14. Conclusions and Recommendations

14.1 Conclusions

Adani is proposing to develop a 60 million tonne (product) per annum (Mtpa) thermal coal mine in the north Galilee Basin approximately 160 kilometres (km) north-west of the town of Clermont, Central Queensland. All coal will be railed via a privately owned rail line connecting to the existing QR National rail infrastructure at Moranbah, and shipped through coal terminal facilities at the Port of Abbot Point and the Port of Hay Point (Dudgeon Point expansion). The Carmichael Coal Mine and Rail Project (the Project) will have an operating life of approximately 90 years.

- The Project (Mine): a greenfield coal mine over EPC1690 and the eastern portion of EPC1080, which includes both open cut and underground mining, on mine infrastructure and associated mine processing facilities (the Mine) and the Mine (offsite) infrastructure including:
  - A workers accommodation village and associated facilities
  - A permanent airport site
  - Water supply infrastructure
- The Project (Rail): a greenfield rail line connecting the Mine to the existing Goonyella and Newlands rail systems to provide for the export of coal via the Port of Hay Point (Dudgeon Point expansion) and the Port of Abbot Point, respectively; including:
  - Rail (west): a 120 km dual gauge portion from the Mine site running west to east to Diamond Creek
  - Rail (east): a 69 km narrow gauge portion running east from Diamond Creek connecting to the Goonyella rail system south of Moranbah

Environmental values relevant to the Project (Rail) that have been investigated and assessed as part of the Project (Rail) Environmental Impact Statement (EIS) include:

- Climate, natural hazards and climate change
- Land Management
- Nature conservation
- Water resources
- Air quality
- Greenhouse gas emissions
- Noise and vibration
- Waste
- Transport
- Hazard and risk

Values relevant to the Indigenous and non-indigenous cultural heritage, social, economic and cumulative elements and specific matters of national environmental significance are described in Volume 1 for the Project as a whole. The following subsections summarises the findings of the impact assessment for the Project (Rail).

An initial Draft Environmental Management Plan (EMP) is presented in Volume 3 Section 13 for the Project (Rail).

14.1.1 Climate, Natural Hazards and Climate Change

Climatic parameters such as an increase in temperate extremes, extreme precipitation/flooding, evaporation, wind speed and humidity all have the potential to impact on the Project (Rail) structures and operations.

The principal effect of natural hazards on the operating railway is likely to be associated with rainfall, flood events and changes to the flows of waterways and overland flow paths, and particularly the rise in flood levels (afflux).

Hydraulic modelling has been undertaken to determine the effect of rail bridge crossings on waterways with regards to afflux levels. In the absence of defined acceptance criterion for afflux , a number of scenarios have been proposed in order to determine acceptable levels for infrastructure and properties.

Bushfires have a low to medium risk of occurring on and/or adjacent to the rail corridor. The rail corridor will provide an adequate fire break in terms of clearing and maintenance. There will be ongoing consultation with adjacent landholders with regards to land management practices in order to maintain and manage adjoining firebreaks.

14.1.2 Land

Landscape and visual impacts of the Project (Rail) range from moderate significance through minor significance to not significant for the ten viewing locations assessed. Potential sensitive receptors are at a distance of between 1.6 and 4 km from the Project (Rail) and most views are well screened by vegetation or topography in the direction of the view to the Project (Rail).

Lighting impacts during operations are negligible as the rail line will not be lit. Some lighting will be required at the maintenance facility. Construction lighting is restricted to the construction camps and selected activities.

Due to the nature of the Project (Rail) there will be a permanent impact on the visual landscape and amenity for some viewing locations within the Project (Rail) area.

The main potential impacts in relation to topography, geology and soils associated with the Project (Rail) include impacts to a small loss of agricultural land and an increased risk of erosion and sedimentation during construction and operation. Soils in some locations have limitations such as sodicity which may also pose risks for successful rehabilitation. A soil survey methodology will be developed for the Project (Rail) to better define and refine the presence of , strategic cropping land (management area), the location of major soil types, the presence of poorer quality soils, and topsoil stripping depths. An Erosion and Sediment Control Plan in accordance with the Best Practice Erosion and Sediment Control (IECA, 2008) guidelines will also be developed.

A desktop land contamination study identified the potential impacts of contaminated land in the study area. The study did not identify any lots registered on the Department of Environment and Heritage Protection (DEHP) Contaminated Land Register (CLR). One lot is registered on the Environmental Management Register. Maintenance and fuel storage areas may need to be registered on the Environmental Management Register due to the nature of activities conducted at these sites. Storage

and handling controls for hazardous substances during construction and operation will limit risk of soil contamination occurring as a result of the Project (Rail).

