												
	ERA 64 Water treatment	Treating 10 ML or more raw water in a day. Carrying out, in a day, advanced treatment (i.e. treatment of water that has been treated in a sewerage treatment plant) of 5 ML or more of water, allowing the release of waste to waterways	Post draft EIS				X		X												

Legislation	Approval / permit required	Comments	Timing – preparation of application material	Project wide[1]	Site preparation / civil works[2]	100 m corridor including rail line and passing loops	Accommodation camps[3]	Rail depot (storage and manufacturing yard)	Rolling stock maintenance depot	Concrete batching plants	Temporary lay down areas (track and road crossings)	Temporary lay down areas (waterway crossings)	Water way crossings	Turning circles	Water supply[4]	Haulage and transport of plant / materials during construction and operations	Quarries and borrow pits	Ongoing railway operation and maintenance[5]	Road crossings	Rail crossings	Stock route crossings
State Approval requirements coordinated under the Sustainable Planning Act 2009																					
Environmental Protection Act 1994	Suitability statement required for development on land listed on the EMR / CLR	Site assessment required to determine level of contamination and if any remediation required.	Post draft EIS		X		X		X				X				X				
	Disposal permit for removing or disposing of contaminated soil	Required where contaminated soil is proposed to be removed from site	Post draft EIS		X		X		X				X				X				
Fisheries Act 1994	Development permit for removal of / damage to marine plants	Required where the NGBR Project will involve damage to marine plants, likely in areas within the coastal zone and under tidal influence i.e. watercourse crossings at the northern end of the final rail corridor	Post draft EIS		X							X	X								
	Development permit for carrying out Operational Works / Waterway Barrier Works Permit	Required where temporary or permanent waterway barrier works are required for construction and operation works.	Post draft EIS		X							X	X								
Forestry Act 1959	Permit to search for and to get samples of quarry material	To occur early to inform the EIS process.	Granted														X				
	Sales Permit		Post draft EIS														X				
Land Act 1994	Permit for temporary road closure	May be required for establishment of site access roads	Post draft EIS		X																
	Reconfiguring a lot	Required where land parcels are required to be reconfigured or tenure converted	Post draft EIS	X																	

Legislation	Approval / permit required	Comments	Timing – preparation of application material	Project wide[1]	Site preparation / civil works[2]	100 m corridor including rail line and passing loops	Accommodation camps[3]	Rail depot (storage and manufacturing yard)	Rolling stock maintenance depot	Concrete batching plants	Temporary lay down areas (track and road crossings)	Temporary lay down areas (waterway crossings)	Water way crossings	Turning circles	Water supply[4]	Haulage and transport of plant / materials during construction and operations	Quarries and borrow pits	Ongoing railway operation and maintenance[5]	Road crossings	Rail crossings	Stock route crossings
Land Protection (Pest and Stock Route Management) Act 2002	Permit for activity in a Stock Route area		Post draft EIS																		X
Transport Infrastructure Act 1994	Road control permit / traffic control permit	Required for works within a State-controlled road corridor and to control traffic during works on a State-controlled road	Post draft EIS		X														X	X	
Transport (Rail Safety Act) 2010	Railway Manager accreditation (infrastructure and operator)	Concurrent process	In progress	X																	
Vegetation Management Act	Development permit for Operational Works – clearing vegetation	Where clearing of assessable vegetation is required a PMAV and PVMP will be developed	Post draft EIS		X	X	X	X	X		X	X	X	X	X		X		X	X	X
Water Act 2000	Riverine protection permit		Post draft EIS									X	X		X						
	Permit to take water (temporary)		Post draft EIS												X						
	Water allocation		Post draft EIS												X						
	Water licence		Post draft EIS												X						
State approval requirements not coordinated under the Sustainable Planning Act																					
Explosives Act 1999	Permit for use, handling or transport of explosives		Post draft EIS		X											X	X				
National Greenhouse and Energy Reporting Act 2007	General duty of care	Where a report on GHG emissions associated with the NGBR Project are required under NGER	Draft EIS	X																	

Legislation	Approval / permit required	Comments	Timing – preparation of application material	Project wide[1]	Site preparation / civil works[2]	100 m corridor including rail line and passing loops	Accommodation camps[3]	Rail depot (storage and manufacturing yard)	Rolling stock maintenance depot	Concrete batching plants	Temporary lay down areas (track and road crossings)	Temporary lay down areas (waterway crossings)	Water way crossings	Turning circles	Water supply[4]	Haulage and transport of plant / materials during construction and operations	Quarries and borrow pits	Ongoing railway operation and maintenance[5]	Road crossings	Rail crossings	Stock route crossings
State approval requirements not coordinated under the Sustainable Planning Act																					
Nature Conservation Act 1992	Permit to take / clear protected plants (includes all native vegetation)	Approval required for any proposed ‘taking’ or destruction of certain listed flora and fauna species or vegetation on State land	Post draft EIS		X	X	X	X	X		X	X	X	X	X		X		X	X	X
Strategic Cropping Land Act 2011 and Strategic Cropping Land Regulation 2011	Approval in accordance with SPP 1/12	Approval required where the NGBR Project will unavoidably have a permanent impact on areas of SCL	Post draft EIS	X																	
Transport Infrastructure Act 1994	Port development consent on strategic port land	On strategic port land in accordance with the Port of Abbot Point Land Use Plan, administered by NQBP	Post draft EIS	X																	
Work Health and Safety Act 2011	Permit for storage / use of dangerous goods	Where the relevant thresholds are exceeded	Post draft EIS		X		X	X	X							X	X				
Waste Reduction and Recycling Act 2011	Approval of resource for beneficial use	Where resources may be diverted from waste disposal streams and be reused as part of waste management strategy	Post draft EIS	X																	

7.17 Conclusions

7.17.1 Compliance with the EPBC Act

An important consideration throughout development of the NGBR Project and preparation of this EIS has been consideration of ecologically sustainable development. Table 7-70 provides an overview of how the principles of ecologically sustainable development (as defined in the EPBC Act) have been applied to the NGBR Project.

