APPENDIX C

Environmental risk assessment

Contents

Tables

Appendix C Environmental risk assessment

C1 Purpose

The purpose of this environmental risk assessment is to:

- identify and describe the potential environmental risks and issues to be considered in the environmental impact statement (EIS) prior to any impact assessment or mitigation being applied
- rank environmental risks based on the risk assessment with an aim of refining the scope of the various impact studies contained in the EIS.

C1.1 Methodology

The environmental risk analysis was undertaken in accordance with the principles of the Australian and New Zealand standard *AS/NZS ISO 31000:2018 Risk Management –Guidelines*. This involved categorising each of the environmental values by identifying the consequence of the impact and the likelihood of the impact occurring.

For the risk assessment, a pre-mitigation scenario was assessed and a risk ranking determined. The potential impacts and risks were identified by firstly considering the key issues contained in the Secretary's Environmental Assessment Requirements (the SEARs) (see Appendix A) and then, based on desktop assessments, preliminary site investigations, previous experience, and modelling and monitoring results, a list of potential impacts was compiled for determination of risk. The risk analysis involved assessing the risk level of each identified potential impact by identifying both the consequences of the impact and the likelihood that the impact could occur.

The risk assessment is discussed further in the following sections.

C1.1.1 Risk assessment

For those environmental values where an impact may occur, a qualitative risk assessment method based on *AS/NZS 31000:2018 Risk Management—Principles and Guidelines* is considered appropriate.

As derived from the ARTC *Environmental Assessment Procedure 2-9000-PEN-00-PR-1001 Rev1*, the definitions of the likelihood used are provided in Table C1-1 and the consequence criteria are provided in Table C1-2. The resulting risk matrix is provided in Table C1-3.

TABLE C1-1 DEFINITION OF LIKELIHOOD

Likelihood	Definition	Frequency of occurrence	Percentile
Almost certain	Is expected to occur in most circumstances	Once per month	>90%
Likely	Will probably occur in most circumstances	Between once a month and once a year	60–90%
Possible	Might occur at some time	Between once a year and once in five years	30–<60%
Unlikely	Could occur at some time	Between once in 5 years and once in 20 years	10–30%
Rare	May occur in exceptional circumstances	Once in more than 20 years	<10%

TABLE C1-2 CONSEQUENCE CRITERIA

	Consequence				
Risk Category	**Not significant**	**Minor**	**Moderate**	**Major**	**Extreme**
Safety—Impact to People	No medical treatment required	Lost Time Injury (LTI) results OR medical treatment required	Serious injury occurs	Single fatality occurs	Multiple but localised fatalities occur
Assets—Engineering impact(s) and satisfying objectives	Up to 6 hours (hrs) track closure	>6 hrs to 24 hrs track closure	>24 hrs to 48 hrs track closure	>48 hrs to 5 days track closure	>5 days track closure
Financial—Total Outturn Cost impact	Up to 0.05% of program budget (i.e. to $5 m in $10 b)	>0.05% to 0.5% of program budget (i.e.>$5 m to $50 m in $10 b)	>0.5% to 1.5% of program budget (i.e.>$50 m to $150 m in $10 b)	>1.5% to 5% of program budget (i.e.>$150 m to $500 m in $10 b)	>5% of program budget (i.e.>$500 m in $10 m)
	Up to 0.1% of project budget (e.g. to $100 k in $100 m)	>0.1% to 0.5% of project budget (e.g. >$100 k–$500 k in $100 m)	>0.5% to 2.5% of project budget (e.g. >$500 k–$2.5 m in $100 m)	>2.5% to 10% of project budget (e.g. >$2.5 m–$10 m in $100 m)	>10% of project budget (e.g. >$10 m in $100 m)
Environment—Environment impact heritage, flora and fauna, archaeology and Indigenous, pollution and amenity (Public)	Contained environmental damage—fully recoverable (no cost or ARTC action required)	Isolated environmental damage—minimal ARTC remediation required	Localised/clustered environmental damage—requiring remediation	Considerable environmental damage—requiring remediation	Widespread long-term or permanent environmental damage—remediation required
Regulatory—Regulatory/ legislation exposure non-compliance and our licence to operate	Minimal or no regulatory involvement	Notice to produce information	Improvement notice or threatened action	Prohibition notice or fine(s)	Prosecution of the company and/or its office holders
Reputation—Reputational exposure customer dissatisfaction, shareholder support, service quality and reliability, public image and stakeholder attitudes	Isolated event able to be resolved (up to 7 days)	Management intervention required (>7 days to 3 months)	Tactical (business unit/ divisional) intervention required (>3 months to 18 months)	Strategic intervention required (>18 months to 3 years)	Corporate loss of shareholder and/or customer support (tangible business impact >3 years)
Schedule—Time-based impacts	Influences schedule up to 1% of program approved schedule period	Influences schedule >1% to 2.5% of program approved schedule period	Influences schedule >2.5% to 5% of program approved schedule period	Influences schedule>5% to 10% of program approved schedule period	Influences schedule >10% of program approved schedule period
	Influences schedule up to 2% of project approved schedule period	Influences schedule >2% to 5% of project approved schedule period	Influences schedule >5% to 10% of project approved schedule period	Influences schedule >10% to 20% of project approved schedule period	Influences schedule >20% of project approved schedule period