The extent of the land through which the Project (Rail) traverses is classified as production from relatively natural environments and is used predominantly for cattle grazing and fattening. The existing infrastructure that services the rural holdings in the vicinity of the Project Area is insufficient for the development of the project and will require upgrading to service the project.

Construction and operation of the Project (Rail) has the potential to result in direct permanent changes to the land use and tenure. The key impact of the Project (Rail) on the existing land use and tenure will be the cumulative shift of the existing rural/agricultural land within the Project Area to a mining and associated infrastructure related land use. This change in land use is also likely to trigger the following:

- Some loss of agricultural land
- Change in tenure of the land within the Project Area
- Some alteration to stock routes and property access
- Sterilisation of areas of strategic cropping land (management area) and Good Quality Agricultural Land (GQAL)
- Changes and impacts on existing road network crossings
- Potential impacts on the construction and/or operation of proposed other developments such as water pipelines and rail lines
- Potential impacts on the quantity and/or quality of water storages used for farming and agricultural purposes

Adani has undertaken consultation with landholders and other stakeholders (Isaac Regional Council, Department of Natural Resources and Mines, Department of Transport and Main Roads, amongst others) to determine the most appropriate alignment based on the following parameters:

- The extent of intrusion of the rail corridor into the property, including the location of the corridor adjacent to property boundaries
- Preservation of existing internal property access tracks and intra property access where possible
- Amalgamation of private tracks with local roads
- Grade separation of private tracks where possible
- Maximising the distance of the rail alignment from homesteads where possible

The Project (Rail) alignment has been subject to multiple iterations based on feedback from landholders to optimise alignments and minimise impacts on properties. Wherever possible the alignment runs parallel to property boundaries in order to minimise severance of holdings and minimise impacts on property operations. Additional mitigation of impacts on individual property holdings will be managed directly with landholders as part of negotiation of compensation agreements.

Adani will continue to work with landowners and State and local governments to minimise the potential impacts of the Project (Rail) on the land use and tenure of the existing environment.

14.1.3 Nature Conservation

The Project (Rail) passes through a predominantly cleared and fragmented landscape. Of the approximately 37,000 hectares (ha) Study Area, 28,242 ha is non-remnant vegetation (76 per cent) and 8,367 ha is remnant vegetation. Within the highly fragmented remnant vegetation, a range of vegetation communities and habitat types are present.

One Threatened Ecological Community (TEC) is mapped as being present within the rail corridor and infrastructure and construction camp footprints based on the presence of its constituent Regional Ecosystems (REs). Approximately 37.4 ha of Brigalow TEC occurs within the construction footprint.

No threatened flora species listed under the EPBC Act or the NC Act were recorded within the Study Area from field surveys. One EPBC Act listed threatened flora species and one NC Act listed flora species are considered likely to occur within the Study Area.

Eight terrestrial fauna habitat types are defined across the Study Area, these contain broadly similar habitat values in terms of structure, but provide varying value for wildlife based on their specific forage and shelter resources. Open cleared land was the most common and widespread fauna habitat type within the Study Area, typically providing a low diversity of suitable resources for fauna compared to the higher ecological value of remnant vegetation, which typically occurred in association with watercourses and creek lines.

One threatened bird listed under the EPBC Act was recorded during field surveys, *Geophaps scripta scripta* (squatter pigeon (southern)). The squatter pigeon is likely to be locally common within the Study Area, and the broader region, where suitable habitat is present. A further three EPBC Act listed threatened fauna species (one reptile, two mammals and one bird) are considered likely to occur at the Study Area and potential habitat for these species within the Study Area, including within the construction footprint was identified and mapped. In relation to EPBC Act listed fauna species, the Project (Rail) is not considered to support an important population or habitat critical to the survival, therefore, it is not considered to constitute a 'significant impact' to any of these species.

Two common EPBC Act listed migratory bird species were recorded at the Study Area. In addition, two EPBC Act listed migratory bird species not recorded during field studies are considered likely to occur. However, habitats at the Study Area, including those within the construction footprint are not considered likely to support important assemblages of migratory species.

Aquatic habitats throughout the Study Area are categorised into five broad waterbody types that vary in size and morphology. No conservation significant aquatic species were recorded within these habitats, nor are any considered likely to occur.

