Adani Mining Pty Ltd

NORTH GALILEE BASIN RAIL PROJECT

Environmental Impact Statement

Chapter 18 Hazard, risk, health and safety

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18. Hazard, risk, health and safety

18.1 Purpose of the chapter

This chapter identifies and assesses the potential hazards to people, property and the surrounding environment (which have been defined as sensitive receptors) that may result from construction, operation and decommissioning of the Northern Galilee Basin Rail Project (NGBR Project). Hazards may include potential accidents, spills, wildlife, traffic collisions and the use of hazardous substances. The possible frequency of identified hazards (likelihood) and potential consequence of the hazard occurring have been identified and an overall risk rating determined.

This chapter also assesses the potential impacts of the NGBR Project on the community in terms of public health and safety. It describes existing community values, the potential impacts of the NGBR Project on those values, and provides management and mitigation measures that will be implemented to minimise those impacts. Human health and public safety impacts can potentially arise from air pollution, odour, lighting, amenity, dust, noise and water quality degradation. Workplace health and safety issues are not assessed in this chapter as they will be assessed and managed separately through development and implementation of a Work Health and Safety Management System for construction, operation and decommissioning of the NGBR Project and in accordance with statutory processes and relevant health and safety legislation. The health and safety management system will comply with the requirements of the Australian Standard AS/NZS 4801:2001, Occupational health and safety management systems—Specification with guidance for use.

Hazard identification focuses on non-routine (abnormal) hazardous events that may result in impacts on identified sensitive receptors and environmental values. Potential impacts arising from day-to-day, normal construction and operational activities are not considered as a risk event given that they will be managed by reasonable environmental and health and safety practices in combination with relevant requirements, approvals and licences. These impacts are adequately addressed in relevant chapters of the NGBR Project Environmental Impact Statement (EIS) and are not covered in this hazard, risk, health and safety assessment.

This hazard, risk, health and safety 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.

An Emergency Management Plan is provided in Volume 2 Appendix P Environmental management plan framework. The Emergency Management Plan has been developed for the hazards and risks identified in this chapter and will be updated and expanded as the NGBR Project progresses and hazards and risk are further defined.

18.2 Methodology

18.2.1 Study area

The study area for the hazard, risk, health and safety assessment includes localities that have the potential to be directly or indirectly affected by the NGBR Project. This includes people, property and the surrounding environment as follows:

- NGBR Project footprint which consists of a nominal 1,000 m wide preliminary investigation corridor that includes properties on which permanent and temporary construction and operational ancillary infrastructure will be located

- Land use and infrastructure on properties intersected by the final rail corridor (a nominal 100 m wide corridor) and ancillary infrastructure
- Surrounding receiving natural environment including flora, fauna and water resources
- Users of major transport infrastructure within Whitsunday Regional Council Local Government Area (LGA) and Isaac Regional Council LGA.

These existing environmental factors have been described and defined as sensitive receptors for this assessment within Section 18.3.6.

18.2.2 Data sources

This hazard, risk, health and safety assessment draws on the findings from other assessments conducted as part of the EIS for the NGBR Project, including:

- North Galilee Basin Railway Concept Design Report (Aarvee Associates 2013
- 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

The assessment has also relied on relevant publicly available data from government agencies such as Bureau of Meteorology (BOM) and Geosciences Australia.

18.2.3 Legislation and guidelines

A number of key legislation, policy, standards and codes relevant to the potential hazards and risks associated with the NGBR Project were reviewed, as listed below:

- Relevant legislation and policy, including:
  - *Building Act 1975*
  - *Building Fire Safety Regulations 2008*
  - *Disaster Management Act 2003*
  - *Fire and Rescue Services Act 1990*
  - *Transport Infrastructure (Dangerous Goods by Rail) Regulation 2008*
  - *Transport Operations (Road Use Management - Dangerous Goods) Regulation 2008*
  - *Transport (Rail Safety) Act 2010*
  - *Transport (Rail Safety) Regulation 2010*
  - *Work Health and Safety Act 2011*
  - *Work Health and Safety Regulation 2011*
  - *State Planning Policy 1/03, Mitigating the Adverse Impacts of Floods, Bushfire and Landslide*
  - *Environmental Protection (Air) Policy 2008*

  - *Environmental Protection (Noise) Policy 2008*
  - State Planning Policy, Draft for Consultation (Department of State Development, Infrastructure and Planning 2013).
- Relevant standards, codes and guidelines, including:
  - AS/NZS ISO 31000:2009 Risk management – Principles and guidelines (AS/NZS ISO 31000:2009)
  - HB 327:2010 Communicating and consulting about risk (HB 327:2010)
  - AS 1940:2004, The storage and handling of flammable and combustible liquids (AS 1940:2004)
  - AS/NZS 4801:2001, Occupational health and safety management systems—Specification with guidance for use (AS/NZS 4801:2001)
  - HB 203:2012, Managing environment-related risk (HB 203:2012)
  - AS 1692:2006 Steel tanks for flammable and combustible liquids (AS 1692:2006)
  - AS 2419.1-2005 Fire Hydrant Installations - System design, installation and commissioning (AS 2419.1-2005)
  - AS 2419.2-2009 Fire Hydrant Installations –Fire hydrant valves (AS 2419.2-2009)
  - AS 2941-2008 Fixed fire protection installations – Pumpset systems (AS 2941-2008)
  - AS 1851-2012 Routine service of fire protection systems and equipment (AS 1851-2012)
  - *Australian Code for Transport of Dangerous Goods by Road and Rail*, Seventh edition, Commonwealth of Australia
  - *Building Code of Australia*, Australian Building Codes Board 2011
  - New South Wales Department of Planning's *Hazardous Industry Planning Advisory Paper No 4 Risk Criteria for Land Use Safety Planning*, 2011
  - New South Wales Department of Planning's *Hazardous Industry Planning Advisory Paper No 3 Risk Assessment*, 2011.

Where relevant, standards, codes and guidelines have been considered during development of the NGBR Project concept design and incorporated into the mitigation and management measures summarised in Section 18.5. Descriptions and requirements of relevant legislation and policies are explored further in Volume 1 Chapter 20 Legislation and approvals.

18.2.4 Hazard identification

To assess the potential hazards and risks associated with the NGBR Project, a preliminary hazard assessment was undertaken in accordance with the New South Wales Department of Planning *Hazardous Industry Planning Advisory Papers No. 3 and 4*. The purpose of undertaking the preliminary assessment was to identify hazards and risks associated with the NGBR Project at a level of detail commensurate with the present stage of the project's planning. However, the assessment does not provide a comprehensive quantitative assessment of all potential risks, and a more detailed hazard, risk, health and safety assessment will be undertaken at the detailed design stage.

The methodology employed for the preliminary identification of hazards included:

- Identification of existing environmental values and sensitive receptors
- Review of the NGBR Project activities throughout construction, operation and decommissioning

- Review of the potentially hazardous substances that will be used by the NGBR Project.

The hazard, risk, health and safety assessment is based on a description of the NGBR Project provided in Volume 1 Chapter 2 Project description, and includes an assessment of the activities associated with construction, operation and decommissioning of the NGBR Project.