Table 7-70 Ecologically sustainable development principles

ESD Principle	How applied
(a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations	A key consideration during development of this EIS has been assessment of the beneficial and adverse impacts across the lifetime of the NGBR Project. Mitigation and management measures have been developed that seek a balance between environmental integrity, social development and economic development.
(b) if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation	Evaluation and assessment of alternatives and options has aimed to reduce the risk of serious and irreversible environmental damage. Extensive stakeholder consultation was undertaken and a range of technical specialists were engaged to apply scientific rigour to the assessment of potential impacts. Where lack of full scientific certainty has occurred, the precautionary principle has been applied and a conservative approach used with a clear commitment for further necessary scientific studies prior to construction commencement.
(c) the principle of inter-generational equity-that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations	The NGBR Project represents a long-term investment in Queensland and Australia's rail infrastructure with significant economic and social benefits for current and future generations including: Substantial employment opportunities during both construction (1,700 people) and operation (369 people) Increased jobs for local and state suppliers, services and contractors throughout both construction and operation Increased ability to export coal overseas at higher profit rates due to transport efficiency, thereby aiding in the expansion of the Queensland economy. While the NGBR Project may have short and long-term environmental impacts, a number of mitigation measures will be implemented to avoid and limit serious, long-term and irreversible environmental damage. A benefit of the NGBR Project is that it will be designed as a multi-user railway with a design life of more than 90 years, ensuring it remains available for use by future generations.

ESD Principle	How applied
(d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making	A thorough ecological assessment has been undertaken for the NGBR Project to identify and manage potential impacts on biological diversity and ecological processes. The alignment of the NGBR Project final rail corridor (a nominal 100 m wide corridor) was selected taking into consideration vulnerable and endangered terrestrial and aquatic flora and fauna species, as well as threatened and endangered ecological communities. Where possible, modifications have been made to the NGBR Project design to avoid or minimise its effect on these species and communities.
(e) improved valuation, pricing and incentive mechanisms should be promoted	This EIS assesses the environmental consequences of the NGBR Project and identifies suitable mitigation and management measures for potential adverse impacts. The implementation of these measures represents an economic cost to Adani and will increase the capital cost of construction and operation of the NGBR Project. The appropriateness of proposed mitigation measures (i.e. cost and practicality) was determined based upon the severity of the impact being mitigated which demonstrates that environmental resources were given appropriate valuation.

7.17.2 Project rationale and justification

The NGBR Project is a standard gauge rail project which is proposed to connect the Carmichael Project rail infrastructure to the Port of Abbot Point. The NGBR Project will service the Carmichael Project and third-parties, allowing coal to be transported to the Port of Abbot Point for international export.

The Galilee Basin spans over 247,000 km^2 of land which is considered to be one of the last undeveloped coal reserves within Queensland and is expected to become the largest coal producing region in the State. In June 2012, the Queensland government announced its support for the development of the coal industry in the Galilee Basin and recognised the need for infrastructure, particularly rail links from mine to port, to support such development.

The NGBR Project is proposed to provide a more direct and operationally more cost effective transport solution direct to the Port of Abbot Point in accordance with the Queensland Government's preference for a single north-south multi-user common access rail corridor servicing the Galilee Basin, as outlined in the Galilee Basin Coal Infrastructure Framework (DSDIP 2013). This will aid in the reduction of current rail congestion and cumulative impacts experienced on the Goonyella and Newlands systems via Moranbah.

The NGBR Project aligns with a number of key State government policies that guide and inform the development of Queensland's abundant coal resources including:

- Galilee Basin Coal Infrastructure Framework (DSDIP 2013)
- Coal Plan 2030 (DSDIP 2010)
- Queensland Infrastructure Plan (DLGP 2011a)
- Draft Moving Freight strategy (DTMR 2013)

- Queensland Regionalisation Strategy (DLGP 2011b).

Economic assessments estimate that at a regional level, the NGBR Project is expected to generate a significant and positive economic impact in the Mackay, Isaac and Whitsunday (MIW) region and Queensland. The NGBR Project will involve a capital investment of approximately $2.2 billion which includes capital expenditure on earthworks, drainage, bridges, road works, rail track and signalling, communications and construction management costs.

Economic modelling estimates that the NGBR Project will generate approximately 6,150 jobs (1,700 direct and 4,452 indirect) in the MIW region and just under 7,000 jobs (2,017 direct and 4,981 indirect) in total across Queensland during the peak construction year of 2015. In 2015, modelling estimates that the NGBR Project will contribute $791 million to Gross Regional Product in the MIW region and $909 million to Queensland's Gross State Product.

Once fully operational, modelling estimates that the NGBR Project will contribute $209 million to Gross Regional Product in the MIW region per annum and $369 million per annum to Queensland's Gross State Product. Operation of the NGBR Project is also estimated to generate 1,097 (277 direct and 820 indirect) full time equivalent positions each year in the MIW region and 1,940 (369 direct and 1,571 indirect) full time equivalent positions each year across Queensland over the life of the NGBR Project.

