



Adani Mining Pty Ltd

NORTH GALILEE BASIN RAIL PROJECT

Environmental Impact Statement

Chapter 19 Cumulative impact assessment

November 2013

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19. Cumulative impact assessment

19.1 Purpose of chapter

The purpose of this chapter is to assess the impacts of the North Galilee Basin Rail Project (NGBR Project) cumulatively with those of other proposed projects in the region. 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
- 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.

This cumulative impact assessment chapter was prepared in accordance with the Terms of Reference (TOR) for the NGBR Project. A table that cross-references the contents of this chapter and the TOR is included as Volume 2 Appendix A Terms of Reference cross-reference.

In accordance with the TOR, residual impacts with the potential to interact with other projects and thereby having a potential cumulative impact has also been discussed within other chapters of this Environmental Impact Statement (EIS). These were included as follows:

- Volume 1 Chapter 15 Social Impact Assessment
- Volume 1 Chapter 7 Matters of National Environmental Significance.

19.2 Methodology

19.2.1 Study area

The study area for the identification of proposed projects was defined by the regional area of the NGBR Project, in the context of the wider region. 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 distant). This study area is shown in Figure 19-1. As spatial extent and duration vary between impacts, this parameter was considered on an impact by impact basis.

19.2.2 Data sources

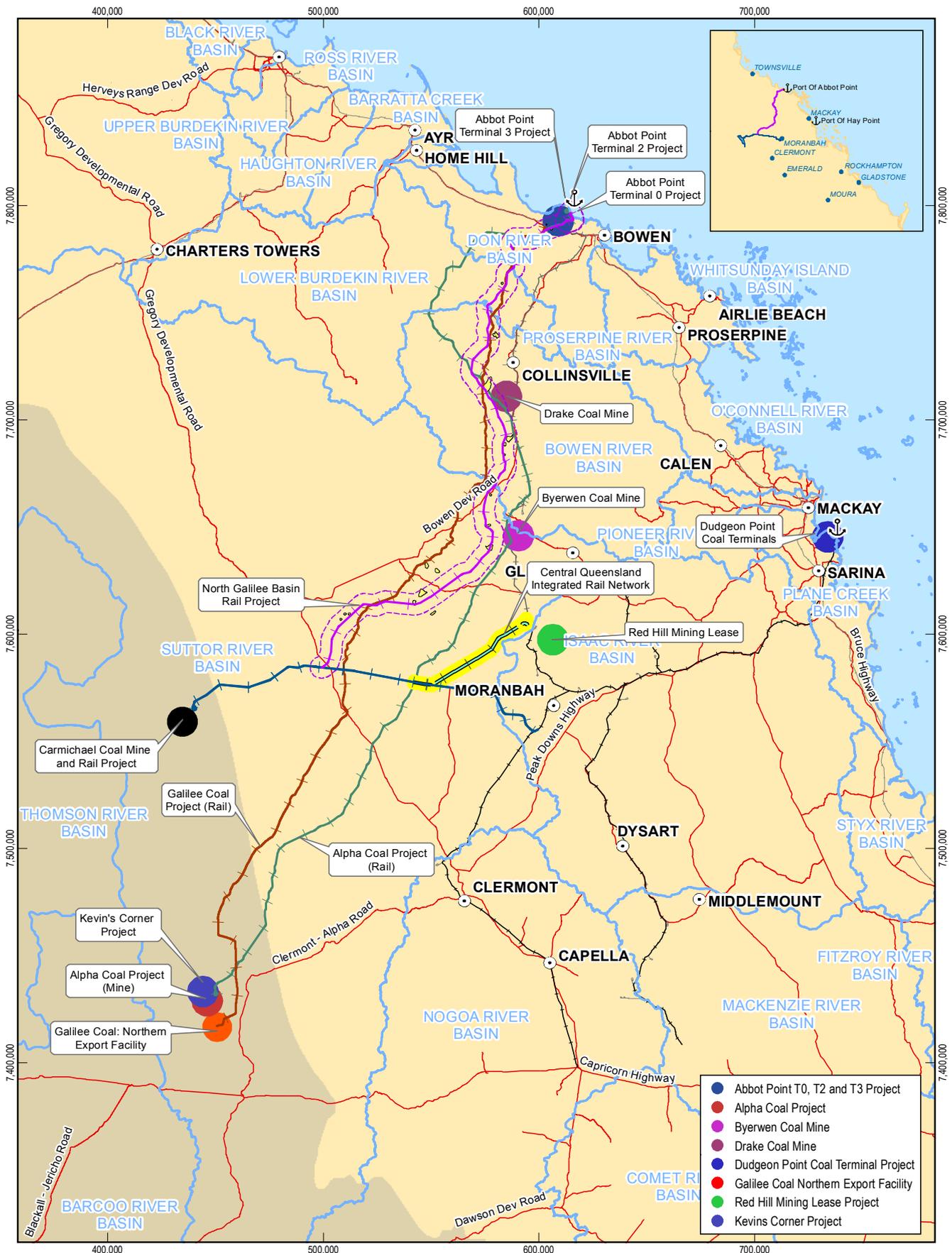
The cumulative impact assessment relied on the following data sources:

- 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)
- Galilee Basin Development Strategy (DSDIP 2013c)

- Publically 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 7 Matters of national environmental significance
- 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.