TABLE C1-3 RISK ASSESSMENT MATRIX

Likelihood	Consequence				
	Not significant	Minor	Moderate	Major	Extreme
Almost certain	Medium	Medium	High	Very high	Very high
Likely	Low	Medium	High	Very high	Very high
Possible	Low	Low	Medium	High	High
Unlikely	Low	Low	Low	Medium	Medium
Rare	Low	Low	Low	Low	Medium

Based on the key issues risk score, consideration of the level of priority ascribed to the key issues was made with very high risks being considered the highest priority requiring a higher level of assessment.

In conjunction with the SEARs, the scoping requirements for the environmental assessment were applied in the following manner:

- Very high impacts—Assessment and planning is necessary to avoid these impacts to the greatest extent possible.
- High impacts—Detailed specialist investigation and assessment is necessary to enable identification of appropriate management and mitigation options.
- Medium impacts—Further investigation as part of the environmental assessment is desirable, to address some uncertainties. Impacts could be mitigated through the application of relatively standard environmental mitigation measures.
- Low impacts—May not require specialist investigations, particularly where identifiable management/mitigation guidelines exist; then, potentially, only broad or desktop investigation is necessary. Impacts could be mitigated through other workings or may not be required at all.

C1.2 Environmental risk assessment

Using the framework described above, the environmental risk assessment for the proposal is presented in Table C1-4.

The environmental risk assessment is based on a pre-mitigation measure scenario, in that they do not consider the effect of appropriately implemented mitigation measures. The risks identified in the risk analysis would therefore likely be reduced through the application of appropriate mitigation measures described in Chapter 27 and throughout the EIS.

A number of positive impacts are also likely to result from the proposal and typically include the following:

- mimosa weed management in PCT52 to retain line of sight at level crossings
- potential transportation of locally produced agricultural goods as a result of the proposal
- reduction in heavy vehicle movements on rural roads
- avoidance of congested rail network
- enhanced road safety, speed and reliability
- improved safety at all level crossing
- positive influx of construction worker spending in Moree (on local accommodation, goods and services)
- positive opportunities for local employment and skill development
- reduction in overall GHG emissions per tonne transported due to reduction in truck haulage.

Potential positive impacts have been excluded from the risk assessment.