Potential impacts to the identified terrestrial and aquatic ecological values throughout the construction and operation phases of the Project (Rail) are summarised into four broad categories:

- Clearing of vegetation
- Disturbances of watercourses and changes to surface water flows
- Increased anthropogenic activity leading to disturbance
- Introduction of weeds and feral pest species

Clearing for the construction footprint will result in the loss of approximately 367 ha of remnant vegetation. Of this, 37.4 ha of EPBC Act listed Brigalow TEC is endangered remnant vegetation, while 200.4 ha of of-concern REs and 128.5 ha of least concern REs are proposed to be cleared.

Avoidance of ecologically sensitive areas has been considered in the rail alignment and also in placement of ancillary facilities such as construction camps.

To address these impacts, mitigation measures are outlined, including the management plans, the design of fauna-friendly culverts and fish passageways to facilitate fauna and fish passage across the proposed railway line, on-going monitoring and provision of offsets to address loss of fauna habitat and vegetation where residual impacts cannot be adequately avoided or mitigated.

Offsets under a combination of Commonwealth and State legislation will be required. An offset strategy will be provided to identify offset requirements and availability and propose various offset options that meet the relevant legislative requirements.

In consideration of the extensive areas of existing disturbance within the proposed rail corridor, and the relatively localised nature of impacts associated with civil works, the management of these impacts through an integrated suite of actions, and with the provision of offsets, the overall impacts of the Project (Rail) are such that biodiversity values of the area are unlikely to be compromised.

14.1.4 Water Resources

From east to west, the Project (Rail) traverses the western most extremity of the Fitzroy River catchment and then across the broad, flat Suttor and Belyando River sub-catchments of the Burdekin River to the Project (Mine).

The hydrological regime is characterised by a prolonged dry autumn, winter and spring with little or no flow and summers where large tropical rain systems and cyclones flood local creeks and rivers for weeks at a time across wide floodplains. Highly dispersive cracking clay soils in a gilgai landscape absorb large amounts of rain before discharging highly turbid, sediment-charged runoff to the rivers and creeks. Ecologically, the waterways are described as slight to moderately disturbed due to the loss of much riparian vegetation as a result of the land use.

Twelve major waterways and 76 minor waterways and overland flow paths are traversed by the Project (Rail). The major waterway crossings will comprise either a bridge or culvert or a combination of both depending on the predicted depth of the water. Crossings of the smaller waterways will also consist of either a bridge or culvert or a combination of both but will predominantly be culvert only.

Identified environmental values for the affected waterways include:

- Aquatic ecosystems
- Stock watering and farm use
- Floodplains and flooding

The main construction phase surface water effects on these values relate to the potential disturbance of watercourses for the crossings, which manifest as:

- Change and / or interruption to flows that might occur while in-stream works are being undertaken
- Degradation of water quality through mobilisation of sediment, or accidental releases of fuels and other environmentally hazardous substances
- Barriers to movement of aquatic fauna

The main surface water environmental effects of railway during the operating (permanent) phase on the environmental values derive from long term changes to surface water flows and include:

- Increased depth and extent of flooding
- Possibly longer inundation periods
- Possibly altered drainage patterns
- Scouring and geomorphological changes due to in-stream structures

Mitigation measures in relation to surface water resource impacts will include:

- Management of hydrocarbons and other environmentally hazardous materials including storage and handling requirements and disposal of contaminated wastes
- Erosion and sediment control throughout construction
- Stormwater controls at construction camps, laydown areas and maintenance areas
- Design of water crossings to minimise impacts on afflux and concentration of flows that might lead to scouring

Groundwater resources are likely to be most vulnerable to impact in the vicinity of major creeks/rivers and other areas characterised by relatively shallow depths to groundwater. Small volumes of temporary construction dewatering may be required during watercourse crossings and spills and leaks of hydrocarbons could result in contamination of alluvial aquifers where these are present. Such areas are likely to be limited to crossing points of the Belyando River and the Mistake, Logan and Diamond creeks. In general no significant impacts on groundwater resources and/or quality are anticipated given:

- No long-term lowering of groundwater levels due to construction dewatering activities is anticipated
- The majority of the Project (Rail) area does not contain well developed or extensive alluvial aquifers. Groundwater in the area is therefore not considered threatened or vulnerable as a resource.
- Outside of the main river corridors groundwater and surface water connectivity is thought to be limited

Similarly, no significant long term impacts on groundwater resources and groundwater quality are anticipated during operation of the rail line given that:

- Only a small number of shallow cuttings are included in the preliminary rail design and hence no significant permanent lowering of groundwater levels due to drainage of cutting areas is anticipated
- River crossing points will be designed such that compaction of alluvial sediments and upstream ponding of surface water flow is minimised

14.1.5 Air Quality

The most important air pollutant associated with the Project (Rail) is particulate matter, which primarily consists of fugitive releases during the transportation of coal but will also arise from diesel locomotive exhaust. Concentrations of total suspended particulates (i.e. PM_{10} and $PM_{2.5}$) and dust deposition at sensitive receptors identified in areas surrounding the rail line have been assessed against the air quality objectives set out for the Project (Rail).

The Project (Rail) was split into three sections for modelling to assess impacts as a function of distance away from the alignment. The AUSROADS model was used as this is the most suitable for linear infrastructure. In relation to particulate matter concentrations, there are nominal exceedances of the air quality objectives at the fence line of the Project (Rail) however predicted levels quickly dropped to within the objectives within short distances from the fence-line and no sensitive human receptor locations were affected.

For the assessment of the amenity impact of dust deposition, AUSPLUME dispersion modelling was used with area sources at 4 m above ground level. The maximum incremental dust deposition level is below the deposition guideline equivalent of 2 g/m^2/month at and beyond 50 m from the track centre line.

Dust emissions from the proposed Project (Rail) are not expected to affect crop or pasture health or health of cattle and native animals in proximity to the railway.

Non-dust pollutants arising from locomotive exhaust were also examined and the most influential constituent was found to be nitrogen dioxide (NO_2). However, the highest level of NO_2 at any Project (Rail) fence-line was just 58 per cent of its assessment criterion with all other products of combustion constituents being lower fractions of their respective assessment criteria.

While the air quality impact assessment of the Project (Rail) found that air quality objectives would be met within close proximity of the rail line and that a negligible change in ambient air quality is expected at the identified sensitive receptor locations, measures to minimise particulate emissions from coal trains will be implemented.

14.1.6 Greenhouse Gas Emissions

The Project (Rail) construction and operation will result in the generation of greenhouse gas (GHG) emissions.

The GHG emissions generated during the construction of the Project (Rail) will result from emissions generated due to vegetation removal and from wastewater treatment, transport and energy usage in vehicles, plant and equipment.

The GHG emissions generated during the operation of the Project (Rail) include fugitive emissions (coal dust) and direct emission sources such as diesel usage. These GHG emissions will contribute to Queensland and Australia's overall GHG emissions over an extended period of time.

The total Scope 1 emissions over the life of the Project (Rail) are estimated as follows:

- The total construction emissions were estimated as 311 kt CO_2-e (thousands of tonnes of carbon dioxide equivalent)
- The total operation emissions were estimated as 57,335 kt CO_2-e
- Over the 90 year life of the Project (Rail), average annual emissions were estimated as 637 kt CO_2-e per annum

Adani will continue to examine opportunities to minimise the greenhouse gas emissions associated with the Project (Rail) and will manage and report emissions in accordance with legislative requirements and good practice programs in place in Australia.

14.1.7 Noise and Vibration

With regard to potential noise and vibration impacts associated with the Project (Rail), construction activities such as impact piling are predicted to generate the highest sound pressure levels at distance. However, given the separation distance between construction work and the nearest sensitive receptors, and the temporary nature of works, it is unlikely that any adverse noise impacts will occur during construction. Mitigation measures to minimise construction noise will be utilised in the vicinity of sensitive receptors.

Vibration levels produced by rail corridor construction activities are predicted to be well below the most stringent structural damage criteria of 3 mm/s at all identified receptors.

The assessment indicates that operational rail noise levels from the proposed corridor are expected to meet the 65dB(A) $L_{Aeq,24hrs}$ and 87dB(A) L_{max} noise targets adopted from Queensland Rail's Code of Practice for Railway Noise Management at all identified sensitive receptors. Similarly, operational vibration targets will readily be met at all identified receptors.

Given the distance to the nearest sensitive receptors, noise and vibration impacts from blasting are unlikely to occur under the majority of scenarios. Under worst-case conditions it has been predicted that a marginal exceedance of the airblast overpressure criteria may occur at the nearest sensitive receptor when blasting is conducted at the closest point of the Project (Rail) to the receptor. Blasting mitigation measures have been recommended to assist in reducing the magnitude of the noise and vibration levels as well as the perception of vibration at sensitive locations. It is recommended that blast monitoring be considered to assess compliance and confirm the predictions. All residential receptors will be informed when blasting is to be undertaken.