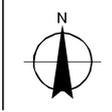
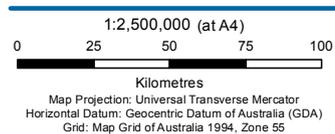


- Abbot Point T0, T2 and T3 Project
- Alpha Coal Project
- Byerwen Coal Mine
- Drake Coal Mine
- Dudgeon Point Coal Terminal Project
- Galilee Coal Northern Export Facility
- Red Hill Mining Lease Project
- Kevin's Corner Project

LEGEND

- Population Centre
- State Road
- Other Rail Network
- Goonyella System
- Newlands System
- Central Queensland Integrated Rail Network
- Alpha Coal Rail
- Galilee Coal Project
- Galilee Basin
- Carmichael
- 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.



Adani Mining Pty Ltd
North Galilee Basin Rail Project

**Cumulative impact assessment
Projects**

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Figure 19-1

19.2.3 Legislation and guidelines

The legislation relevant to this cumulative impact assessment is as follows:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *State Development and Public Works Organisation Act 1971* (SDPWO Act).

In the absence of standard or legislated guidelines in Queensland, the cumulative impact assessment made reference to the following publications:

- Cumulative Impacts a Good Practice Guide for the Australian Coal Mining Industry (Franks *et al.* 2010), prepared at the Centre for Social Responsibility in Mining, The University of Queensland, Australia
- Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions (Walker & Johnston 1999), prepared for the European Commission.

Cumulative Impacts a Good Practice Guide for the Australian Coal Mining Industry (Franks *et al.* 2010) provides guidance on the typology of impacts to be considered, and typical management measures that apply to cumulative impacts, as opposed to project-specific impacts.

Guidelines for the Assessment of Indirect and Cumulative Impacts (Walker and Johnston 1999) provides guidance on setting spatial and temporal boundaries for assessment and considering the magnitude and significance of impacts.

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 would 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 19.3.

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.

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 19.2.2.

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 would occur in the spatial extent or duration of residual impacts. Any impacts that were not considered to be overlapping were not considered further. 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.

19.2.4 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 TOR. As such, this cumulative impact assessment inherits the limitations of these other assessments, such as the exclusion of Scope 3 emissions.

19.3 Existing environment

19.3.1 Overview

This Section outlines the proposed projects in the region of the NGBR Project. The location of these projects in relation to the NGBR Project is depicted Figure 19-1.

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. A single north-south corridor promotes the minimisation of impacts to landholders and the broader region.

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. The proposed projects potentially affected by the GBCIF are identified in Figure 19-1 and are as follows:

- 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.

19.3.2 Abbot Point Coal Terminal (APCT) Expansions

North Queensland Bulk Ports (NQBPs) 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 would 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 will begin 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 have prepared an EIS for Terminal 0. Furthermore, Adani, BHP Billiton, GVK Hancock and NQBPs – 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 NQBPs webpage.

19.3.3 Central Queensland Integrated Rail Project

The Central Queensland Integrated Rail Project (CQIRP) is proposed by Aurizon and would incorporate a 180 km rail corridor from the Galilee Basin to the existing Newlands system, upgrades and deviation to the Newlands system. As discussed in Section 19.3.1 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.

19.3.4 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 in Section 19.3.1 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 'coordinated project' under the SDPWO Act and 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.

19.3.5 Galilee Coal Project

The Galilee Coal Project (Northern Export Facility) – also known as the China First Coal Project – is proposed by Waratah Coal and would incorporate a coal mine, railway and port facility. The railway would 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 in Section 19.3.1 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, would incorporate onshore and offshore components, including the Waratah Coal Abbot Point Stand Alone Jetty, and dredging activities. The Waratah Coal Terminal would have a throughout 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).

19.3.6 Byerwen Coal Mine

The Byerwen Coal Mine is proposed by QCoal and would incorporate an open cut coal mine, train loading facilities and connection to an existing rail line to Abbot Point. The mine would produce up to 10 mtpa of coal. The Byerwen Coal Mine Project is located approximately 4 km to the east of the NGBR Project.

The Byerwen 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.

19.3.7 Red Hill Mining Lease Project

The Red Hill Mining Lease Project is proposed by BHP Billiton Mitsubishi Alliance and would comprise a new underground coal mine plus the expansion of Broadmeadow coal mine and Goonyella Riverside coal mine. The new mine would 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 available for this project.

19.3.8 Alpha Coal Project

The Alpha Coal Project is proposed by GVK Hancock and would 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 19-1). As discussed in Section 19.3.1 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.

19.3.9 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 would 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).

19.3.10 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.

19.4 Cumulative impacts

The development of the GBCIF single north-south rail corridor will facilitate the streamlined development of rail infrastructure in the Galilee Basin and significantly reduce or eliminate the cumulative impacts posed by the development of the rail components of these projects. Therefore, cumulative impacts have been assessed based on these projects being built within a single rail corridor.