18.2.5 Risk assessment

For each identified potential hazard, a risk assessment was undertaken which included consideration of the likelihood and consequence of the hazard occurring. The definitions used to determine the likelihood and consequence of a hazard occurring are provided in Table 18-1 and Table 18–2 respectively. The overall risk rating of a hazard is a combination of its likelihood and consequence of occurrence. Table 18-3 outlines the risk matrix used to determine the overall risk rating for each hazard.

Table 18-1 Likelihood definitions

Likelihood	Definition
Almost certain	Frequency of occurrence expected to exceed 95% Impact is occurring now or could occur within months
Likely	Frequency of occurrence expected to be 50% to 95% Will probably occur in many circumstances Could occur annually
Possible	Frequency of occurrence expected to be 20% to 50% May occur some of the time but a distinct possibility it would not Could occur in the next 2 to 5 years
Unlikely	Frequency of occurrence expected to be 5% to 20% May occur in some circumstances but not anticipated Could occur once in the next 5 to 30 years
Rare	Frequency of occurrence expected to be < 5% Only likely to occur in exceptional circumstances Not likely to occur in the next 30 years

Table 18-2 Consequence definitions

Consequence	Definition		
	Environment	Health and safety	Community and reputation
Major	Extensive long term environmental harm and/or harm that is extremely widespread. Significant resources required to respond to the incident and rehabilitate. Impacts unlikely to be reversible within 10 years.	Multiple fatalities and/or significant irreversible effects to 10s of people	Prominent negative international media coverage over several days. Significant negative impact on share price for months.
Severe	Major or widespread, unplanned environmental impact on- or off-site. Degradation of overall conservation status of ecosystems. Significant resources required to respond and rehabilitate. Impacts are reversible within 5 to 10 years.	Single fatality and/or severe disability (permanent disabling injury) or illness to one or more persons	National media coverage over several days. Community / Non - government organisations legal actions. Impact on local economy.
Moderate	Moderate, unplanned environmental impact contained within the rail corridor or minor impact that is off-site. Unplanned impacts do not result in degradation of overall conservation status of ecosystems. Resources will be required for responding to the incident and implementing mitigation measures over a period of time. Impacts are reversible within 1 to 5 years.	Serious bodily injury or illness (e.g. fractures) and/or lost time injury > 2 weeks.	Local media coverage over several days or State media coverage. Negative impact on local economy. Persistent community complaints.

Consequence	Definition		
	Environment	Health and safety	Community and reputation
Minor	Minor, unplanned localised environmental impact, contained within the rail corridor or with negligible off site effects. Planned or unplanned impacts do not result in degradation of overall conservation status of ecosystems. Minor resources required to respond to the incident. Impacts are reversible within a year.	Medium term, largely reversible injury or illness to one or more persons. Restricted work injury. Lost time injury < 2 weeks.	Local media coverage. Complaint to site and/or regulator.
Insignificant	Negligible, reversible environmental effect. Any impacts are contained within the rail corridor and are short term in nature. Minimal resources required to respond to an incident.	First aid treatment or medical treatment in hospital.	No media coverage. No community complaints.

Table 18-3 Overall risk rating

Likelihood	Consequence				
	Major	Severe	Moderate	Minor	Insignificant
Almost certain	Extreme	Extreme	High	Medium	Medium
Likely	Extreme	Extreme	High	Medium	Medium
Possible	High	High	Medium	Medium	Low
Unlikely	High	Medium	Medium	Low	Low
Rare	Medium	Medium	Medium	Low	Low

18.3 Existing environment

18.3.1 Land use

The NGBR Project traverses a total of 64 properties. Nearest potential sensitive receptors were identified within approximately six kilometres of the preliminary investigation corridor for the NGBR Project, including 23 homesteads. The NGBR Project is located within the Regional Landscape and Rural Production Area (RLRPA) land use category under the Mackay, Isaac and Whitsunday Regional Plan (MIWRP). The RLRPA includes land with significant biodiversity values, Good Quality Agricultural Land (GQAL), cultural and landscape heritage values, extractive resources of economic significance (e.g. mining), water catchments, native forests, coastal wetlands, land unsuitable for urban/rural residential purposes and rural towns and associated activities such as transport and telecommunication networks (DLGP 2012). The NGBR Project final rail corridor does not cross any existing mining lease or mineral development licence areas, or key resource areas.

Within the local study area, land use is predominantly for the purposes of cattle breeding and fattening, and GQAL has the potential to be present. Potential Strategic Cropping Land is also defined in the area by the Western Cropping management zone and Coastal Queensland management zone (refer Volume 1 Chapter 3 Land use and tenure). In terms of non-rural land, the NGBR Project traverses land designated for industrial use including port handling activities and environmental buffers, toward the Port of Abbot Point. The main population centres surrounding the NGBR Project are located in excess of 18 km from the NGBR Project final rail corridor at Moranbah, Collinsville and Bowen.

18.3.2 Existing infrastructure

The NGBR Project intersects the North Queensland Gas Pipeline, owned by Energy Infrastructure Management Pty Ltd, at chainage 150.77 km and the SunWater Burdekin Moranbah Pipeline at chainage 150.7 km. There are also a total of 13 power lines (including two high voltage transmission lines) and three telecommunication and figure optic cables services that cross the NGBR Project final rail corridor.

18.3.3 Nature conservation

A total of 61 Regional Ecosystems (RE) are mapped within the preliminary investigation corridor comprising seven ‘endangered’ REs, 18 ‘of concern’ REs and 36 ‘least concern’ REs (*Vegetation Management Act 1999* (VM Act) status). Constituent REs of three threatened ecological communities (TEC) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), regulated growth vegetation and essential habitat are also mapped within the preliminary investigation corridor. Twenty-two threatened flora species and 33 threatened fauna species (EPBC Act and/or *Nature Conservation Act 1992* (NC Act) listed) were identified within the preliminary investigation corridor.

The NGBR Project crosses 567 waterways, including 16 major waterways, which may contain aquatic habitats that provide foraging, refuge and breeding grounds for fish, turtles, amphibians, waterbirds and invertebrates. Terrestrial fauna including amphibians, reptiles, mammals and bird species were also identified within the preliminary investigation corridor and the wider study area. Historically, the landscape within the preliminary investigation corridor has been exposed to a number of threatening processes mostly related to land use, including agricultural and mining activity resulting in vegetation clearing. This has resulted in direct mortality of flora and fauna, habitat loss and fragmentation, erosion and sedimentation of watercourses and the introduction of exotic animals and plants.

18.3.4 Water resources

The majority of the NGBR Project final rail corridor traverses through the Burdekin River Basin. The NGBR Project study area is described based on four dominant catchments, mainly the Suttor River, Bowen River and the Lower Burdekin River catchments within the Burdekin Basin and the Don River catchment that makes up the Don Drainage Basin.

Water usage within the Don River Basins and Burdekin River is dominated by urban, industrial, stock watering and domestic uses. Water resource infrastructure includes channels, pipelines, pumps, pumping stations, weirs such as the Bowen Weir and major dams like Burdekin Falls Dam. Stock water is supplied directly from the rivers in the wet season and for the rest of the year by residual natural waterholes or constructed impoundments of wet season runoff.