14.1.8 Waste

Waste will be generated during the construction, operation and decommissioning phases of the Project (Rail). The largest volume of waste will be vegetation waste from construction vegetation clearing and also excess cut material from earthworks. Hazardous wastes potentially generated during both construction and operation will largely consist of waste oils and oily wastes from maintenance activities. Suitable waste management and disposal services are available in the region and none of the wastes anticipated to be generated from construction or operation are likely to cause any particular problems in terms of waste management.

Decommissioning wastes will include the track and ballast as well as locomotives and wagons. None of these wastes are likely to present particular hazards in terms of treatment and disposal requirements, and recycling opportunities are likely to exist. Decommissioning is not proposed for about 90 years and appropriate reuse, recycling and disposal options will need to be identified at this time.

The waste management hierarchy for the Project (Rail) follows a framework for prioritising waste management practices to achieve the best environmental outcomes possible. This waste management hierarchy follows a strategy of:

- Avoid unnecessary resource consumption
- Reduce waste generation and disposal
- Re-use waste resources without further manufacturing
- Recycle waste resources to make the same or different products
- Recover waste resources, including the recovery of energy
- Treat waste before disposal, including reducing the hazardous nature of waste
- Dispose of waste only if there is no viable alternative

The characterisation of waste streams for the Project (Rail) is based on its concept design during the construction and operational phases, and is generally defined as either construction or demolition waste, or commercial and industrial waste under the *Waste Reduction and Recycling Act 2011*. Similar waste material will be generated during both phases, however, in different quantities. Based on the management measures proposed for the Project (Rail), it is unlikely that the waste generated during the construction and operational phases of the Project (Rail) will have a significant environmental impact.

14.1.9 Transport

During the construction phase the worst case construction period was identified to generate approximately 50,910 vehicle trips per month (or 1,697 daily trips). This includes all on-road and off-road trips.

During construction, the analysis of the estimated traffic generated by the Project (Rail) will exceed the threshold of a five per cent increase in average daily traffic along the majority of the proposed haulage roads. However, the analysis is based on the worst case scenario and would only occur over a period of approximately 18 months. In addition, the increase in traffic associated with the construction of the Project (Rail) would not impact on the service performance of these roads.

When planning logistics for construction related traffic, special consideration will be given to traffic levels on the eastern end of Peak Downs Highway during peak periods. Construction of level crossings and

grade separated crossings will be planned and managed to minimise delays and will ensure that adequate warning is available to motorists.

Construction traffic management issues will be addressed through the preparation and implementation of a Construction Traffic Management Plan, which will be developed during the detailed design phase. Traffic management will address key safety and logistical issues that may arise from the construction of the Project (Rail) as well as including a program for provision of information on construction traffic and works on roads to the community.

It is proposed to provide grade separation for crossings of the Gregory Developmental Road. This will avoid any traffic related impacts on these roads during operation. At-grade crossings are proposed for minor roads and, while these roads carry very light traffic, traffic may be delayed by train movements, with up to 36 movements per day.

Rail crossings and signals will conform to legislative requirements

14.1.10 Hazard and Risk

The hazard and risk assessment identified a total of 40 hazards which resulted in nine high risks, 23 medium risks and eight low risks in the absence of management and mitigation. After mitigation measures have been implemented, the residual risks arising comprise two high risks (traffic accident or train collision with pedestrian or vehicle), seven medium and 31 low risks. Preventative and responsive measures have been identified to mitigate these risks.

Based on the studies conducted, it can be concluded that there are no hazards during normal operations which have offsite impacts from the proposed rail line, maintenance yard and other associated infrastructure. The proposed controls identified and outlined in this assessment adequately safeguard against risks associated with the Project (Rail).

There are potential risks to health and safety of the workforce from the Project (Rail). The implementation of workplace health and safety procedures and the mitigation measures identified will minimise the potential risks to acceptable levels.

14.2 Recommendations

The Draft Environmental Management Plan documents the range of management and mitigation measures to be implemented during the construction and operation of the Project (Rail). Based on the findings of the EIS and assuming implementation of the Draft EMP and Draft Offsets Strategy (see Volume 1 Section 10) it is considered that the Project can be undertaken without unacceptable social, environmental or cultural impacts. The Project (Rail), together with the Project (Mine) also presents a range of opportunities and positive impacts to regional and State economies.

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