All other projects consider above have been assessed separately based on their separation distance from the study area and have been described as non-rail projects in the assessment below.

19.4.1 Climate, natural hazards and climate change

As discussed in Volume 1 Chapter 17 Climate and natural hazards following the implementation of proposed mitigation measures, three hazards remain ranked with a medium residual risk given the measure of consequence, namely the risk of extreme heat and extreme precipitation causing flooding or inundation of critical infrastructure.

The various management plans incorporated into the Environmental Management Plan for the NGBR Project (refer Volume 2 Appendix P Environmental management plan framework) will serve to significantly reduce the potential consequential impacts occurring during natural hazard events. Management plans will be periodically updated, expanded or reduced as required throughout the life of the NGBR Project as the potential consequences change between pre-construction, construction and operation and in response to future refinements in predictions. Therefore cumulative impacts are considered to be low and have not been considered further.

19.4.2 Land use and tenure

As discussed in Volume 1 Chapter 3 Land use and tenure after the implementation of the proposed management and mitigation measures, residual land use impacts resulting from the NGBR Project are anticipated to be minimal. Cumulative impacts on land use would mostly be caused by land fragmentation by multiple rail corridors and therefore no cumulative impacts would be expected from other non-rail projects due to the geographical separation from the NGBR Project study area. As it is anticipated that the rail corridor will be built within the GBCIF single north-south rail corridor impacts on land use will be low and confined to a single corridor. Therefore cumulative impacts are considered to be low and have not been considered further.

19.4.3 Scenic amenity and lighting

The NGBR Project residual impacts on scenic amenity and lighting include:

- Changes to the landscape within the final rail corridor due to vegetation clearing and earthworks
- The establishment of the rail embankment on which the rail ballast, sleepers and tracks would be placed (potentially up to 25 m high).

As identified in Volume 1 Chapter 4 Scenic amenity and lighting the majority of sensitive receptors within the study area will experience a minor or negligible level of visual impact as a result of the NGBR Project.

Cumulative visual impacts involving vegetation clearing, landscape changes and possible fragmentation of the rural landscape would be limited due to separation distance. Each proponent will aim to minimise vegetation clearing impacts, though fragmentation and some vegetation clearing of the land are unavoidable cumulative impacts of rail construction to increase capacity.

However, it is anticipated that the rail corridor will be built within the GBCIF single north-south rail corridor in a remote region and therefore cumulative impacts on sensitive receptors will be low and confined to a single corridor.

19.4.4 Topography, geology, soils and land contamination

As discussed in Volume 1 Chapter 5 Topography, geology, soils and land contamination minimal residual impacts, predominantly of local significance, are anticipated to affect the identified environmental values. These include:

- Cut and fill activities will alter the existing topography, specifically where infrastructure is proposed to traverse steep low hills from chainage 71.3 km to 82.2 km
- Erosion of soil resources and potential sedimentation of waterways
- Areas of GQAL and SCL will be permanently intersected by the rail corridor.

The cumulative impacts from the construction and operation of the other rail projects include further fragmentation of GQAL and SCL, further erosion and sedimentation of waterways, and changes to topography. The potential fragmentation of GQAL and SCL associated with the non-rail projects are considered to be sufficiently separated from the NGBR project footprint to result in any cumulative impacts. However there is a potential for cumulative impacts from the other rail related projects.

The cumulative impacts from NGBR Project will be mitigated through the GBCIF which is anticipated to result in a single north-south rail corridor and therefore the identified cumulative impacts on topography, geology, soils, GQAL, SCL, ASS and contaminated land will be low and confined to a single corridor. Residual impacts on SCL which are unavoidable will be compensated.

19.4.5 Nature conservation

NGBR Project impacts

As discussed in Volume 1 Chapter 6 Nature Conservation the following residual impacts were identified involving the disturbance of:

- Three mapped TECs protected under the EPBC Act:
 - 100.3 ha of brigalow (*Acacia harpophylla*) dominant and co-dominant
 - 117.1 ha of natural grasslands of the Queensland central highlands and the northern Fitzroy Basin
 - 35.8 ha of semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar regions
- Potential habitat for five threatened species listed under the EPBC Act:
 - 64.6 ha of *Eucalyptus raveretiana* habitat
 - 45.6 ha of Australian painted snipe habitat
 - 2,143.4 ha of black-throated finch (southern) habitat
 - 2,390.1 ha of Koala habitat
 - 246.6 ha of ornamental snake habitat
 - 1,788.1 ha of squatter pigeon (southern) habitat
- Endangered REs and of concern REs protected under the VM Act (refer to Volume 1 Chapter 6 Nature Conservation)
- Threshold REs, protected under the VM Act (refer to Volume 1 Chapter 6 Nature Conservation)
- Potential habitat for 16 threatened species protected under the NC Act (refer to Volume 1 Chapter 6 Nature Conservation)
- Watercourse vegetation, wetland protection areas (including trigger areas) and wetland REs (refer to Volume 1 Chapter 6 Nature Conservation)
- Marine habitat (refer to Volume 1 Chapter 6 Nature Conservation).