Waterways along the preliminary investigation corridor are predominately set within rural or semi-rural/bushland settings and have been modified over time by land clearance and other agricultural practices. Catchment responses to land clearance include increased runoff, increased drainage density, increased erosion and sediment yields within the catchment. These impacts can, in turn, affect water quality. Assessment of water quality parameters identified results greater than water quality objectives (WQO) at gauging sites within each catchment identified (based on Queensland Water Quality Guidelines). Salinity was identified as one of the main groundwater quality issues within the Burdekin Basin. Turbidity and total suspended solids in the Bowen River and Suttor River catchments were found to be up to four times higher than WQO, particularly in areas affected by loss of riparian vegetation. The concentrations of ammonia, total nitrogen, total phosphorus and certain metals in the catchments were consistently greater than the WQO for the protection of aquatic ecosystems.

18.3.5 Transport

Construction and operation of the NGBR Project will require use of the surrounding road network for the movement of construction materials, plant and equipment, workers, supervisory personnel, and additional supporting infrastructure. State-controlled roads of relevance to the NGBR Project include Bruce Highway, Bowen Developmental Road, Gregory Developmental Road and Suttor Developmental Road. Local roads include Glenore Road, Stratford Road, Strathalbyn Road and Strathmore Road. Traffic volumes assessed indicate free and uninterrupted travelling conditions on all assessed roads. Review of existing heavy vehicle networks indicates the access to camps and construction yards from the Port of Abbot Point and other locations around the State will be provided via State-controlled roads.

The Aurizon Newlands rail network, which links the Port of Abbot Point coal terminal to Newlands Junction, is located in the vicinity of the NGBR Project. The NGBR Project will run along the western extent of the Newlands rail network primarily interacting with this rail service (via grade-separated crossings) in the northern section of the NGBR Project in the vicinity of the Port of Abbot Point. The southern section of the NGBR Project will also adjoin the proposed Carmichael Project rail infrastructure near Mistake Creek.

The NGBR Project will intersect with 25 public roads, gazetted public road reserves (unconstructed), occupational (private farm) tracks within private property boundaries and/or connecting adjoining properties of different ownership, gazetted stock routes, existing rail lines and other proposed rail corridors being planned (by others) and utility and services crossings (Aarvee Associates 2013). The key road network (and associated existing and proposed key intersections) for the NGBR Project is as follows:

- State-Controlled Roads
  - Bruce Highway
  - Bowen Developmental Road
  - Gregory Developmental Road
  - Suttor Developmental Road
- Local Roads
  - Glenore Road
  - Stratford Road
  - Strathalbyn Road
  - Strathmore Road.

18.3.6 Sensitive receptors

The land use surrounding the NGBR Project is primarily rural in nature with a limited number of potential sensitive receptors. Those identified were within approximately six kilometres of the 1,000 m preliminary investigation corridor for the NGBR Project. Twenty-three sensitive receptors were identified, all of which were homesteads. No other types of sensitive receptors, such as educational institutions, places of worship or medical facilities, were identified. The average distance of the 23 potential sensitive receptors is approximately 3.7 km from the 100 m final rail corridor, with the closest being approximately 1.1 km distant.

For the purposes of this assessment, sensitive receptors are considered any location where members of the public may be present (i.e. homesteads, roads, townships, nature reserves and parks) that may have a significantly increased sensitivity or exposure to negative impacts within and outside the NGBR Project footprint.

18.4 Hazardous substances inventory

During construction and operation of the NGBR Project a number of hazardous substances will be used, including some listed in the Australian Dangerous Goods Code (ADG Code). Table 18-4 provides an indicative list of the hazardous substances that will be used, the likely quantities to be stored on site and the purpose for the substance. Safety Data Sheets (SDS) will be available at appropriate locations where these substances are stored or used.

It is expected that hazardous substances will be transported by road via any of the eight approach roads identified in Volume 1 Chapter 14 Transport (refer section 18.3.5).

Large quantities of fuel will be required to maintain the large earthmoving fleet during the construction period. Bulk fuel will be supplied via B-double tankers to on-site self-bunded storage facilities. These storage points will be planned as part of the detailed construction planning and require approval from the Department of Environment and Heritage Protection (DEHP) and local councils at that time. It is expected that diesel fuel storages will be greater than 20,000 L at each location.

Preliminary locations for three storage tanks have been identified, where there are existing access routes and increased passive security:

- Rolling stock maintenance facility – Ch. 31.75 km
- Secondary construction yard – Ch. 170.64 km
- Track construction depot – Ch. 305.0 km.

Onsite fuel trucks with 12,000 L capacities will then service onsite plant on a daily basis from these storage facilities.

It is not envisaged that large volumes of other hazardous materials will be routinely stored on site for this type of construction. Any storage and use of other hazardous materials will adhere to the requirements of DEHP and local councils. Potential impacts from transport and use of these chemicals is outlined below. An assessment of activities involving hazardous substances is provided in Section 18.5, where event specific impacts are identified and mitigation measures offered to prevent and respond to those impacts.

Table 18-4 Hazardous substance inventory

Chemical name	Construction	Operation	Purpose
Diesel	120 kL	1,050 kL	Fuel for vehicle operations during construction phase. Fuel for train operations and other mobile equipment.
	15 kL	15 kL	Fuel for back-up generators
Lubrication/ Hydraulic oils	15 kL	330 kL	Lubrication of equipment
Aluminium sulfate	N/A	4 kL	Water treatment
Sodium hypochlorite	3 kL	3 kL	Water treatment
Ammonium Nitrate Fuel Oil	20 tonnes bin capacity mounted on truck.	N/A	Blasting for track construction.
Nitrogen gas	144 m^3	60 m^3	Pneumatic equipment
Acetylene	245 m^3	80 m^3	Welding / Oxy-acetylene cutting
Oxygen	245 m^3	80 m^3	Welding / Oxy-acetylene cutting
Herbicides and Pesticides	< 200 kL	< 200 kL	Pest and weed control
Car batteries (sulfuric acid)	0.25 tonne	0.5 tonne	Spent batteries from vehicles
Waste oil	0.5 tonne	1 tonne	From vehicles / equipment

18.4.1 Diesel

Diesel is a combustible liquid with a flash point of > 61.5°C, vapour pressure < one mm Hg @ 25°C and specific gravity 0.85 at 15°C. Diesel has very low solubility in water and is incompatible with strong oxidising agents. Due to the properties of diesel, there is no risk of an explosion with a diesel fire. Diesel is toxic to plants and animals. Contact with skin and eyes will cause irritation. Inhalation by humans in high concentrations will result in dizziness, headaches, nausea, vomiting, drowsiness or narcosis. Diesel is not persistent and is therefore considered unlikely to bioaccumulate through food chains. The safety data sheet for automotive diesel indicates that it is biodegradable (BP 2013).