7.17.3 Environmental acceptability of the project

The NGBR Project has been and will continue to be developed to having regard to achieveing environmentally sustainable outcomes. This was achieved in accordance with the following steps:

- Avoidance of sensitive environmental areas via a comprehensive route selection study
- Assessment of all potential environmental impacts of the chosen route
- Mitigation of the potential impacts through design criteria and industry standard management measures
- Management of any residual impacts through the development of comprehensive management plans
- Where required, residual impacts will be offset to achieve an overall gain in biodiversity value
- Monitoring of ongoing impacts during the life of the NGBR Project through the development of adaptive management and monitoring protocol.

The outcomes of the assessment and management measures outlined above have been discussed in previous sections throughout this chapter. It is anticipated that any residual impacts associated with the development of the NGBR Project will be appropriately managed and the impacts to MNES values will be negligible; in this regard, Adani considers the development of the NGBR Project to be environmentally acceptable.

7.18 EIS Guidelines cross-reference

Table 7-71 provides a cross-reference to the EIS Guidelines for the NGBR Project.

Table 7-71 EIS Guidelines cross-reference table

EIS Guidelines Requirement / Section Number	Cross-reference
5 Specific content requirements	
An extract of Schedule 4 of the EPBC Regulations 2000, which sets out the matters that must be addressed in an EIS, is provided at Attachment 1. The following content requirements are based on these matters and considerations, with the addition of directions specific to the proposed action and the receiving environment. Requirements on presentation and consultation, that have proven valuable in communicating with members of the public and specific interest groups, are also included.	N/A
5.1 Executive summary	
The EIS must provide an executive summary that outlines the key findings of the EIS. The executive summary must briefly: a) state the background and the need for the proposal; b) discuss alternatives and the reasons for selecting the preferred option and rejecting the alternatives; c) summarise the construction, operational activities and decommissioning associated with putting the proposed action into practice; d) state the proposed schedule for each key component of the proposal, the relationships and interdependencies between each stage, the expected duration of each stage and the proposed action as a whole; e) provide an overview of the existing regional and local environments, summarising the features of the physical, biological, social, cultural and economic environment relating to the proposed action and associated activities; f) summarise stakeholder consultation undertaken in preparing the EIS; g) describe the expected, likely and potential impacts of the proposed action on matters of National Environmental Significance during construction, operational and decommissioning phases, including cumulative impacts; h) summarise the environmental protection measures and safeguards, mitigation measures, offsets and monitoring to be implemented for the proposal; and i) provide an outline of the environmental record of the proponent.	Volume 1 Chapter 7 Executive summary

EIS Guidelines Requirement / Section Number	Cross-reference
5.2 Objective	
The objectives of the EIS must be clearly stated and include specific reference to EPBC Act legislative requirements.	Volume 1 Chapter 7 Section 7.1.5
5.3 General information	
The EIS must provide the background of the proposed development. This must include: a) the title of the proposal; b) the full name and postal address of the designated proponent; c) a clear outline of the proposal; d) the location of the proposal; e) the background to the development of the proposal; f) how the proposed action relates to any other developments that have been, or are being, taken or that have been approved in the region; g) the current status of the proposal;. h) the consequences of not proceeding with the proposed action or components of the proposal; i) a brief explanation of the scope, structure and legislative basis of the EIS; j) the specific EPBC Act matters affected by the proposal; and k) a description of government planning policies, statutory controls and agreements which will influence the proposal. All applicable jurisdictions and areas of responsible authorities within the area (both terrestrial and marine) must be listed and shown on maps at appropriate scales.	Volume 1 Chapter 7 a) Section 7.1.1 b) Section 7.1.2 c) Section 7.2 d) Section 7.1.1 and Figure 7.1 e) Section 7.1.3 f) Section 7.1.4 g) Section 7. h) Section 7.3.1 i) Section 7.1.1 j) Section 7.1.1 k) Section 7.1.3, Figure 7.2 and Section 7.12.

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5.4 The proposed action description	
The EIS must describe the proposed action in sufficient detail to allow an understanding of all stages (including interdependencies between stages) and components of the proposal, and determine potential environmental impacts associated with the proposal. Those elements with potential implications for matters protected under Part 3 of the EPBC Act must be highlighted. All construction, operational and decommissioning components of the action must be described in detail. This must include the precise location (including coordinates) of all works to be undertaken, structures to be built, footprints of the various elements of the project or elements of the action that may have impacts on matters of National Environmental Significance. The description of the action must also include details on how the works are to be undertaken (including stages of development and their timing) and design parameters for those aspects of the structures or elements of the action that may have relevant impacts on matters of National Environmental Significance. Details of proposed monitoring and enforcement programs to help limit the impacts of the ongoing operations on matters of National Environmental Significance must also be addressed.	Volume 1 Chapter 7 Section 7.2 Volume 1 Chapter 7 Section 7.5 to 7.10 Volume 1 Chapter 7 Section 7.2 Volume 1 Chapter 7 Section 7.5 to 7.10
5.5 Project details	
The EIS must provide the description of the proposed action and must discuss: a) the environmental principles on which the development will be managed; b) all the components of the proposed action including: i. associated infrastructure, including transport networks/corridors; ii. construction;	Volume 1 Chapter 7: a) Section 7.2.1 b) i. Section 7.2.2 ii. Section 7.2.3 iii. Section 7.2.4 iv. Section 7.2.4 v. Section 7.2.4