Implementation of specific construction and operation management measures will mitigate environmental impacts and edge effects associated with the disturbance of species and habitat loss outlined above. Where the residual impacts are unavoidable the NGBR Project will provide offsets (refer to Volume 2 Appendix O Offsets strategy) to compensate for the residual impacts of the NGBR Project on terrestrial or aquatic ecological values.

A cumulative assessment of the above residual impacts to conservation values has been provided in the following sections. Notwithstanding, due to the nature and scale of these residual impacts, they are not expected to significantly reduce the overall potential habitat for these protected conservation values within the wider bioregion to the extent that over time offsets can't mitigate any losses. Therefore cumulative impacts from disturbance of nature conservation values are considered to be low.

Threatened ecological communities

A review of the relevant project impacts on listed threatened ecological communities under the EPBC Act has been undertaken to understand whether there is potential to have cumulative loss of these communities. Findings from that review are provided in Table 19-1. A combined total cumulative impact data is not available due to the projects adopting different methodologies in their ecological assessments.

Table 19-1 Threatened ecological communities

Project	Brigalow TEC	Natural grasslands	Semi-evergreen vine thickets
APCT Expansions CIA	NA	NA	NA
Abbot Point Terminal 0 Project	None identified	None identified	20 ha not directly impacted
Carmichael Coal Mine and Rail Project	276 ha	None identified	None identified
Byerwen Coal Mine	316.3 ha	84.4 ha	18 ha
Alpha Coal Project – Rail	110 ha	108 ha	14 ha
Galilee Coal Project (Northern Export Facility)	Information not yet available	Information not yet available	Information not yet available
Kevin's Corner Project	Not present	22 ha	None identified

There is the potential for the projects in the Galilee Basin to have a cumulative impact on the brigalow and natural grassland TECs, and therefore, on the presence of TECs within Queensland generally. Clearing will result in reductions in extent, diversity and abundance of these communities and the species that utilise them.

In relation to the brigalow TEC there is potential for significant cumulative impact given:

- Clearing from multiple projects of this TEC will reduce the extent of this ecological community within the local and regional landscape
- Clearing has the potential to fragment this TEC
- The alteration of landscape due to mining and rail activities will affect the persistence of this TEC.

In relation to the natural grasslands TEC, significant cumulative impacts could potentially occur on this TEC, given:

- Clearing from multiple projects of this TEC will reduce the extent of this ecological community within the local and regional landscape
- Clearing will remove some of this TEC and will result in fragmentation of patches of this TEC.

In relation to the semi-evergreen vine thickets TEC there is potential for significant cumulative impact given:

- clearing from multiple projects of this TEC will reduce the extent of this ecological community within the local and regional landscape
- clearing will remove some of this TEC and will result in fragmentation of patches of this TEC.

There is potential for a cumulative impact on TECs. Cumulative impacts on TECs from the development of the multiple rail corridors will be reduced through the development of the GBCIF single north-south rail corridor. The development of the single rail corridor will significantly reduce the clearing in the region. Therefore cumulative impacts from clearing of TECs are considered low.

Each proponent will be required to offset the residual impacts on TECs such that an overall improvement in biodiversity is achieved.

Regional ecosystems

A total of 24 endangered REs and of concern REs, two threshold regional ecosystems and nine endangered and of concern high value regrowth regional ecosystems protected under the VM Act are proposed to be cleared as part of the NGBR Project. Table 19-2 identifies where these RE’s have been identified to be cleared by other projects. A combined total cumulative impact data is not available due to the projects adopting different methodologies in their ecological assessments.

Table 19-2 Regional ecosystems

Project	Clearance of endangered REs and of concern REs	Clearance of threshold REs
APCT Expansions (CIA)	11.3.33 – 6.7 ha 11.2.3 – 21.2 ha	11.4.11 – 21.2 ha
Abbot Point Terminal 0 Project	11.2.3 – 20 ha (not directly impacted)	None identified
Carmichael Coal Mine and Rail Project (Mine only)	11.4.5 – 6 ha 11.4.9 – <1 ha 11.4.11 – 53 ha 11.3.1 – <1 ha 11.3.3 – 4 ha 11.3.4 – 14 ha	None identified
Carmichael Coal Mine and Rail Project (Rail only)	11.9.10 – 1.4 ha 11.4.5 – 3.5 ha 11.4.6 – 20.7 ha 11.4.8 – 2.5 ha 11.4.9 – 23.9 ha 11.4.11 – 128.1 ha 11.3.1 – 11 ha 11.3.3 – 46.7 ha	11.3.5 – 20.4 ha