18.4.2 Oils

Oils are typically clear amber viscous liquids with specific gravity of 1.01 to 1.03 and a boiling point of 100 to 105°C. The safety data sheet states that prolonged exposure may irritate eyes and skin. When released into the environment, oils will absorb to the sediment and soil. Oils can be toxic to plants / animals and coating of plants and animals with oil can cause harm. Oils have very low water solubility and therefore potential bioavailability and bioaccumulation in aquatic organisms is unlikely. Biodegradability of oil depends on the oil product, pathway for exposure, location of potential receptors, and the sensitivity of the receiving environment. Although hydraulic oils contain components that are inherently biodegradable, some components may persist in the environment.

18.4.3 Aluminium sulfate

Aluminium sulfate is often used as a water treatment chemical. It is typically a colourless odourless liquid with specific gravity of 1.30 to 1.32. Aluminium sulfate is slightly corrosive and incompatible with alkalis (e.g. sodium hydroxide) and may be corrosive to most metals. The safety data sheet states that aluminium sulfate is non-flammable but may evolve toxic aluminium / sulfur oxides when heated to decomposition. Prolonged exposure to aluminium sulfate can cause chronic toxicity effects in aquatic organisms. Bioaccumulation of aluminium sulfate is unlikely as it is soluble and will hydrolyse on contact with water to give dilute sulphuric acid. Aluminium sulfate is not considered to accumulate through food chains (Chem One 2010).

18.4.4 Sodium hypochlorite

Sodium hypochlorite is a pale yellow-green coloured liquid that is used in the treatment and disinfection of water. It is alkaline and miscible with water, stable under normal storage and handling conditions, and is incompatible with acids and metals. Sodium hypochlorite is known to be toxic to humans causing severe eye irritation, which can result in permanent injury. It is a severe skin irritant and corrosive contact may cause skin burns. Sodium hypochlorite is soluble in water and causes acute toxic effects to aquatic organisms. The safety data sheet for sodium hypochlorite indicates that it is biodegradable (Orica 2013).

18.4.5 Ammonium nitrate fuel oil

Ammonium Nitrate Fuel Oil (ANFO) requires a specialist licence to use and manage in Australia. The product can be used in a number of forms, and hence formulation utilised for this NGBR Project will be decided by explosives contractors. The specialised controllers will determine ingredient percentages and rates. These controllers will likely utilise various mixtures of ANFO in blasting depending on the ground conditions and the blast size. Explosive residues

are likely to be minimal in volume and not likely to be a source of contamination for sensitive receptors.

18.4.6 Nitrogen gas

Nitrogen gas is a non-flammable, colourless and odourless gas having a vapour density of 0.967 and a boiling point of -195.8°C. It is a non-toxic and non-irritating gas but in confined spaces will displace oxygen, potentially causing asphyxiation. Nitrogen is a major component of air and is non-toxic to plants except by displacing oxygen required for respiration.

18.4.7 Acetylene gas

Acetylene is a highly flammable and explosive gas that is colourless with a garlic-like odour. It has a vapour pressure of 4700 kPa at 25°C and a flash point of < 23°C. Acetylene has a lower explosion limit of 2.5 %. It is a non-toxic and non-irritating gas but in confined spaces will displace oxygen, potentially causing asphyxiation.

18.4.8 Oxygen gas

Oxygen is an oxidizing, colourless and odourless gas. Contact with combustible material may cause a fire. It is not toxic to humans or other organisms.

18.4.9 Other substances

Other chemicals such as herbicides and pesticides, and sulfuric acid contained in vehicle batteries, will be present on site during various stages of the NGBR Project. Sulfuric acid is a highly corrosive liquid with a pungent odour that is soluble in water. It is not anticipated that large volumes of this substance will be present on site. Appropriate measures will be taken to minimise the potential for battery leaking and exposure to this substance. Herbicides used on site will be applied in accordance with the instructions for use on the herbicide container label and in accordance with registration for use. All substances will be handled by the appropriate agent and stored according to their label instructions or the safety data sheet to minimise the potential for contamination.

18.5 Potential impacts and mitigation measures

18.5.1 Hazard assessment

The results of the hazard, risk, health and safety assessment undertaken for the NGBR Project are provided in Table 18-5. Potential hazards are identified according to an activity, and impacts (i.e. the measure of consequence) are identified according to that activity rather than for a particular environmental value. Likelihood and consequence together determine the level of risk for that potential event, and proposed mitigation and management measures are identified to prevent or respond to the impact. Residual risk measures the likelihood and consequence of the event occurring following the implementation of preventative and responsive measures.

Hazards have been categorised according to different activities undertaken, including but not limited to transport of materials, operation of plant and rail operations. The table also identifies whether the hazard is likely to occur during construction, operation and/or decommissioning. The assessment has been undertaken in accordance with the AS/NZS ISO 31000: 2009 Risk management – Principles and guidelines.

Table 18-5 Hazard, risk, health and safety assessment

Hazard	Stage of Works	Likelihood of Occurrence	Potential Impacts (Consequence)	Overall Risk	Preventative Measures	Responsive Measures	Residual		
							L	C	Risk
Transport (Road)									
Fuel/ oil tanker crash as a result of driver losing control or vehicle hitting a stationary object (tree or pole) or another vehicle causing rupture of fuel/oil tank, which results in spill or leak of diesel in transit.	Construction, Operation, Decommissioning	**Possible**. Number of weekly truck trips during construction considered to be 14. Road contains few hazards, except in wet weather. Average number of weekly truck trips during operation considered to be 47. Local roads are sealed and contain few hazards, except during wet weather. Access roads are unsealed, though gravel compacted, and may present driving hazards.	**Moderate**. Release of diesel to soils if tank ruptures, resulting in soil contamination and vegetation health impacts. Release of diesel to major waterways including Don River, Elliot River, Bogie River, Sandy Creek, Strathmore Creek, Pelican Creek, Bowen River, Upper Suttor River, Rockingham Creek, Isaac River, Suttor River and a number of small creeks such as Dennison Creek, Nebo Creek, Cooper Creek resulting in contamination downstream. Aquatic organisms may be killed or harmed.	Medium	Local roads used to transport fuel are sealed, and access roads to laydown yard, construction camps and concrete batching plants will be gravel compacted. Yards, camps and concrete batching areas will all be hardstand. Safety induction to staff and contract workers which will include awareness regarding traffic rules. All vehicles conform to ADG Code. Regular inspection of vehicles. Implement fatigue management strategies by Queensland Government, Department of Transport and Main Roads (DTMR). Consider using heavy vehicles fitted with forward collision avoidance technology. First aid, spill response and fire fighting equipment will be available with each fuel truck. Transportation of diesel for construction and operation is expected to be via B-double tankers in compliance with Australian Code for Transport of Dangerous Goods by Road and Rail. Portable petroleum-product fuel containers will comply with the requirements under AS/NZS 2906:2001 Fuel containers - Portable - Plastic and metal. Mobile fuel trucks of 12,000 Litres capacity used to refuel onsite equipment will be fitted with automatic shutoff valves and comply with the requirements of the ADG Code.	Responsive measures will be the primary responsibility of the fuel delivery contractor. Emergency management plan to include diesel spills. Containment and immediate clean-up of spills. Removal of contaminated soils and sediments and rehabilitation of damaged vegetation. Sampling as required depending on the extent of spill. Use licenced contractor for removal and disposal of spilled and clean-up material. Notify Emergency Services in case of spills on public roads. Notification to DEHP as required under the approval conditions.	Rare	Minor	Low
Driver loses control or vehicle hits stationary object, (tree or pole) or another vehicle. As a result, vehicle carrying acetylene, oxygen or nitrogen gas cylinders crashes and results in gas leakage.	Construction, Operation	**Unlikely**. Number of truck trips for these substances is very low. Cylinder design minimises risk of rupture, even in accident situations. The trucks will comply with the requirements for transporting dangerous materials, including compatibility requirements.	**Minor**. Very localised and very short term impact only. Release volumes will be negligible. Damage to plants and animals unlikely. Release of acetylene may result in fire and explosion in presence of an ignition source.	Low	All vehicles conform to ADG Code. Consider using heavy vehicles fitted with forward collision avoidance technology. Drivers trained in safe driving of the vehicle. First aid equipment will be available with each truck. Gases will be transported to site in individual cylinders.	None required - quantities of gas small and will dissipate quickly.	Rare	Minor	Low