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iii. commissioning; iv. operation (including use by parties other than the proponent); v. related maintenance activities, both long and short term; and vi. decommissioning. c) describe the local and regional economic, social and built context, including historical and future trends (example sources: Australian Bureau of Statistics, Great Barrier Reef Outlook Report 2009) within which this project is proposed; d) future development areas that are currently "greenfield" in the region and the likely nature and timing of development (including but not limited to other proposed rail projects); e) describe the overall planning context in which proponents' decisions for this project have been made (including the overarching plan which this project sits within); f) a detailed description of social and economic impacts and drivers for the proposal; g) the precise location of works to be undertaken (including specific footprint areas), structures to be built or other elements of the proposed action that may have impacts on the environment (aerial photographs, maps, figures and diagrams must be incorporated); h) reference must be made to detailed technical information in appendices where relevant; and i) how the works are to be undertaken and design parameters for all aspects of the structures or elements of the proposal. This must include: i. an explanation of the anticipated timetable for construction, operation and decommissioning; ii. details of construction and operational equipment to be used; iii. details of the environmental parameters the structures are designed to withstand, based on the expected life of asset (incorporating predictions of climate change and 'worst case scenarios'); iv. details of the sustainability measures that will be employed to minimise the activity's carbon footprint; and v. a summary of the design aspects that will be employed to minimise impacts on environmental, social,	vi. Section 7.2.5 c) Section 7.12.3 d) Section 7.12.2 e) Section 7.1.5 f) Section 7.12.3 g) Section 7.2.1 h) n/a i) i. Section 7.2.3 ii. Section 7.2.3 and Section 7.2.4 iii. Section 7.2.2 iv. Section 7.2.1 v. Section 7.2.1

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cultural and heritage values.	
5.6 Alternatives to the proposal	
The EIS must describe, to the extent reasonably practicable, any prudent and feasible alternatives to the proposal. For each alternative listed the proponent must provide the project details, impacts (positive and negative), location, scale, configuration and staging options. Sufficient detail must be provided to make clear why any alternative is preferred to another. This section must describe, but not be limited to the following: a) site selection including the choice of region for the project and site within that region; b) an analysis of prudent and feasible alternative sites and why this site is likely to have the least impact on matters of National Environmental Significance; c) the alternative of taking no action or not proceeding with components of the proposal; d) potential alternative locations for different components of the proposal; e) potential alternative configuration or scale options for key components of the proposal; f) describe options for integrating operations with existing infrastructure where they exist to mitigate impacts on the general environment, ecosystems and matters of National Environmental Significance; g) a comparative description of adverse and beneficial impacts on the matters protected by the controlling provisions for the proposed action (as relating to alternative options, components or locations); h) a description of how each stage will be affected if one or more of the stages does not occur or is significantly modified; i) a discussion of the reasoning supporting the preferred location and options for the development as a whole. Each key component of the proposal, must be explained in detail and must include a comparison of the adverse and beneficial impacts; j) the advantages and disadvantages of alternatives when considered against relevant matters protected under the EPBC Act (including critical issues identified in the Great Barrier Reef Outlook Report 2009) must be specifically addressed; and k) short, medium and long-term advantages and disadvantages of the options must be considered.	Volume 1 Chapter 7: a) Section 7.3.1 b) Section 7.3.3 c) Section 7.3.4 d) Section 7.3.3 e) Section 7.3.1 f) Section 7.3.2 g) Section 7.3.3 h) n/a i) Section 7.3.3 j) Section 7.3.3 k) Section 7.3.1

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5.7 Consultation	
The EIS must provide details regarding any consultation on the action, including: a) any consultation that has already taken place; b) proposed consultation about relevant impacts of the action; c) if there has been consultation about the proposed action, any documented response to, or result of, the consultation; d) identification of affected parties, including a statement mentioning any communities that may be affected and describing their views; and e) any further proposed consultation about potential impacts of the proposal.	Volume 1 Chapter 7 Section 7.1.7
5.8 Matters of National Environmental Significance	
The EIS must include a discussion of matters of National Environmental Significance which must include: a) Listed threatened species and communities (sections 18 & 18A); b) Listed migratory species (sections 20 & 20A); c) World Heritage Properties (sections 12 & 15A); d) National Heritage Places (sections 15B & 15C); e) Commonwealth marine areas (sections 23 & 24A); and f) Great Barrier Reef Marine Park (sections 24B & 24C)	Volume 1 Chapter 7 a) Section 7.8 b) Section 7.10 c) Section 7.6 d) Section 7.6 e) Section 7.11 f) Section 7.7
5.9 The existing environment	
The EIS must provide a description of the project area including baseline condition and trends of terrestrial, coastal and marine environments, including hydrology, sediment flows, geography, flora and fauna, cultural and heritage values, and all relevant socio-economic considerations.	Volume 1 Chapter 7 Sections 7.5
This section must link to the proposed action description, potential impacts to matters of National Environmental Significance	Volume 1 Chapter 7