TABLE C1-4 ENVIRONMENTAL RISK ASSESSMENT

		Pre-mitigated risk		
Risk ID	**Potential impact**	**Consequence**	**Likelihood**	**Risk**
Land use and property				
Construction				
LUP-1	Temporary occupation or leasing of properties for construction limiting land use during construction	Minor	Almost certain	Medium
LUP-2	Impacts on other infrastructure during construction including utilities, and access to facilities and properties	Moderate	Likely	High
LUP-3	Biosecurity risks, particularly during earthworks and construction vehicle movements	Major	Possible	High
LUP-4	Disruption to farming operations and agricultural vehicle movements on local road network and within internal private access roads during construction	Moderate	Likely	High
Operation				
LUP-5	Permanent property acquisition and changes to land use	Minor	Likely	Medium
LUP-6	Impacts to agricultural land classes impacting capability and productivity	Moderate	Possible	Medium
LUP-7	Impact on travelling stock reserves (TSR)	Moderate	Almost certain	High
LUP-8	Division or fragmentation of property and changes to property management leading to loss of viability	Major	Rare	Low
Biodiversity				
Construction				
BIO-1	Potential increase of threatening processes (weed and pest distribution) due to increased vehicle and plant movements	Major	Possible	High
BIO-2	Disruption to fauna connectivity during bridge and culvert construction	Minor	Likely	Medium
BIO-3	Impacts on endangered populations and threatened species during construction	Moderate	Possible	Medium
BIO-4	Removal of breeding places/habitat features (hollow-bearing trees)	Moderate	Possible	Medium
BIO-5	Impacts to aquatic species and species-specific aquatic habitat within and around watercourses	Moderate	Possible	Medium
BIO-6	Impacts to riparian vegetation	Moderate	Almost certain	High
BIO-7	Potential impacts on groundwater dependant ecosystems	Minor	Unlikely	Low
BIO-8	Increase in native fauna impacts due to construction vehicle strikes	Minor	Unlikely	Low
Operation				
BIO-9	Interaction between wildlife and trains resulting in injury or death (train strikes)	Minor	Possible	Low
BIO-10	Loss of fauna connectivity due to linear nature of project	Minor	Unlikely	Low
BIO-11	Increase of threatening processes (weed and pest distribution) due to increased train movements	Major	Possible	High
BIO-12	Increase in bushfire risk due to operational maintenance	Major	Possible	High
BIO-13	Water quality impacts affecting aquatic biodiversity	Minor	Unlikely	Low

		Pre-mitigated risk		
Risk ID	**Potential impact**	**Consequence**	**Likelihood**	**Risk**
Traffic and transport				
Construction				
TT-1	Impacts of construction vehicle movements associated with earthworks and materials with potential impacts to road safety, road dilapidation and traffic delays (Oak and Morton Street in particular—possible loop)	Moderate	Likely	High
TT-2	Impacts from detours and traffic control	Moderate	Almost certain	High
TT-3	Temporary severance of public road network	Moderate	Almost certain	High
TT-4	Temporary impacts to private property access	Minor	Almost certain	Medium
TT-5	Worker parking results in congestion or social impacts	Minor	Possible	Low
TT-6	Impacts to emergency services due to access delays	Major	Rare	Low
Operation				
TT-7	Traffic impacts at signalled level crossings causing delays	Minor	Likely	Medium
TT-8	Impacts to private property access (short stacking)	Major	Possible	High
TT-9	Increase in travel distance due to realignment of public roads	Moderate	Rare	Low
Flooding and hydrology				
Construction and operation				
FH-1	Potential increased hazard of flooding of residential areas and houses	Extreme	Almost certain	Very high
FH-2	Increased flooding velocity and duration across agricultural land	Moderate	Almost certain	High
FH-3	Increased duration of flooding of critical infrastructure	Major	Almost certain	Very high
FH-4	Increased hazard of flooding of transport network	Extreme	Almost certain	Very high
FH-5	Formation failure during flood event	Extreme	Unlikely	Medium
FH-6	Flooding impacts during construction before flood design structures could be built	Major	Possible	High
FH-7	Potential for increased scour, erosion and geomorphological changes	Major	Possible	High
Water quality and groundwater				
Construction				
WQ-1	No water-take agreements can be reached for the purposes of construction	Moderate	Unlikely	Medium
WQ-2	Potential for construction activities to cause pollution of surface or groundwater sources	Moderate	Possible	Medium
WQ-3	Plumes (silt) and pollution (hydraulics and concrete) caused by demolition works of Mehi and Gwydir bridges	Moderate	Likely	High
WQ-4	Impacts to groundwater flows (including extent of drawdown) during excavation	Moderate	Unlikely	Low
WQ-5	Impacts to groundwater dependent surface flows, ecosystems and species during construction	Moderate	Possible	Medium
WQ-6	Impacts to surface water quality during construction due to an exceedance of the rainfall event that the water quality protection measures would be designed to cope with, resulting in water quality objectives (WQOs) not being met	Moderate	Possible	Medium