Project	Clearance of endangered REs and of concern REs	Clearance of threshold REs
Byerwen Coal Mine	11.4.2 – 165.4 ha 11.4.8 – 34.6 ha 11.4.9 – 62.2 ha 11.3.1 – 8.7 ha 11.3.4 – 1.6 ha	None identified
Alpha Coal Project – Rail	11.12.10 – 2.12 11.11.13 – 4.3 ha 11.9.1 – 7.25 11.9.10 – 4.95 11.9.12 – 0.45 11.4.2 – 0.97 11.4.5 – 0.45 11.4.6 – 0.68 11.4.8 – 25.45 11.4.9 – 55.55 11.4.11 – 8.48 ha 11.3.1 – 24.45 11.3.2 – 25.42 ha 11.3.3 – 15.4 11.3.4 – 7.17 11.3.33 – 7.61 ha 11.3.34 – 3.38 11.2.3 – 12.6	None identified
Galilee Coal Project (Northern Export Facility)	Information not yet available	Information not yet available
Kevin’s Corner Project	11.3.2 – 26.8 ha	None identified

There is potential for a cumulative impact on the following regional ecosystems 11.12.10, 11.11.13, 11.9.1, 11.9.10, 11.9.12, 11.4.2, 11.4.5, 11.4.6, 11.4.8, 11.4.9, 11.4.11, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.33, 11.3.34, 11.2.3.

Cumulative impacts on these regional ecosystems from the development of the multiple rail corridors will be reduced as it is anticipated that the rail corridor will be built within the GBCIF single north-south rail corridor. The development of the single rail corridor will significantly reduce the clearing of REs in the region. Cumulative impacts on these regional ecosystems from the other non-rail projects are considered to be negligible as they are spatially separated such that their impacts are independent. Therefore cumulative impacts from clearing of REs are considered low.

Each proponent will be required to offset the residual impacts on endangered and of concern regional ecosystems under the Queensland Biodiversity Offset Policy (DERM 2011).

Threatened species under the EPBC Act

A review of the relevant projects identified clearance of the following potential habitat for six threatened species under the EPBC Act:

- Eucalyptus raveretiana habitat

- Australian painted snipe habitat
- Black-throated finch
- Koala
- Ornamental snake
- Squatter pigeon.

Table 19-3 identifies where these species are impacted by the other projects. A combined total cumulative impact data is not available due to the projects adopting different methodologies in their ecological assessments.

Table 19-3 Threatened species under the EPBC Act

Project	<i>Eucalyptus raveretiana</i> habitat	Australian painted snipe habitat	black-throated finch (southern) habitat	Koala habitat	ornamental snake habitat	squatter pigeon (southern) habitat
APCT Expansions	NA	NA	NA	NA	NA	NA
Abbot Point Terminal 0 Project	not identified	not identified	not identified	not identified	not identified	not identified
Carmichael Coal Mine and Rail Project	not identified	not identified	10,396 ha of potential habitat directly impacted 6,147 ha of potential habitat indirectly impacted	10,807 ha of potential habitat direct impact 5,566 ha of potential habitat indirect impact	1,227 ha of potential habitat direct impact 3 ha of potential habitat indirect impact	11,778 ha of potential habitat direct impact 6,176 ha of potential habitat indirect impact
Byerwen Coal Mine	not identified	8.7 ha of habitat	651.2 ha of habitat	not identified	637.5 ha of habitat	1047.4 ha of habitat
Alpha Coal Project – Rail	Removal of a limited number of individuals to construct a river crossing	Habitat may be impacted	Direct impact - 7,932 ha of high potential habitat (Mine and rail) 3,746 ha of low potential habitat (Mine and rail) Indirect Impact – not identified	not identified	1,794 ha of high potential habitat (Mine and rail) 739 ha of low potential habitat (Mine and rail) direct impact	habitat modelling not feasible 13,180 ha of remnant vegetation (Mine and rail) direct impact
Galilee Coal Project (Northern Export)	Information not yet available	Information not yet available	2,789 ha primary habitat 2,053 ha secondary	4,742 ha primary habitat 0 ha secondary habitat	33.7 ha primary habitat 878 ha secondary	2,789 ha primary habitat 2,053 ha secondary

Project	<i>Eucalyptus raveretiana</i> habitat	Australian painted snipe habitat	black-throated finch (southern) habitat	Koala habitat	ornamental snake habitat	squatter pigeon (southern) habitat
Facility)			habitat direct impact 8,758 ha primary habitat 667 ha secondary habitat indirect impact	direct impact 10,390 ha primary habitat 1,303 ha secondary habitat indirect impact	habitat direct impact 12 ha primary habitat 1,100 ha secondary habitat indirect impact	habitat direct impact 8,758 ha primary habitat 667 ha secondary habitat indirect impact
Kevin's Corner Project	not identified	not identified	730 ha of high value habitat direct impact 270 ha of high value habitat indirect impact	619 ha of high value habitat direct impact 148 ha of high value habitat indirect impact	602 ha of high value habitat direct impact 242 ha of high value habitat indirect impact	882 ha of high value habitat direct impact 276 ha of high value habitat indirect impact

Cumulative impacts to the black-throated finch (southern) are predicted to occur as a consequence of the cumulative loss of habitat across the NGBR and other projects. The cumulative loss of habitat across projects will increase pressure on black-throated finch habitat in the region, and is likely to exacerbate the potential impact resulting directly from the NGBR Project.