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(listed at 5.8), and proposed avoidance, mitigation adaptive management framework and/or offset measures throughout the life of the project including construction, operation and decommissioning. This section is to also identify and reference any relevant (published and unpublished) studies undertaken in the area which will assist in describing patterns and trends in the environment.	Sections 7.6 to 7.12
The EIS must provide a description of the environment of the proposed action site and the surrounding areas that may be affected by the action. This discussion must include the following information: a) a discussion of any previous surveys or studies in relation to matters of National Environmental Significance listed as controlling provisions for the proposed action; b) a discussion of the results of the output from the protected matters search tool (accessible from the department's website), indicating the presence of matters of National Environmental Significance, with the discussion focused on any species or values considered likely or known to occur in areas impacted by the proposed action must be addressed; c) a discussion of listed threatened and/or migratory species and ecological communities that are likely to be present in the vicinity of the site, or impacted by the proposed action; d) targeted surveys for listed threatened and/or migratory species and ecological communities that are likely or known to be present in the vicinity of the site, or impacted by the proposed action must be carried out and at a minimum the following details must be included: i. details of the scope, timing (survey season/s) and methodology for studies or surveys used to provide information on the listed species/community/habitat at the site and in areas that may be impacted by the project; ii. where departmental survey guidelines exist for listed threatened and/or migratory species and ecological communities, surveys must be in accordance with these guidelines; and iii. include a summary of the location, size and breeding status of threatened and migratory species listed under the EPBC Act which are likely to occur in the area affected by the proposal. e) information on listed ecological communities, threatened and/or migratory species, including foraging, roosting, resting and nesting habitats, must include but not be limited to: i. description and maps of habitat (including maps of and descriptions of critical habitat) for threatened	Volume 1 Chapter 7 a) Section 7.4.3 b) Section 7.4.2 c) Section 7.8 to 7.10 d) Section 7.4.3 e) Section 7.8 to 7.10 f) Section 7.1.2 g) Sections 7.7.1, 7.8.1, 7.8.2, 7.9.1, 7.9.2 and 7.9.3 h) Section 7.5 to 7.12 i) Sections 7.7.1, 7.8.1, 7.8.2, 7.9.1, 7.9.2 and 7.9.3 j) Section 7.5 to 7.12 k) Section 7.6.2 l) Sections 7.5 and 7.12 m) Section 7.10.2 n) Section 7.5 to 7.11

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species, ecological communities and migratory species; ii. the importance of habitat (including habitat condition, utilisation and connectivity) in a local, regional, national and international context; iii. the status of the population in the area likely to be affected by the proposed development relative to other areas outside the area likely to be affected; iv. genetic diversity; v. the viability of the local, regional and overall populations; vi. local and regional representation; vii. conservation and biodiversity values; viii. economic, social and cultural values of species; ix. the extent (in hectares) of any areas of important or unique habitat; and x. seasonality influences. f) identify the desired conservation outcomes that the project has for matters of National Environmental Significance; g) describe the biophysical/regional conditions that are required for matters of National Environmental Significance to be maintained and that are required to reach articulated conservation objectives for matters of National Environmental Significance; h) identify factors that influence matters of National Environmental Significance including human-induced and natural factors (for example, climate change and flooding); i) describe and quantify natural variability of matters of National Environmental Significance where adequate data is available or can be sourced; j) describe the extent to which the general environment, ecosystems and matters of National Environmental Significance are already stressed or under threat by natural and anthropogenic effects; k) a description of the World Heritage and National Heritage values of the Great Barrier Reef World Heritage property and	

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National Heritage place; l) a description of the values of wetlands of high ecological significance in the area; m) a description of the Commonwealth marine environment and identification of those aspects of the Commonwealth marine area potentially affected by the proposal; and n) identify and describe the existing uses of the area and nearby areas that may be affected by the proposed action (for example, tourism, commercial and recreational fishing, research and traditional use activities). All maps provided must be produced at a sufficiently fine scale and must be as accurate as possible, and must consider their primary purpose and end use (for example, to evaluate habitat loss and inform locations of monitoring and reference sites).	
5.10 Relevant impacts	
The EIS must include a description of all of the relevant impacts (please refer to section 527E of the EPBC Act for the meaning of impact) of the action. Relevant impacts (both direct and indirect) are impacts that the action will have or is likely to have on a matter protected by a controlling provision (as listed in the preamble of this document). Impacts during each of the construction, operational and the decommissioning phases of the project must be addressed, and the following information must be provided: a) a detailed assessment of the nature, extent, likelihood and consequence of the likely short-term and long-term impacts (specific guidance is provided for impacts from increased shipping, however, these are not the only expected impacts of the proposed action of this nature); b) a statement whether any relevant impacts are likely to be unknown, unpredictable, irreversible or sub-lethal (reversible over time) and what confidence level is placed on the predictions of relevant impacts; c) analysis of the significance of the relevant impacts; d) any technical data and other information used or needed to make a detailed assessment of the relevant impacts; e) describe how soon restoration of habitat could be achieved to reinstate ecosystem function for matters of National Environmental Significance; f) where possible, identify how much likely change to matters of National Environmental Significance exceeds natural variability in the region;	Volume 1 Chapter 7 Sections 7.5 to 7.12 a) Sections 7.5 to 7.12 b) Section 7.5 to 7.12 c) Sections 7.5 to 7.12 d) Sections 7.5 to 7.12 e) Section 7.5 to 7.12 f) Section 7.5 to 7.12 g) Section 7.5 to 7.12 h) Section 7.5 to 7.12