		Pre-mitigated risk		
Risk ID	**Potential impact**	**Consequence**	**Likelihood**	**Risk**
WQ-7	Impacts to sensitive receiving environments as a result of construction	Moderate	Possible	Medium
WQ-8	Impacts, including erosion and sediment transport downstream, as a result of works in waterways	Moderate	Likely	High
WQ-9	Loss of topsoil due to construction works causing an increase in sediment loads during rainfall events	Moderate	Likely	High
Operation				
WQ-10	Potential for pollution of surface or groundwater during operation (freight materials, contaminants from train operation)	Moderate	Unlikely	Low
WQ-11	Settlement of alluvial soils due to formation loading resulting in reduction of underlying permeability	Major	Rare	Low
WQ-12	Water quality impacts associated with the introduction of drainage infrastructure such as culverts	Moderate	Possible	Medium
Non-Aboriginal/European heritage				
Construction and operation				
HER-1	Direct impacts on known listed heritage items, being the Mehi and Gwydir bridges	Major	Almost certain	High
HER-2	Direct impacts on known unlisted heritage items (Moree Hotel and identified underbridges)	Moderate	Possible	Medium
HER-3	Impact on unidentified European heritage items during construction	Moderate	Unlikely	Low
HER-4	Impact to private memorial sites	Minor	Possible	Low
HER-5	Visual impacts on heritage items close to the proposal site	Moderate	Likely	High
HER-6	Impacts on nearby heritage items from vibration during construction and operation	Moderate	Possible	Medium
Aboriginal heritage				
Construction and operation				
HER-5	Potential impacts on four known listed Aboriginal heritage sites (PADS)	Major	Almost certain	Very high
HER-6	Impacts to identified surface artefacts	Moderate	Likely	High
HER-6	Impact to areas of cultural significance such as Steel Bridge Camp	Moderate	Likely	High
HER-7	Impact on unidentified Aboriginal heritage items during construction	Major	Possible	High
Noise and vibration				
Construction				
NV-1	Construction noise associated with works around Moree where there is concentration of sensitive receivers	Moderate	Almost certain	High
NV-2	Impacts on rural properties associated with construction equipment, albeit impacts at any given location will be transient due to linear nature of the project	Moderate	Almost certain	High
NV-3	Impacts from additional construction traffic noise	Moderate	Almost certain	High
NV-4	Potential impacts of vibration on structures, including heritage structures, around Moree	Moderate	Possible	Medium
NV-5	Noise and vibration impacts of out-of-hours work (including ancillary and utility infrastructure works), particularly around Moree where there is a concentration of sensitive receivers	Moderate	Possible	Medium