Hazard	Stage of Works	Likelihood of Occurrence	Potential Impacts (Consequence)	Overall Risk	Preventative Measures	Responsive Measures	Residual		
							L	C	Risk
Traffic accident on primary access roads or other public road as a result of vehicle colliding with another vehicle or a stationary object on road such as tree/ pole or pedestrian enroute to site.	Construction, Operation, Decommissioning	**Possible**. Road accident statistics for the period from 2006 to 2011 are 15 to 28 fatalities per year on roads to be used by NGBR Project traffic.	**Major**. Death or injury to occupants of the other vehicle/pedestrian. Potential impacts will be reduced due to availability of emergency services in local towns such as Bowen, Collinsville, Glenden, Mackay and Moranbah.	High	NGBR Project generated traffic will operate mostly during daylight hours; however some trips may be done at night time. A Traffic Management Plan will be developed in consultation with DTMR and Council. A specific Traffic Management Plan will be developed for oversized loads. Designated travel route through townships for heavy vehicles. First aid kits in all NGBR Project related vehicles. Safety induction to staff and contract workers which will include awareness regarding traffic rules. Implementation of DTMR fatigue management strategies. Consider using heavy vehicles fitted with forward collision avoidance technology.	Incorporate vehicle accident response in Emergency Management Plan. Develop the plan in conjunction with emergency services. Notify emergency services of any accidents.	Unlikely	Major	High
Vehicle washed away by flood waters	Construction, Operation, Decommissioning	**Possible**. Construction period includes storm and flooding seasons. Vehicle use during construction period involves a considerable number of trips for cars, trucks and buses.	**Major**. Injury or death of worker. Loss of vehicle.	High	Monitor for weather forecast. Drive to conditions and follow signage. Designated travel route. NGBR Project generated traffic will operate mostly during daylight hours; however some trips may be done at night time. First aid kits in all NGBR Project related vehicles. Safety induction to staff and contract workers which will include awareness regarding traffic rules. No vehicles are to enter, or attempt to cross, flood waters.	Incorporate vehicle accident response in Emergency Management Plan. During detailed design phase, develop the plan in conjunction with emergency services. Notify emergency services of any accidents.	Unlikely	Major	High
Transport (Rail)									
Rail construction activities impact on cultural heritage.	Construction	**Possible**. Rail line of 300 km within a nominal 100 m corridor has potential for occurrence of cultural heritage. No surveys to date, but desktop searches have revealed 21 sites of Indigenous cultural heritage with potentially high significance.	**Moderate**. Damage to cultural heritage items/objects.	Medium	Cultural heritage survey and management. Communication with traditional landowners. Cultural Heritage Management Plans have been negotiated, agreed and signed with relevant Aboriginal parties of the area affected by the NGBR Project.	Cultural Heritage Management Plan will be adhered to. Cultural Heritage awareness training for all staff. Site inductions to workers and visitors.	Rare	Minor	Low
Construction activities impact high pressure buried gas pipeline.	Construction	**Unlikely**. North Queensland Gas Pipeline crossing the alignment at approximate chainage 150.8 km. The depth of gas pipeline is unknown.	**Severe**. Minor damage or rupture of the gas pipeline. May result in gas leak, fire and explosion. Potential for injury and death.	Medium	Liaise with owners of the North Queensland Gas Pipeline to collect information on the pipeline crossings including requirements for pipeline crossing. Undertake necessary studies and prepare design for the crossing in consultation with the owners/operators of the high pressure gas pipeline.	Notification to owners/operators of the gas pipeline and to the Queensland Police Services / Emergency Services. Provide suitable medical response and transport to nearest hospital.	Rare	Severe	Medium
Person in contact with high voltage electrical lines.	Construction	**Unlikely**. The proposed railway route has 13 power line crossing including Strathmore-Ross (275 kV) and Collinsville-Clare (132 kV) power lines.	**Severe**. Accidental injury or death.	Medium	Service removal and treatment will occur during the site establishment phase of construction (refer Volume 1 Chapter 2 Description of the project) Adequate temporary signage will be installed by near high voltage power line crossing. Adequate job safety measures will be implemented during construction works.	Notification to Queensland Police Services / Emergency Services. Provide suitable medical response and transport to nearest hospital.	Rare	Severe	Medium

Hazard	Stage of Works	Likelihood of Occurrence	Potential Impacts (Consequence)	Overall Risk	Preventative Measures	Responsive Measures	Residual		
							L	C	Risk
Persons accessing the rail construction site or operating rail line without authorisation	Construction, Operation	**Unlikely**. It is considered unlikely that this event will occur.	**Severe**. Accidental death or injury to unauthorised person. Unauthorised person causes environmental incident, for example deliberately breaches fuel storage tanks and associated infrastructure.	Medium	Livestock type fencing will be established on both sides of the final rail corridor, subject to consultation with adjacent landholders. Security fencing will be also be provided at the rolling stock maintenance yard, flash butt weld yard and fuel storages. NGBR Project maintenance will include security inspections of the final rail corridor. Dedicated security personnel for each construction camp. Security personnel will patrol the construction site after hours. Legitimate persons working at the project will wear clear identification. Install warning signs along any roads and tracks in the vicinity of the rail line stating that access is prohibited without authorisation.	Remove any unauthorised persons from site immediately. Notification to Queensland Police Services / Emergency Services for removal and/or arrest of persons.	Rare	Severe	Medium
Train derailment due to debris on track or extreme wet weather event.	Operation	**Possible**. Poorly constructed track, excessive speed, broken or misaligned rails due to wheelburn or wheelflat may cause derailment. Subsidence/washout due to rain or flooding beyond design consideration. Animals within the final rail corridor.	**Moderate**. Potential for injury resulting in temporary stoppage to movement of coal trains depending on the severity of the incident.	Medium	Track construction to Australian Standards/ Aurizon Standards. Rail safety accreditation will be obtained and maintained. Routine inspection and maintenance of tracks, foundations and relief drainage along rail line. Training and assessment of rail safety works for workers. Regular flood monitoring Routine inspection and maintenance of wagons and locomotives. Safety management systems Fencing along final rail corridor Occupational crossings provided.	Emergency Management Plan will be developed. Workers will be trained to respond during emergencies.	Rare	Moderate	Medium
Train on train collision, collision with track maintenance machine or train collision with vehicle.	Operation	**Unlikely**. Potential for collision with vehicle at the level crossings. Potential for train collision with track machine during maintenance.	**Severe**. Potential for injury and/or fatality to train personnel and/or other passengers resulting in temporary stoppage to movement of coal trains depending on the severity of the incident.	Medium	Routine inspection and maintenance of signalling equipment. Installation of passive or active controls at level crossings. Construction of grade separators for identified crossings as required by DTMR. Installation of signalling system. If feasible, reduce train speed when crossing roads at level crossings.	Emergency Management Plan will be developed in consultation with local hospitals. Workers will be trained to respond during emergencies. Notify Queensland Police Service, Queensland Ambulance Service and local Council. Transport injured person using services of Queensland Ambulance Service to nearby hospital.	Rare	Severe	Medium