Squatter pigeon and koala are likely to be present in much of the wider landscape than that occupied by the NGBR Project. This is based on the presence of potentially suitable habitat, which extends beyond the NGBR Project area. However, much of the landscape in the region is dominated by non-remnant vegetation with fragmented remnant vegetation often restricted to watercourses. The squatter pigeon has been confirmed present at most of the project locations. As this species is considered to be widely distributed and have relatively broad habitat preferences, large areas of potential habitat have been identified as being either directly or indirectly impacted by each project. An overall reduction in the regional availability of habitat for the subspecies will occur as a result of the projects but is not expected to be significant in the wider regional context.

The ornamental snake was confirmed present on a number of project sites. The presence of the ornamental snake is highly dependent on areas that contain suitable microhabitats (i.e. cracking clay soil with gilgais) within potential habitat areas. A cumulative impact assessment only highlights the loss of overall potential habitat, thereby appearing more significant than is likely to be the reality. Impacts to the species will be felt at a higher magnitude from each individual project whereby localised populations may be directly impacted through the destruction of important microhabitat features instead of impacted from a cumulative sense.

Cumulative impacts on the listed threatened species from the development of the multiple rail corridors will be reduced as it is anticipated that the rail corridor will be built within the GBCIF single north-south rail corridor. The development of the single rail corridor will significantly reduce the clearing of suitable habitat for these species in the region. Therefore cumulative impacts from clearing of REs are considered low.

Each proponent will be required to provide offsets in accordance with Commonwealth and State policies for unavoidable impacts on potential habitat for each of the abovementioned species. These offsets should take account of the potential cumulative impacts that each project will realise, addressing indirect impacts, fragmentation and loss of habitat regionally instead of considering only localised direct impacts or habitat loss. This has been accounted for by the NGBR Project in designing and considering offset requirements (refer Volume 2 Appendix O Offset strategy).

Listed species under the NC Act

As identified in Volume 1 Chapter 6 Nature conservation a number of habitats for listed species under the NC Act are directly impacted by the NGBR Project. Table 19-4 identifies where these species are impacted by the other projects. A combined total cumulative impact data is not available due to the projects adopting different methodologies in their ecological assessments.

Table 19-4 Listed species under the NC Act

Project	Clearance of potential habitat for 16 threatened species protected under the NC Act.
APCT Expansions (CIA)	NA
Abbot Point Terminal 0 Project	None identified
Carmichael Coal Mine and Rail Project (Mine only)	Little pied bat – 24 ha Black-neck stork – 6 ha Cotton pygmy-goose – 6 ha Black throated finch – 24 ha Squatter pigeon (southern) 24 ha
Carmichael Coal Mine and Rail Project (Rail only)	Little pied bat - 147.1 ha Black-neck stork - 66 ha Cotton pygmy-goose - 66 ha
Byerwen Coal Mine	Squatter pigeon (southern) – 1047.4 ha Black-neck stork – 19 ha Cotton pygmy-goose - 19 ha Little pied bat – 1510.9 ha Black throated finch (southern) – 651.2 ha Australian painted snipe – 8.7 ha Square tailed kite – 1261.5 ha Ornamental snake – 637.5 ha Common death adder - 1239.7 ha
Alpha Coal Project – Rail	None identified
Galilee Coal Project (Northern Export Facility)	Information not yet available
Kevin's Corner Project	Squatter pigeon – potential loss of habitat Little pied bat – potential loss of habitat

There is potential for a cumulative impact on the above listed species and their habitats. Cumulative impacts on the listed species from the development of the multiple rail corridors will be reduced as it is anticipated that the rail corridor will be built within the GBCIF single north-south rail corridor. The development of the single rail corridor will significantly reduce the clearing of suitable habitat for these species in the region. Therefore cumulative impacts from clearing of REs are considered low.

Each proponent will be required to offset the residual impacts on these species and habitats in accordance with Queensland Biodiversity Offsets Policy (QBOP).

Watercourse vegetation and wetlands

As identified in Volume 1 Chapter 6 Nature conservation a number of watercourse vegetation, wetland protection areas (including trigger areas) and wetland REs are directly impacted by the NGBR Project. Table 19-5 identifies where these values are impacted by the other projects. A combined total cumulative impact data is not available due to the projects adopting different methodologies in their ecological assessments.

Table 19-5 Watercourse vegetation and wetlands

Project	Clearance of watercourse vegetation, wetland protection areas (including trigger areas) and wetland REs
APCT Expansions (CIA)	NA
Abbot Point Terminal 0 Project	NA
Carmichael Coal Mine and Rail Project (Mine only)	NA
Carmichael Coal Mine and Rail Project (Rail only)	Minor losses of aquatic habitat. Short lived impacts NA wetlands
Byerwen Coal Mine	Indirect impacts on HES wetland (minor) Direct impacts of: 17.8 km of Stream order 1 11.1 km of stream order 2 7.3 km of stream order 3 50 m of stream order 4
Alpha Coal Project – Rail	< 1 ha of Caley Valley Wetland Limited loss of riparian and in stream habitats at pylon and waterway crossing locations.
Galilee Coal Project (Northern Export Facility)	Information not yet available
Kevin's Corner Project	None identified

The potential cumulative impacts on aquatic environmental values include clearance of aquatic vegetation, loss of direct habitat, and alteration of stream and floodplain hydrology. Alteration to hydrology is further discussed in Section 19.4.7.

