

CHAPTER

26

INLAND
RAIL 

Cumulative Impacts

NORTH STAR TO NSW/QUEENSLAND BORDER ENVIRONMENTAL IMPACT STATEMENT

 ARTC

The Australian Government is delivering
Inland Rail through the Australian
Rail Track Corporation (ARTC), in
partnership with the private sector.

Contents

26.	CUMULATIVE IMPACTS	26-1
26.1	Overview	26-1
26.2	Assessment methodology	26-1
26.2.1	Approach	26-1
26.2.2	Assessment matrix	26-2
26.3	Projects included in the cumulative impact assessment	26-3
26.4	Cumulative impacts and risks	26-8
26.4.1	Biodiversity	26-8
26.4.2	Heritage	26-8
26.4.3	Surface water and hydrology	26-10
26.4.4	Groundwater	26-11
26.4.5	Land resources	26-11
26.4.6	Noise and vibration	26-12
26.4.7	Air quality	26-12
26.4.8	Climate change risk and adaptation	26-13
26.4.9	Traffic and transport	26-13
26.4.10	Landscape and visual impact	26-13
26.4.11	Land use and property	26-14
26.4.12	Social impact	26-15
26.4.13	Economics	26-16
26.4.14	Loss of containment of dangerous goods	26-16
26.4.15	Waste and resource management	26-17
26.5	Summary of residual cumulative impacts and mitigations	26-17

Figures

Figure 26.1	Cumulative impact projects	26-7
-------------	----------------------------	------

Tables

Table 26.1	Assessment matrix	26-2
Table 26.2	Impact significance	26-2
Table 26.3	Example cumulative impact assessment	26-3
Table 26.4	Projects included in the cumulative impact assessment	26-4
Table 26.5	Aboriginal heritage sites recorded within 20 km x 20 km around the study area	26-9

26. Cumulative impacts

26.1 Overview

This chapter forms part of the Inland Rail's North Star to NSW/Queensland Border project's (the proposal's) environmental impact statement (EIS).

When numerous projects occur in a region, they can cause cumulative impacts. Cumulative impacts:

- ▶ May differ from those of an individual project when considered in isolation
- ▶ May be positive or negative
- ▶ Have a severity and duration that depend on the spatial and temporal overlap of projects occurring in a region.

Chapters 11 to 25 of the proposal have considered existing projects within the pre-defined study areas of the assessment undertaken in each chapter. They have already been accounted for in the impact assessment of the proposal. Therefore, this cumulative impact assessment deals only with:

- ▶ Projects that have been approved but where construction has not commenced
- ▶ Projects that have commenced construction
- ▶ Projects that have only recently been completed
- ▶ Projects that are currently being assessed as state significant infrastructure (SSI) within Gwydir, Moree Plains and Inverell local government areas, or as coordinated projects in Goondiwindi local government area.

For the purpose of this assessment the cumulative impact study area is defined as the spatial area of influence, which is determined by each of the environmental and social issues being assessed for the proposal. The area of influence types considered in the assessment were:

- ▶ Derived by impact assessments—the area of influence is determined for each environmental value by the corresponding impact assessment, as undertaken to address the relevant component of the Secretary's Environmental Assessment Requirements (SEARs)
- ▶ Administrative—the area of influence is determined by recognised administrative boundaries
- ▶ Designated area—the area of influence is determined by the recognised physical operation extent of the proposal.

This cumulative impact assessment has been prepared in accordance with the SEARs, which require:

'An assessment of the cumulative impacts of the Project, taking into account other projects that have been approved but where construction has not commenced, projects that have commenced construction, and projects that have recently been completed.'

The assessment draws on the findings of Chapters 11 to 25 as well as impact assessments of projects within the area of influence of the issues assessed.