Hazard	Stage of Works	Likelihood of Occurrence	Potential Impacts (Consequence)	Overall Risk	Preventative Measures	Responsive Measures	Residual		
							L	C	Risk
Train/ track inspection vehicle collisions with livestock	Operation	**Unlikely**. Requirement to cross stock crossings is infrequent.	**Minor**. Potential for injury to livestock resulting in temporary stoppage to movement of coal trains depending on the severity of the incident.	Low	Fencing to be erected along the final rail corridor progressively during construction and will be maintained during operations. Provide adequate underpass throughout the alignment as required in consultation with the land owners and discussions with DEHP. At-grade stock crossings are also proposed, fenced with yards either side. Routine inspection and maintenance.	Workers will be trained in the correct procedure to follow in the incident of train collision with live stock. Transport injured livestock to nearest veterinary hospital.	Rare	Minor	Low
Coal train fire	Operation	**Possible**. Historically such incidents have happened in Australia.	**Severe**. Potential for injury and/or fatality.	High	Suitable designed coal wagons. Coal loader operator and workers will monitor the condition of coal.	Emergency Management Plan will be developed. Workers will be trained to respond during emergencies.	Unlikely	Minor	Low
Spills from wagons of coal trains.	Operation	**Possible**. With properly loaded wagons and wagons in good condition, the spills are unlikely when wagons are stationary. During the journey some coal dust is likely to become airborne.	**Minor**. Release of coal to land. Depending on location of spill, coal may flow into a creek or rivers. Coal dust will contain metals in inorganic form and will not release any toxic components when in contact with water. Sediment release would potentially cause direct smothering of aquatic and riparian ecosystems adjacent to discharge locations and impact downstream water quality. Severity of impacts depend on quantity released.	Medium	Consider wagon washing to reduce emissions from empty wagons on the return trip to mine. Minimise gaps between release doors of coal wagons. Avoid overloading of wagons. If required, treat coal surface in rail wagons with a chemical veneer (from approved suppliers) which forms a crust over the coal surface, minimising coal dust over the journey. Refer Volume 1 Chapter 10 Air quality	Coal Dust Management Plan to be developed to similar standard as Aurizon coal dust management plan. Measures to mitigate the emissions will be investigated and applied through Volume 2 Appendix P Environmental management plan framework, which will consider the recommendations made in the QR National Coal Dust Management Plan (QR Network, 2010). Clean up any major spills as required.	Unlikely	Insignificant	Low
Hazardous substance storage									
Spill or leak from diesel storage tanks.	Construction, Operation, Decommissioning	**Possible**. All storages will comply with AS 1940:2004 requirements, thus minimising the likelihood of rupture or leak that results in release to the environment. Spills or leaks may occur during transfer.	**Moderate**. Contamination of soil in the vicinity of storages. Extent of contamination will depend on the quantity released. Potential contamination of surface waters either by direct release or leaching through soil. Contamination of surface waters may result in damage to aquatic ecosystems.	Medium	Design, construction and operation of tanks, bunds and transfer facilities will comply with AS 1940:2004 and AS 1692:2006 requirements and be installed aboveground on impervious surfaces and fully bunded. Procedures will be developed for fuel transfer operations. Personal protective equipment and spill response equipment will be available on site Personnel trained in procedures and use of equipment.	Emergency Management Plan will include diesel spills. Contaminated spill clean-up material will be contained for regulated waste disposal. Sumps will be cleaned out as required.	Rare	Minor	Low
Spill or leak of diesel onsite from plant and equipment or mobile fuel tanker.	Construction, Operation	**Unlikely**. Minor spills may occur. Most spills will occur within the project areas where surface runoff will be drained to local collection sumps. Impacts on the environment are unlikely due to small quantities. Spills may have potential to reach creeks directly especially if spills occur from the mobile plant and equipment near creek/river crossings.	**Moderate**. Contamination of soil. Potential contamination of surface waters either by direct release or leaching through soil. Quantities involved will be typically less than 400-500 L.	Medium	Catchment areas onsite which remain free of contaminants will be separated from dirty areas to prevent offsite contaminant flows. Spill response procedures, provision of personal protective equipment and spill response equipment and adequate training to personnel.	Emergency Management Plan will include diesel spills. All contaminated soil will be collected. Contaminated spill clean-up material will be contained for regulated waste disposal. Sumps will be clean out as required.	Rare	Minor	Low