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g) describe how this project will contribute to the desired conservation objectives for matters of National Environmental Significance; h) a description of the framework used to assess impacts, including risk assessment processes, based on best available practice; and i) analysis of potential impacts, from the interaction of environmental events such as cyclones and flooding with the proposed action, including impacts such as changed flow regimes and degraded water quality. Any related cumulative impacts should also be reflected in the analysis (but the information provided should also allow identification of impacts attributable to this action alone).	i) Section 7.5 to 7.12
5.10.1 Impacts to listed migratory species, threatened species and ecological communities	
The EIS must provide an assessment of all potential and likely impacts to listed migratory species, threatened species and ecological communities from the construction, on-going operation and decommissioning of the development. Relevant conservation advices, recovery plans and threat abatement plans should be sourced.	Volume 1 Chapter 7 MNES, Section 7.4 8, 7.9 and 7.10
5.10.2 Impacts to listed values of the great barrier reef world heritage property	
The EIS must provide an assessment of all potential and likely impacts to the World Heritage values of the Great Barrier Reef World Heritage property that have been identified as being expressed in the vicinity of the proposed action during construction, operation (including through facilitated impacts such as shipping) and decommissioning of the proposal. This assessment must include an analysis of the impact of the proposed action on the expression of the values at this location and how this in turn impacts on the overall values of the Great Barrier Reef World Heritage property. Provide an analysis of direct, indirect and relevant impacts of the proposed action on the integrity and Outstanding Universal Value of the Great Barrier Reef World Heritage Area.	Volume 1 Chapter 7 Section 7.6.3 and Section 7.12
5.10.3 Impacts to listed values of the great barrier reef national heritage place	
The EIS must provide an assessment of all potential and likely impacts to the National Heritage values of the Great Barrier Reef National Heritage place that have been identified as being expressed in the vicinity of the proposed action during construction, operation (including through facilitated impacts such as shipping) and decommissioning of the proposal. This assessment must include an analysis of the impact of the action on the expression of the values at this location and how this in turn impacts on the	Volume 1 Chapter 7 MNES, Section 7.6.3 and Section 7.12

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overall values of the Great Barrier Reef National Heritage place.	
5.10.4 Impacts to the commonwealth marine environment	
The EIS must provide an assessment and discussion of the potential direct, indirect and consequential impacts of the proposed development on the Commonwealth marine environment.	Volume 1 Chapter 7 MNES, Section 7.10.3 and Section 7.12
5.10.5 Impacts to the great barrier reef marine park	
The EIS must provide an assessment and discussion of the potential direct, indirect and consequential impacts of the proposed development on the environment and values of the Great Barrier Reef Marine Park.	Volume 1 Chapter 7 MNES, Section 7.7 and Section 7.12
5.10.6 Cumulative impacts of the proposed development	
The EIS must identify and address cumulative impacts (please refer to section 527E of the EPBC Act for the meaning of impact), where potential project impacts are in addition to existing impacts of other activities (including known current and potential future expansions or developments by the proponent and other parties in the region and vicinity). The EIS must also address the potential cumulative impact of the proposed action on ecosystem resilience. Where relevant to the potential impact, a risk assessment must be conducted and documented. The risk assessment must include known potential future expansions or developments by the proponent and other parties and known impacts on ecosystem resilience and matters of National Environmental Significance. Information on cumulative impacts must include, but not be limited to: a) description of existing, planned or potential developments (including construction status) of a similar type and scale to the proposed development, that have been approved within the last five years or are still under assessment with emphasis on those in the region that have, will have or are likely to have impacts on the same matters of National Environmental Significance; b) description of any current or likely development precincts or zones in the region, their relationship to the proposed development and the likely cumulative impacts on the general environment, ecosystems and matters of National	Volume 1 Chapter 7 MNES, Section 7.11. a) Section 7.12.2 b) Section 7.12.2 c) Section 7.12.2 d) Section 7.12.3 e) Section 7.12.3 f) Section 7.12.4 g) Section 7.12.4 h) Section 7.12.4 i) Section 7.12.4

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Environmental Significance as all projects are developed to capacity; c) discussion of the impacts of other tourism, residential, industrial and infrastructure projects both directly and indirectly related to the proposed action in a regional context; d) discussion of the range of developments which will be facilitated or impacted (either positively or negatively) by the proposed action and if the project will result in an intensification of development in the region; e) housing, workforce and local and regional community changes as a result of the development; f) discussion of known impacts on ecosystem resilience, including reference to issues identified in the Great Barrier Reef Outlook Report 2009; g) discussion and analysis of the cumulative impacts of this proposed action on the integrity and Outstanding Universal Value of the Great Barrier Reef World Heritage Area; h) discussion of any potential future changes to the development which are likely to change the nature or scale of environmental impacts; i) outline if existing impacts on the environment in general and matters of National Environmental Significance will be amplified by the action in combination with impacts of other projects; j) discussion of the developments and activities which are likely to be facilitated by the proposal; k) identify if the resulting impacts on the general environment, ecosystems and matters of National Environmental Significance could be unacceptable; l) identify if these impacts on the general environment, ecosystems and matters of National Environmental Significance could be permanent. If the impacts on matters of National Environmental Significance are not permanent, describe how long it will take before recovery from the effect; m) describe how the cumulative impact of the proposed project will impact on the reproductive capacity and/or survival of listed threatened and migratory species; n) explain how much recovery of matters of National Environmental Significance population, habitat, ecosystems and the environment in general could occur, with and without mitigation (for example, complete, partial, none); o) in conducting the risk assessment, key information sources and indicators for assessing change and impact must be described.	j) Section 7.12.5 k) Section 7.12.4 l) Section 7.12.4 m) Section 7.12.4 n) Section 7.12.4 o) Section 7.12.1