Each proponent is expected to implement standard control measures to minimise the above potential impacts and thus no significant cumulative impact is predicted. Each proponent will be required to offset the residual impacts on these values in accordance with Queensland Biodiversity Offsets Policy (QBOP).

Marine habitat

Residual impacts on marine habitat are limited to the loss of regional ecosystems 11.1.2 and 11.1.4 (tidal vegetation in the Caley Valley Wetland) within the Abbot Point Region. Each proponent will be required to offset the residual impacts on these regional ecosystems in accordance with Queensland Marine Fish Habitat Offsets Policy (FHMOP 005.2).

19.4.6 Matters of national environmental significance

As discussed in Volume 1 Chapter 7 MNES the following residual impacts from the NGBR Project on MNES are predicted:

- No significant impacts to TECs confirmed to be present (Brigalow and SEVT), as neither the construction nor operation of the NGBR Project will result in a reduction in the extent of, increased fragmentation of, or degradation in the quality of any TEC
- No significant impacts to listed threatened species confirmed to be present (black ironbox and squatter pigeon (southern)) or likely to occur (black-throated finch (southern), Australian painted snipe, ornamental snake, koala), as neither the construction nor operation of the NGBR Project will lead to declines in or fragmentations of important populations of the species or impact habitat critical to the survival of those species
- No significant impacts to listed migratory species confirmed present or likely to occur, as neither the construction nor operation of the NGBR Project will impact areas that constitute important habitat for migratory species or ecologically significant proportions of the populations of those species.

The Project Offset Strategy (Volume 1, Section 9 Offsets Strategy of this EIS) will address the unavoidable loss of TEC areas and habitat for EPBC Act listed threatened flora and fauna resultant from the construction of the NGBR Project.

The cumulative impacts on the TECs and habitat for EPBC Act listed threatened flora and fauna are discussed in Section 19.4.5.

19.4.7 Water resources

As discussed in Volume 1 Chapter 9 Water resources the construction and operation of the NGBR Project has the potential to directly and indirectly impact water resources within the study area. However, through the implementation of proposed management and mitigation measures the potential residual impacts on surface water, flood regime, water quality, water use and groundwater are anticipated to be minimal.

The construction of multiple rail lines in the region has the potential to cumulatively impacts hydrology and surface water in the area. However it is anticipated that the rail corridor will be built within the GBCIF single north-south rail corridor therefore cumulative impacts on water resources will be minimised and confined to a single corridor.

Cumulative impacts on water resources from the other non-rail projects are considered to be negligible as they are spatially separated such that their impacts are independent.

19.4.8 Air quality

As discussed in Volume 1 Chapter 10 Air quality negligible change to background air quality is expected at any of the identified sensitive receptors and suitably designed construction camps were considered to be sufficiently resilient to air quality impacts. On the basis of this assessment, no residual impacts are expected to result from the NGBR Project.

The operation of multiple rail lines may have cumulative impacts on air quality due to increased coal dust emissions. However, significant cumulative impacts are not considered likely assuming individual proponents whether they are a rail related or non-rail related project implement standard dust control measures during construction and operation

19.4.9 Noise and vibration

As discussed in Volume 1 Chapter 12 Noise and Vibration it is expected that noise and vibration caused by the construction and operation of the NGBR Project will be appropriately managed through the implementation of the mitigation measures identified in the chapter. Therefore no residual noise impacts have been identified.

However, noise and vibration impacts during construction and operation of the NGBR Project have the potential to interact cumulatively with other proposed rail lines. The NGBR Project and its interactions with other rail projects would occur in a remote region and there are limited sensitive receptors.

Given the separation distance between construction work and the nearest sensitive receptors it is unlikely that the NGBR Project will contribute cumulatively to any adverse noise impacts during construction works. It is expected that each proponent will take reasonable and practical measures to mitigate noise during construction to minimise unreasonable noise.

Potential noise impacts arising during the operational phase may include: disturbance to sleep, social activities and work activities; and disturbance to livestock and native fauna. Potential vibration impacts arising during the operational phase may include: disturbance to sleep, social activities and work activities.

Should all proposed projects proceed, there could be a possible magnification of potential noise and vibration impacts where they intersect. However it is anticipated that the rail corridor will be built within the GBCIF single north-south rail corridor in a remote region and therefore cumulative impacts on sensitive receptors will be low and confined to a single corridor.

Cumulative impacts from the other non-rail projects are considered to be negligible as they are spatially separated such that their impacts are independent.

19.4.10 Waste

No residual impacts from waste are expected to result from the NGBR Project. However, there may be a cumulative impact on waste disposal facilities in the region where the NGBR Project utilises the same waste disposal facilities as the other projects. It is expected that each proponent will comply with the *Waste Reduction and Recycling Act 2011* and Waste Reduction and Recycling Strategy 2010–2020 thus minimising impact on the regional waste disposal facilities.