Hazard	Stage of Works	Likelihood of Occurrence	Potential Impacts (Consequence)	Overall Risk	Preventative Measures	Responsive Measures	Residual		
							L	C	Risk
Spill or leak from oil or waste oil storage.	Construction, Operation, Decommissioning	**Unlikely**. It is considered unlikely that spills will enter the environment as oils and waste oils will be handled and stored in contained areas.	**Minor**. Contamination of soil. Contamination of surface waters either by direct release or leaching through soil. Quantities are likely to be less than 200L and material is viscous, reducing likelihood of flows to waterways.	Low	Design and construction of storage tanks comply with AS 1692 requirements. Storages comply with AS 1940 requirements. Procedures developed for storing and handling oils and waste oils. Spill clean-up equipment available at workshop and other oil/waste oil storage areas. Personnel trained in use.	Collect any contaminated materials and place in secure containers for disposal through licenced contractor as a regulated waste. Clean out/surface drains and collection sumps as required.	Rare	Minor	Low
Spills or leaks of untreated sewage.	Construction, Operation, Decommissioning	**Unlikely**. Likelihood greatest for spills associated with transfers.	**Minor**. Nuisance odour generation. Potential impacts will be dependent on size of spill or leaks and the receiving environment. Likely impacts will be limited, however will include pollution of soil with nutrients and pathogenic organisms.	Low	Storage, pumping and transmission systems designed to Australian Standards. Monitoring of untreated sewage tanks and pipes for leaks. A package sewage treatment plant will be installed at each construction workers camp proposed at chainages 15 km, 63 km, 130 km, 170 km, and 262 km as well as at the maintenance facilities for the operational phase. Treated sewage wastewater will be used on-site for landscaping or irrigation where possible.	Prompt cessation of transfer operations and clean-up of affected areas.	Rare	Minor	Low
Hypochlorite spill from storage at water treatment plant.	Construction, Operation, Decommissioning	**Unlikely**. Storage and handling will comply with Australian Standards. Dosing will be automated, minimising risk of operator error. Quantity of hypochlorite to be stored and used is very low.	**Severe**. Potentially severe impacts on ecosystems if released to surface waters or land.	Medium	Aluminium sulfate and sodium hypochlorite will be transported in bulk containers and stored in a dry well-ventilated bunded area and away from non-compatible substances. Storages comply with AS 1940 requirements. Store and handle as per manufacturer's instructions and SDS. Minimise inventory on-site. Conduct routine inspections.	Address hypochlorite spills and leaks in Emergency Management Plan	Rare	Minor	Low
Spill or leaks from gas cylinders holding nitrogen, acetylene and oxygen	Construction, Operation	**Unlikely**. Storage and handling will comply with Australian Standards.	**Minor**. Gases are non-toxic and non-irritating; nitrogen and acetylene have potential to cause injury through asphyxiation when in confined spaces.	Low	Compressed gas cylinders will be stored in a specific storage area as per manufacturers SDS. Storage and handling will comply with Australia Standards. Cylinders will be kept upright in a secure area on a floor to prevent falling. Emergency response procedures will be developed and incorporated into Emergency Management Plan.	None required - quantities of gas small and will dissipate quickly.	Rare	Minor	Low
Operation of Plant									
Mobile plant/ crane collisions with pedestrians/ vehicles/ other infrastructure	Construction	**Possible**. Potential for collision with pedestrians, vehicles or infrastructure.	**Severe**. Potential damage to infrastructure or vehicle. Potential for damage to overhead power lines resulting in interruptions to power supplies or electrocution. Potential for injury and/ or fatality.	High	Define movement tracks for people and mobile plants. Installation of proper signage. Restrictions on speed for mobile plant.	Emergency Management Plan will be developed in consultation with local hospitals. Notify Queensland Police Services, Queensland Ambulance and local Council. Transport injured person to nearby hospital.	Rare	Severe	Medium

Hazard	Stage of Works	Likelihood of Occurrence	Potential Impacts (Consequence)	Overall Risk	Preventative Measures	Responsive Measures	Residual		
							L	C	Risk
Stationary plant –flash-butt welding incident.	Construction, Operation	**Possible**. Tracks will be welded for 300 km long dual gauge line. Short rails of 25 m length will be welded to 300 m length in a dedicated flash-butt welding facility.	**Severe**. Potential for explosion from welding operations. Potential for injury and/ or fatality due to electrocution resulting in temporary stoppage of work depending on the severity of the incident.	High	Approved welders to carry out works. Equipment shall meet with the requirements of Australian Standards. Routine inspection of the equipment. Keep equipment clean and free from grit, oil, grease and solvents.	Emergency Management Plan will be developed in consultation with local hospitals, Notify Queensland Police, Queensland Ambulance and local Council. Workers will be trained to use welding equipment.	Unlikely	Severe	Medium
Vehicle interactions with pedestrians or other infrastructure at laydown yard.	Construction, Operation	**Possible**. Historically such incidents have happened elsewhere. Inadequate signage, defined vehicle and pedestrian movement tracks.	**Severe**. Potential for injury or death.	High	Traffic within yard on defined access tracks. Adequate lighting within the maintenance yard during night time. Provide appropriate and adequate traffic signs along the roads. Comply with requirements under AS 1742 Manual of uniform traffic control devices. Traffic Management Plan will be developed during the detailed design phase for vehicular traffic. Consider no go zones for workers. First aid kits in all NGBR Project related vehicles.	Incorporate vehicle accident response in Emergency Management Plan. Notify emergency services and regulators of any accidents immediately. Provide training to workers and visitors. Provide PPE to workers such as high visibility vests.	Unlikely	Severe	Medium
Fire									
Fire at temporary construction camps.	Construction	**Possible**. May result from an electrical fault or from the kitchen at the accommodation camp.	**Severe**. Potential for injury or fatalities. Damage to assets and infrastructure.	High	Provide fire extinguishers. Design accommodation and infrastructure to Australian Standards and Building Codes. Provide adequate egress arrangements.	Develop Emergency Management Plan. Adequate signage to provide warnings, exit points and emergency assembly areas. Information on first aid providers and fire wardens displayed on community notice boards.	Unlikely	Severe	Medium
Dust									
Excessive fugitive dust during construction activities.	Construction	**Possible**. Construction activities involve clearing of vegetation and bulk earthworks using heavy equipment.	**Minor**. Release of dust from construction activities with potential for deposition on vegetation and surface water bodies. Deposition in waters may impact aquatic and riparian ecosystems as well as water quality. Severity of impacts depend on quantity released. Dust obscuring windows, entering homes or accumulation water tanks Deposition may impact air quality, resulting in health impacts to sensitive receptors and impacts to visual amenity for residences and persons travelling on roads affected by excessive dust.	Medium	Dust suppression measures which include water sprays on roads and at construction sites, incorporating a staged approach to earthworks and clearing and rehabilitating areas as soon as practicable. Consider building temporary gravel roads.	Perform management measures detailed in Dust Management Plan.	Unlikely	Insignificant	Low

Hazard	Stage of Works	Likelihood of Occurrence	Potential Impacts (Consequence)	Overall Risk	Preventative Measures	Responsive Measures	Residual		
							L	C	Risk
Wildlife Hazard									
Wildlife hazards such as snake bite.	Construction, Operation	**Possible**. Field visits identified presence of snakes.	**Severe**. Potential for injury or death.	High	Fauna spotter/catchers present on site during clearing, when snake-related incidences are expected to be highest. Provide adequate warning signs in areas with potential for presence of snakes. Provide adequate illumination if working at night in these areas. Wear adequate PPE while working in these areas. All personnel to carry snake-bandages and be trained in snake-bite response.	Provide immediate first aid to the victim. Transport to hospital for further medical attention. Conduct site specific inductions for all personnel to be aware of wildlife hazards. Use alert systems and notification posters to keep personnel aware of changes to hazards. Ensure the availability of first aid officers on site to treat potential injuries.	Unlikely	Severe	Medium
Pest management (weeds)									
Unsuitable land management	Construction, Operation, Decommissioning	**Possible**. During construction and over the operating life of the NGBR Project.	**Moderate**. Uncontrolled outbreaks of new weeds or an increase in existing weeds which destroy local land use and native vegetation. Post closure of rail infrastructure the area becomes a waste dumping ground for local community and others.	Medium	Adhere to pest management procedures outlined in Volume 2 Appendix P Environmental management plan framework. Washing of vehicles plant and equipment entering and leaving the site during operation and decommissioning. Retain access restriction until decommissioning complete.	Develop weed management program during construction and operations to ensure weeds are controlled. Ongoing rehabilitation management to include weed control.	Unlikely	Minor	Low

18.6 Health and safety

The health and safety values of the community in terms of environmental factors that have the potential to impact human health, public safety and quality of life are outlined in Table 18-6.