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5.10.7 Consequential impacts	
The EIS must provide a detailed assessment of any likely impacts that this development may facilitate (at the local, regional, state, national and international scale - please refer to section 527E of the EPBC Act for the meaning of impact) on: a) the Outstanding Universal Value of the Great Barrier Reef World Heritage property; b) the values of the Great Barrier Reef National Heritage place; c) the environment of the Great Barrier Reef Marine Park, including coastal ecosystems that provide a function in maintaining the health of the Great Barrier Reef; d) listed threatened species and ecological communities; e) listed migratory species; and f) the environment of the Commonwealth marine area.	Volume 1 Chapter 7 Section 7.12.5.4
5.10.8 Increased shipping	
In relation to the projected increase in shipping, the EIS must at a minimum, provide details and discuss the following: a) current vessel numbers and type utilising the Port of Abbot Point, including their size, speed, shipping movements, anchorages, access to/from the port and navigational arrangements; b) the increased level of shipping that will result from the proposed action (including other users of the proposed rail line); c) resulting potential risks to values of Great Barrier Reef World Heritage Area and National Heritage place and the environment of the Great Barrier Reef Marine Park and Commonwealth marine area from the proposed action taking into account cumulative impacts of other rail/terminal proposals; and d) maps of the shipping routes to be used by vessels through the Commonwealth marine area, including a map of the routes in relationship to the Great Barrier Reef World Heritage area and National Heritage place, Great Barrier Reef Marine Park, shipping channels and any other navigational arrangements.	Volume 1 Chapter 7 MNES, Section 7. 10.2, 7.10.3.2 and 7.12.5.4.

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5.10.9 Other uses of the area and nearby areas	
The EIS must identify the potential impacts of the proposed action on other uses of the area, including but not limited to the following: a) social, cultural and heritage values for each stage of the proposal; b) current and projected commercial, recreational and scientific use, including any changes in visitation patterns; c) heritage and social values, including sites of historic or archaeological significance; d) commercial and recreation fishing; and e) traditional use activities.	Volume 1 Chapter 7 MNES, Section 7.11
5.11 Proposed avoidance, safeguards, management and mitigation measures	
The EIS must provide information on proposed avoidance, safeguards and mitigation measures to deal with the impacts of the proposed action. Specific and detailed descriptions of proposed measures must be provided and substantiated, based on best available practices and must include the following elements: a) identify the level of risk associated with potential impacts already identified and those that require mitigation, monitoring or management to avoid or reduce impacts; b) a consolidated list of measures proposed to be undertaken to avoid, prevent, minimise or compensate for the impacts of the action, including: i. a description of proposed avoidance, safeguards and mitigation measures to deal with impacts of the action, including measures proposed to be taken by State governments, local governments, the proponent or users of the rail line other than the proponent; ii. assessment of the expected or predicted effectiveness of the measures; iii. any statutory or policy basis for the mitigation measures; and iv. the cost of the mitigation measures.	Volume 1 Chapter 7 MNES, Section 7.6 to 7.10

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c) particular focus must be given to analysis that demonstrates: i. determining factors in the planning of the proposed action so as to avoid damage to matters of National Environmental Significance; ii. measures to avoid or minimise damage to the Great Barrier Reef World Heritage Area and estuary environment; iii. measures to avoid or minimise damage to the National Heritage Values of the Great Barrier Reef; iv. measures to avoid or minimise damage to the environment of the Great Barrier Reef Marine Park; v. achievement of conservation objectives for individual matters of National Environmental Significance; vi. describing how this project is likely to contribute to protection of matters of National Environmental Significance; vii. how any avoidance, safeguards, management and mitigation measures will increase resilience of the environment, ecosystems and matters of National Environmental Significance within the region; viii. how impact management and mitigation measures will ensure that matters of National Environmental Significance in the affected region are maintained or improved; ix. characterise, quantify and address uncertainties that may affect the effectiveness of management measures and therefore on the confidence that biodiversity values will be maintained (or improved) during and after the project; x. measures to avoid or minimise disturbance to fauna and flora found around and within the proposed action area (particularly listed threatened species and communities and listed migratory species); and, xi. staff training, including training in relation to environmental issues. d) an outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including any provisions for independent environmental auditing; and e) the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.	

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5.12 Other approvals and conditions	
The EIS must include information on any other requirements for approval or conditions from other agencies that apply, or that the proponent reasonably believes are likely to apply, to the proposed action. This must include: a) details of any local or State Government planning scheme, or plan or policy under any local or State Government planning system that deals with the proposed action, including: i. what environmental assessment of the proposed action has been, or is being, carried out under the scheme, plan or policy; and ii. how the scheme provides for the prevention, minimisation and management of any relevant impacts; b) a description of any approval that has been obtained from a State, Territory or Commonwealth agency or authority (other than an approval under the EPBC Act), including any conditions that apply to the action; c) a statement identifying any additional approval that is required; and d) a description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action.	Volume 1 Chapter 7 Section 7.15
5.13 Offsets	
Environmental offsets broadly mean measures to compensate for the adverse residual impacts of a proposed action on the environment. More specifically, offsets are measures to compensate for environmental impacts that cannot be adequately reduced through avoidance or mitigation. Offsets do not reduce the impacts of an action. Instead they provide an environmental counterbalance to manage the impacts that remain after avoidance and mitigation measures have been applied. These remaining impacts are termed ‘residual impacts’ (Further information on offsets can be found in the Australian Government’s framework on the use of environmental offsets (‘offsets’) under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) "Environmental Offsets Policy” October 2012 (or any later revisions)). Offsets are not intended to make proposals with unacceptable impacts acceptable. They simply provide an additional tool that can be used during project design and the Environmental Impact Assessment process. The EIS must outline plans to offset the residual potential impacts of the proposal. Environmental offsets may be appropriate when they: a) are necessary to protect or repair impacts to a protected matter – i.e. a matter of National Environmental Significance or	Volume 1 Chapter 7 Section 7.14