		Pre-mitigated risk		
Risk ID	**Potential impact**	**Consequence**	**Likelihood**	**Risk**
Operation				
NV-6	Noise impacts on sensitive receivers from rail movements between Moree and Camurra	Moderate	Likely	High
NV-7	Impacts to residential receivers at new active level crossing (bells and horns) and night-time movements due to 24-hour operation	Moderate	Likely	High
NV-8	Human comfort vibration (amenity) impacts on sensitive receivers due to the movement of trains along the rail line	Moderate	Possible	Medium
NV-9	Potential damage to structures, including heritage structures close to the proposal site, due to vibration from rail movements	Moderate	Possible	Medium
Social and economic				
Construction				
SE-1	Impacts on amenity for residents, tourists, businesses and other sensitive receivers, as a result of dust, noise and visual impacts during construction	Moderate	Likely	High
SE-2	Direct impacts on community facilities, including recreational facilities (e.g. parks, bikeways) and community infrastructure	Moderate	Likely	High
SE-3	Impacts associated with demand for worker accommodation leading to increased prices and a shortfall for other local needs	Moderate	Likely	High
SE-4	Indirect impacts on the use and enjoyment of community facilities and infrastructure, due to access and amenity impacts	Moderate	Possible	Medium
SE-5	Impacts on the community, including anti-social behaviour and amenity loss, due to temporary workforce occupation	Minor	Unlikely	Low
SE-6	Impacts on services and utilities during construction resulting in a loss of services	Moderate	Possible	Medium
Construction and operation				
SE-7	Displacement of movement networks affecting accessibility to services (active and passive)	Moderate	Likely	High
SE-8	Loss in productivity and severance of agricultural land and functionality of TSR	Major	Likely	Very high
SE-9	Impacts on community values and lifestyle due to loss of amenity associated with increased train operations	Moderate	Possible	Medium
SE-10	Health, safety and wellbeing impacts as a result of increased train operations	Moderate	Possible	Medium
SE-11	Ongoing long-term reduction in property and community facility access due to the new rail line	Moderate	Possible	Medium
Visual amenity				
Construction				
V-1	Temporary visual impacts to residents and other sensitive receivers within the vicinity of construction work, and from areas with views of the proposal site, due to vegetation clearing, earthworks (including spoil mounds), and the presence of infrastructure and machinery	Moderate	Almost certain	High
V-2	Temporary impact to the landscape features and visual amenity to road users along the Newell Highway during construction as a result of vegetation clearing, earthworks and presence of heavy machinery	Moderate	Almost certain	High
V-3	Temporary visual impact of construction laydown areas and work sites during construction	Moderate	Almost certain	High

		Pre-mitigated risk		
Risk ID	**Potential impact**	**Consequence**	**Likelihood**	**Risk**
Operation				
V-4	Impact to landscape features and visual amenity to regional road users along the Newell Highway	Moderate	Almost certain	High
V-5	Impact to local road users along Gwydirfield Road and Back Pally Road and the replacement of Mehi Bridge	Moderate	Almost certain	High
V-6	Visual amenity impacts on residential receivers in close proximity to the rail corridor during operation as a result of the new rail formation and additional train movements (including the addition of double-stacked trains into the landscape)	Moderate	Almost certain	High
V-7	Light pollution from signalled level crossings during operations	Minor	Likely	Medium
Soils and contamination				
Construction				
SC-1	Exposure and potential erosion of saline soils and/or acid sulfate soils (ASS)	Moderate	Possible	Medium
SC-2	Disturbance and erosion of soils during earthwork activities including temporary stockpiles causing sedimentation in down-gradient waterways	Moderate	Possible	Medium
SC-3	Disturbance and mobilisation of existing contamination due to construction activities, causing the further contamination of soils/groundwater	Major	Unlikely	Medium
SC-4	Changes to the soil surface, as a result of earthwork activities, vegetation clearing or creating embankments, resulting in erosion and sedimentation down-gradient	Moderate	Possible	Medium
SC-5	Contamination of land and waterways due to leaks and spills during construction	Major	Possible	High
SC-6	Uncovering hazardous materials during construction activities (including asbestos)	Moderate	Unlikely	Low
SC-7	Inappropriate management and disposal of contaminated waste material	Moderate	Unlikely	Low
Operation				
SC-8	Potential spill of contaminant from maintenance products and material	Moderate	Possible	Medium
SC-9	Contamination of land and waterways due to leaks and spills from train activities	Moderate	Unlikely	Low
SC-11	Uncovering hazardous materials during maintenance activities (including asbestos)	Moderate	Unlikely	Low
Waste				
Construction				
W-1	Increased resource consumption, including, among other factors, fuel, construction materials and energy	Moderate	Almost certain	High
W-2	Environmental impacts associated with the management of non-recyclable waste, resulting in excessive waste being directed to landfill	Minor	Likely	Medium
W-3	Impacts associated with removal of timber from existing rail infrastructure that cannot be repurposed	Minor	Likely	Medium
W-4	Residual spoil resulting from unsuitable materials	Moderate	Likely	High
W-5	Inappropriate management of waste generated during construction, resulting in potential environmental, health and amenity impacts including contamination, water quality impacts, odour and dust	Moderate	Unlikely	Low