19.4.11 Transport

As discussed in Volume 1 Chapter 14 Transport no residual transport impacts have been identified for the NGBR Project.

The performance of all key roads is anticipated to operate satisfactorily at LOS C or better during construction and LOS B during operation. Based on the nominal capacity of the road network, the additional construction and operation traffic resulting from the project can be adequately accommodated at acceptable levels of service. Therefore cumulative impacts resulting from the NGBR Project is considered to be low.

The potential cumulative impact of known future projects in the region on transport infrastructure and the level of service of the key intersections has been considered in the projected growth factor used to determine the background traffic demands. Given the residual traffic impact from the NGBR Project is low, any cumulative impacts from other projects in the area are also expected to be low, particularly in light of the uncertain timeframes for the construction of other

projects in the region and the significant existing capacity of affected roads. Consultation with key stakeholders will be undertaken to inform the preparation of the Road Use Management Plan during the detailed design of the NGBR Project.

19.4.12 Cultural heritage

As discussed in Volume 1 Chapter 15 Cultural heritage the only residual impact anticipated to occur is damage to cultural heritage that is unregistered or unexpected. Surveys will be conducted to attempt to identify these sites; however, if damage occurs, appropriate measures will be implemented to avoid further damage. All other cultural heritage impacts can be alleviated through the implementation of proposed mitigation and management measures. Therefore cumulative impacts resulting from the NGBR Project is considered to be low.

The development of a Cultural Heritage Management Plan is the overarching measure that will assist in the identification of cultural heritage sites, determination of heritage significance, mitigation and management of impacts, and carrying out consultation with Native Title and Traditional Owner stakeholders.

19.4.13 Social and economic impacts

As discussed in Volume 1 Chapter 16 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 proposed 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 the Local Content Strategy (as described in Volume 1 Chapter 16 Social and economic impacts) the NGBR Project will leverage a range of economic and social benefits for the regional study area through increased employment and business development opportunities.

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 low residual impacts will be monitored and addressed through appropriate landholder engagement and impact monitoring mechanisms.

It is acknowledged that during construction there may be potentially minimal residual impacts from workers in workers camps and on some social infrastructure services such as health. No residual impacts have been predicted for housing and accommodation.

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.

It is anticipated that these cumulative impacts will be significantly reduced as the rail corridor is to be built within the GBCIF single north-south rail corridor.

19.4.14 Hazard, risk, health and safety

A Risk Management Plan will developed and implemented for the NGBR Project and include preventative and responsive mitigation measures to reduce the overall risk of potential hazards identified as high risk.

As discussed in Volume 1 Chapter 18 Hazard, risk, health and safety following the implementation of proposed mitigation measures, the following hazards remain ranked with a residual risk:

- Namely the risk of a traffic incident (high residual risk)
- Risk of a vehicle being washed away by flood waters (high residual risk)
- Eleven hazard events were ranked with a residual risk rating of medium
- A total of 18 hazard events regarded as having a low residual risk.

The implementation of a Risk Management Plan (refer Volume 2 Appendix P Environmental management plan framework) will serve to significantly reduce the likelihood of such events occurring. The Risk Management Plan will be periodically updated and expanded as required throughout the life of the NGBR Project as design progresses and risks are further defined.

Many of the potential impacts to public health and safety would occur indirectly as a result of NGBR Project activities. For this reason, the overarching management plans and procedures that will be developed for the NGBR Project will inherently reduce the risk to public health and safety at the same time that risks to other receptors and environmental values are minimised.

The various management plans incorporated into the Environmental Management Plan for the NGBR Project (refer Volume 2 Appendix P Environmental management plan framework) will fit within a health and safety management system, taking into account the policies and procedures adhered to by Adani, its employees and subcontractors.

19.5 Conclusion

This cumulative impacts chapter describes the cumulative impacts of the NGBR Project and other proposed projects in the region. This assessment considered the relevant aspects of the GBCIF which will collocate proposed rail developments within a single, north-south, multi-user, common access rail corridor, from the Galilee Basin to Abbot Point. This framework will promote the minimisation of impacts to landholders and the broader region and thereby reduce potential cumulative impacts that may have otherwise resulted. Other non-rail related projects within the region were also considered and their cumulative impacts were assessed separately, based on their separation distance from the NGBR Project.

It was considered that the mitigation and management measures incorporated into the NGBR Project (refer Volume 2 Appendix P Environmental management plan framework) would effectively avoid or otherwise manage potential cumulative impacts, such that residual consequences were low.

The unavoidable residual impacts with the greatest potential to result in cumulative impacts involved the disturbance of protected conservation values associated with terrestrial ecology. The NGBR Project will provide offsets (refer to Volume 2 Appendix O Offsets strategy) to compensate for these impacts. Similarly each proponent of other projects considered in this assessment will be required to provide offsets in accordance with Commonwealth and State policies for unavoidable impacts on potential habitat for each of the abovementioned values. Over time these offsets should take account of the potential cumulative impacts that each

project will realise with the aim of achieving a 'no net loss' of biodiversity values. Therefore cumulative impacts from disturbance of nature conservation values associated with the NGBR Project are considered low.