Table 18-6 Health and safety values

Environmental factor	Health and safety value
Air	Air quality that is conducive to human health and well-being[1] Air quality that supports agricultural activities[1] Absence of odour
Noise	The qualities of the acoustic environment are those conducive to human health and wellbeing. This includes provision of a suitable acoustic environment for individuals to sleep, study, learn or be involved in recreation, including relaxation and conversation[2] The qualities of the acoustic environment are those conducive to protecting the amenity of the community[2]
Lighting and amenity	Natural lighting conditions Existing scenic amenity conditions
Traffic and roads	Roads supporting traffic volumes appropriate to their design standard Roads free from congestion and safe from speeding drivers and dangerous loads
Water	Stock watering and irrigation[3] For waters that may be used for drinking water—the suitability of the water for supply as drinking water[3] Cultural and spiritual values of the water[3]
Disease Vectors	Construction activities not leading to increases in local populations or spread of biting insects or pests that are known disease vectors

1 Defined in *Environmental Protection (Air) Policy 2008*

2 Defined in *Environmental Protection (Noise) Policy 2008*

3 Defined in *Environmental Protection (Water) Policy 2009*

18.6.1 Potential impacts and mitigation of health and safety values

Impact to air related health and safety values

The construction and operation of the NGBR Project will result in emissions with potential impacts to air, and associated health and safety values (refer Table 18-6). Volume 1 Chapter 10 Air quality includes a dispersion modelling and impact assessment of the following emissions:

- Particulate matter of less than 10 micron (PM_{10})
- Particulate matter of less than 2.5 micron ($PM_{2.5}$)
- Total suspended particulates (TSP)
- Deposited dust
- Nitrogen dioxide (NO_2)

- Sulphur dioxide (SO_2).

The air quality assessment concludes that all of the above emissions would be within the criteria set by the *Environmental Protection (Air) Policy 2008* within a few hundred metres of the NGBR Project 100 m final rail corridor. As the nearest sensitive receptor is 1.1 km from the final rail corridor, it is not expected that health and safety values associated with air quality at sensitive receptors would be impacted.

Impact to odour related health and safety values

Potential sources of odours include:

- Waste water treatment plants
- Waste water irrigation
- Putrescible waste storage (containing organic matter, liable to decay).

The predominant mitigation measure to prevent odour will be ensuring that untreated waste water and putrescible wastes are not stored for long periods of time. Waste water treatment will be sufficient to prevent accumulation of waste water. Similarly, putrescible waste collection will occur as necessary to prevent accumulation of waste on site. Waste receptacles will be cleaned regularly to prevent generation of odour. As the nearest sensitive receptor is 1.1 km from the final rail corridor, odour is not expected to impact sensitive receptors.

Impact to noise related health and safety values

The construction and operation of the NGBR Project will result in emissions with potential impacts to the noise environment, and associated health and safety values (refer Table 18-6). Volume 1 Chapter 12 Noise and vibration includes noise modelling and impact assessment of the following noise sources:

- Construction noise
- Construction vibration
- Blasting overpressure
- Blasting vibration
- Operation noise
- Operation vibration.

Monitoring for the NGBR Project indicated that noise and vibration levels in the vicinity of sensitive receptors were typical of a rural environment, with low background noise levels during day and night periods. Noise modelling indicates that construction noise, blasting overpressure and operation noise would potentially impact sensitive receptors. However, mitigation measures proposed to ensure noise levels are within guideline values. Importantly for sleep disturbance, construction activities will be largely confined to standard daytime working hours (refer Volume 1 Chapter 2 Project description).

Mitigation measures are further detailed in Volume 1 Chapter 12 Noise and vibration. The proposed mitigation measures are included in a Noise and Vibration Management Plan that is incorporated into Volume 2 Appendix P Environmental management plan framework.

Impact to lighting and amenity related health and safety values

The construction and operation of the NGBR Project will result in alterations to lighting and scenic amenity experienced at sensitive receptors. These potential impacts are described in detail in Volume 1 Chapter 4 Scenic amenity and lighting.

The potential for the NGBR Project lighting to impact on health and safety values at sensitive receptors is considered negligible, given that the nearest receptor is 1.1 km from the final rail corridor. Three homesteads are expected to experience moderate visual impact as a result of the NGBR Project. Mitigation measures are proposed in Volume 1 Chapter 4 Scenic amenity and lighting and incorporated into Volume 2 Appendix P Environmental management plan framework.

Impact to traffic and road related health and safety values

Health and safety risks relating to traffic and road use may result from an increased number of vehicles, thereby increasing the likelihood of traffic accidents. Driver fatigue for workers travelling to and from worksites may also pose a potential safety risk to local road users.

Mitigation measures are further detailed in Volume 1 Chapter 14 Transport. The proposed mitigation measures include the development of a Traffic Management Plan (TMP), which is incorporated into Volume 2 Appendix P Environmental management plan framework. The TMP will include measures to preserve health and safety of road users, including:

- Installation of appropriate traffic control, warning signs and notices for safety risks
- Consideration of safety in the final treatment of road crossings
- Establishment of priority controlled crossings to reduce potential safety risks associated with large construction vehicles, particularly at intersections with State-controlled roads.

Vehicle accident response measures are also incorporated into the Emergency Management Plan in Volume 2 Appendix P Environmental management plan framework.

Impact to water related health and safety values

The construction and operation of the NGBR Project will potentially impact water, and associated health and safety values (refer Table 18-6). Construction and operational activities will potentially impact water quality by turbidity or contamination. Potable use of these water supplies would require increased treatment.

Mitigation measures are further detailed in Volume 1 Chapter 9 Water resources and incorporated into Volume 2 Appendix P Environmental management plan framework.

It is considered that the proposed mitigation would appropriately mitigate the impacts of the NGBR Project on the health and safety related environmental values identified in the *Environmental Protection (Water) Policy 2009*.

Disease vector

Mosquitoes have the potential to carry diseases such as malaria, dengue fever, Ross River virus. Therefore, an increase in the number of mosquitoes in a locality as a result of the NGBR Project would result in an increased potential health risk to members of the community.

Potential suitable breeding sites for mosquitoes are areas containing stagnant water along the rail corridor or within construction camps, construction compounds and adjacent to drainage lines and watercourses.

Potential breeding sites will be managed through a Mosquito Management Plan, which includes the following mitigation measures.

- Drainage of sediment basins and other potential breeding areas after rainfall
- Inspection of sediment traps or other potential breeding areas for larvae
- Screening of rainwater tanks at rolling stock maintenance facility

The Mosquito Management Plan is further detailed in Volume 2 Appendix P Environmental management plan framework.

18.7 Conclusion

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.

Following the implementation of proposed mitigation measures, two hazards remain ranked with a high residual risk given the measure of consequence, namely the risk of a traffic incident and risk of a vehicle being washed away by flood waters. Eleven hazard events were ranked with a residual risk rating of medium, with the remaining 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.