		Pre-mitigated risk		
Risk ID	**Potential impact**	**Consequence**	**Likelihood**	**Risk**
Operation				
W-6	Inappropriate management of waste generated during operation, resulting in environmental, health and amenity impacts, including contamination, water quality impacts, odour and dust	Moderate	Unlikely	Low
Climate change				
Operation				
CC-1	Increased flooding resulting in inundation of track and trackside infrastructure (signalling/communications equipment and drainage basins)	Extreme	Possible	High
CC-2	Increased incidence of extreme events (heat, rainfall and bushfire) impacting power supply and demand (both internal and external to the rail corridor) and network (communications) interruption	Extreme	Possible	High
CC-3	Increased heat events leading to track buckling and subsequent disruption of service	Extreme	Possible	High
Air quality and greenhouse gas				
Construction				
AQ-1	Impacts to local air quality during construction due to the following: ▸ lime treatment ▸ dust generation from bulk earthworks, exposed soil/stockpiles, vehicle movements on unsealed roads ▸ operation of construction plant and equipment ▸ construction workforce vehicle movements ▸ increased vehicle movements associated with transport of construction materials	Moderate	Likely	High
AQ-3	Emissions of greenhouse gases from construction energy use and embodied energy in construction materials	Moderate	Likely	High
Operation				
AQ-4	Impacts to local air quality during operation due to the following: ▸ increased train movements between Moree and Camurra North ▸ increased corridor and track maintenance generating both dust and vehicle emissions	Minor	Possible	Low
AQ-4	Emissions of greenhouse gases from operational energy use of trains and maintenance vehicles	Major	Almost certain	Very high
Health and safety and hazardous materials				
Construction				
HS-1	Rupture of, or interference with, underground utilities and services during construction	Extreme	Possible	High
HS-2	Exposure to hazardous materials due to inappropriate transport and storage of hazardous substances and dangerous goods during construction	Extreme	Possible	High
HS-3	Reduced safety for road users and pedestrians during construction, due to additional construction vehicles, changed traffic conditions, and presence of construction machinery	Major	Possible	High
HS-4	Safety risks to residents due to the presence of construction machinery	Major	Unlikely	Medium

		Pre-mitigated risk		
Risk ID	**Potential impact**	**Consequence**	**Likelihood**	**Risk**
HS-5	Increased bushfire risk as a result of construction works, due to the presence of heat-generating machinery and flammable substances	Major	Possible	High
HS-6	Safety risks to workers due to, among other factors, construction machinery, hazardous chemicals and potentially fatigue	Major	Possible	High
Operation				
HS-7	Safety risks to residents associated with the presence of a new operational rail line (and associated infrastructure such as level crossings) and increased train movements	Major	Possible	High
Cumulative impacts				
Construction				
C-1	Cumulative impacts associated with the construction of multiple projects adjoining sections of Inland Rail	Major	Possible	High
C-2	Cumulative impacts from the construction of other major projects in a regional context	Moderate	Possible	Medium