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the environment more broadly with regard to impacts to the Commonwealth marine area; b) relate specifically to the matter (for example, species) being impacted; and c) seek to ensure that the health, diversity and productivity of the environment are maintained or enhanced.	
5.14 Monitoring and reporting	
With regard to monitoring and reporting, the EIS must: a) present appropriate baseline data and measurements to inform ongoing monitoring of environmental parameters; b) demonstrate that the proposed methods for baseline measurements and subsequent monitoring are based on current best practice, are scientifically robust and statistically sound to enable diligent and systematic data collection that will deliver unbiased and sound responses to EIS Guideline requirements; c) identify parameters to be monitored, the performance indicators to be used to evaluate accuracy of predicted impacts and effectiveness of mitigation measures and management response trigger values and response activities; d) identify parameters to be monitored, the performance indicators to be used to evaluate accuracy of predicted impacts and effectiveness of offsets; e) identify and describe any procedural and compliance audit programs and reporting requirements and arrangements which will demonstrate the effectiveness of proposed management measures and monitoring; f) clearly identify what is to be monitored and the reasoning supporting this and must be designed to provide objective evidence regarding activities associated with the proposed action if these activities are adversely impacting on the environment in the short, medium and long term; g) Monitoring programs must demonstrate an understanding and consideration of: i. ecosystems and habitats, flora and fauna (particularly listed threatened species/ecological communities and listed migratory species), and water quality issues as a result of the proposed development; ii. ability to measure the effectiveness of mitigation and/or rehabilitation and offset measures; iii. document the difference between predicted and actual impacts; iv. methods for identification of non-predicted impacts and appropriate reporting and remedial measures; v. application and effectiveness of emergency and contingency plans; and vi. review of consultation and management arrangements with regulatory authorities and the community. A diagram showing monitoring and reporting arrangements must be included in the EIS.	Volume 1 Chapter 7 Section 7.13.2, 7.13.3, 7.13.4 and 7.13.5.

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5.15 Environmental record	
The EIS must include the environmental record of the proponent. This must include details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against the person proposing to take the action. If the person proposing to take the action is a corporation, details of the corporation's environmental policy and planning framework must be provided. Information relating to the persons' environmental record must also include any accreditations (for example, ISO 14001), environmental awards, and other recognition for environmental performance.	Volume 1 Chapter 7 Section 7.1.2
5.16 Additional social and economic matters	
Information must be provided in the EIS on the broad social and economic impacts (positive or negative) of the proposed action for the purposes of the Part 9 decision on approval. Section 136(1)(b) of the EPBC Act requires the Minister to consider economic and social matters when deciding whether to grant approval to the proposed action under Part 9 of the EPBC Act. The requirements under s136(1)(b) encompass a broader range of matters that may be considered than those addressed during the assessment of the potential impacts of a controlled action. As the matters protected by the controlling provisions for this action include "the environment", there is the potential for an overlap between the information provided in response to this, and the information requested in the main body of the guidelines in relation to social, economic and cultural aspects within the definition of the environment. The latter set of information need not be repeated if it will be contained in the body of the EIS.	Volume 1 Chapter 7 Section 7.12.3.1
5.17 Conclusion	
The EIS must include an overall conclusion as to the environmental acceptability of the proposed action, including discussion on the proponent's perception of the compliance with the objectives and requirements of the EPBC Act including the principles of ESD (refer Attachment 2). Reasons justifying undertaking the proposed action in the manner proposed must also be outlined. The conclusion must highlight measures proposed or required to avoid, mitigate or offset any unavoidable impacts on the environment.	Volume 1 Chapter 7 Section 16

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5.18 Information sources	
Information sources used in the formulation of the EIS must be provided. This section will describe consultations and studies undertaken in the course of formulation and preparation of the EIS, and sources of information and technical data. The following details must be provided for information used in developing the EIS: a) the source of the information; b) how recent the information is; c) how the reliability of the information was tested; and d) what uncertainties and/or gaps (if any) are in the information. A copy of all data and the sampling methodologies must be made available to the department for the purpose of peer review on receipt of a written request from the department. Any further or ongoing consultations or studies must be outlined here.	Volume 1 Chapter 23 References
5.19 Reference list and bibliography	
The EIS must include a reference list and bibliography which must be accurate and concise and include the address and date accessed of any internet pages used as data sources.	Volume 1 Chapter 23 References
5.20 Appendices and glossary	
The EIS must include detailed technical information studies or investigations necessary to support the main text of the EIS, but not suitable for inclusion in the main text as appendices (for example, detailed technical or statistical information, maps, risk assessment, baseline data, supplementary reports etc.). A copy of the guidelines must also be included as an appendix. A glossary defining technical terms and abbreviations used in the text must be included to assist the general reader.	Volume 1 Terms and abbreviations Volume 2 (Appendices) Volume 2 Appendix G EIS Guidelines