26.2 Assessment methodology

26.2.1 Approach

The methodology used to assess the proposal's cumulative impacts consisted of the following tasks:

- ▶ Review the residual impacts of the proposal, as described in detail in Chapters 11 to 25 of this EIS
- ▶ Identify projects to be included in the cumulative impact assessment (refer Section 26.3)
- ▶ For projects included in the cumulative impact assessment:
 - ▶ Identify appropriate temporal boundaries
 - ▶ Identify and map appropriate spatial boundaries for each key issue being considered
- ▶ For each key issue being considered, assess the relevance and significance of potential cumulative impacts within the identified temporal and spatial boundaries
- ▶ Identify suitable mitigation measures for significant cumulative impacts.

Where possible, potential cumulative impacts were expressed quantitatively. The extent of compliance with the established standards and guidelines referenced in Chapters 11 to 25 was used to assess the relevance and significance of potential cumulative impacts.

Where cumulative impacts could only be expressed qualitatively, professional judgement regarding the probability, duration and magnitude/intensity of the impact, as well as the sensitivity and value of the receiving environment, was used to assess the relevance and significance of potential cumulative impacts.

26.2.2 Assessment matrix

As shown in Table 26.1, for each potential cumulative impact, a relevance factor of low (1), medium (2) or high (3) was assigned to the following four aspects:

- ▶ Probability of impact
- ▶ Duration of impact
- ▶ Magnitude/intensity of impact
- ▶ Sensitivity of receiving environment.

TABLE 26.1 ASSESSMENT MATRIX

Aspect	Relevance factor		
	Low	Medium	High
Probability of impact	1	2	3
Duration of impact	1	2	3
Magnitude/Intensity of impact	1	2	3
Sensitivity of receiving environment	1	2	3

An impact significance rating of low, medium or high was assigned to each potential cumulative impact, based on the sum of the four relevance factors assigned to the impact.

The consequences associated with each significance rating are outlined in Table 26.2.

TABLE 26.2 IMPACT SIGNIFICANCE

Sum of relevant factors	Impact significance	Consequences
1–6	Low	<ul style="list-style-type: none"> ▶ Negative impacts need to be managed by standard environmental management practices. Special approval conditions are unlikely to be necessary ▶ Monitoring to be part of general project monitoring program.
7–9	Medium	<ul style="list-style-type: none"> ▶ Mitigation measures likely to be necessary and specific management practices to be applied ▶ Specific approval conditions likely ▶ Targeted monitoring program required, where appropriate.
10–12	High	<ul style="list-style-type: none"> ▶ Alternative actions should be considered and/or mitigation measures applied to demonstrate improvement ▶ Specific approval conditions required ▶ Targeted monitoring program necessary, where appropriate.

An example of the cumulative impact assessment process is shown in Table 26.3. The key issue has a low probability of impact (1), medium duration of impact (2), low magnitude/intensity of impact (2), and high receiving environment sensitivity (3). The sum of the four relevance factors is eight. Therefore, according to Table 26.2, the impact significance is 'medium'. A summary of the outcomes of the cumulative impact assessment for each environmental aspect is provided in Section 26.4.

TABLE 26.3 EXAMPLE CUMULATIVE IMPACT ASSESSMENT

Aspect	Relevance factor
Probability of impact	1
Duration of impact	2
Magnitude/intensity of impact	2
Sensitivity of receiving environment	3
Sum	8
Impact significance	Medium

26.3 Projects included in the cumulative impact assessment

Projects included in the cumulative impact assessment are:

- ▶ **Projects outside the overall Inland Rail program of works.** Only SSI projects under section 15U of the *EP&A Act*, and other 'strategic' projects in the public domain as being planned, constructed or operated at the time the SEARs were issued, have been included in the cumulative impact assessment. Where additional projects worthy of inclusion were identified, the Secretary of the NSW Department of Planning, Industry and Environment was consulted for a determination on whether to include the project. Coordinated projects under the *State Development and Public Works Organisation Act, 1971* (Qld) that could be located within the Goondiwindi Shire Council were also considered, however results of searches have shown that there are currently no coordinated projects within the area considered
- ▶ **Inland Rail projects immediately adjacent to the proposal.** These projects include the Narrabri to North Star and the Border to Gowrie projects of Inland Rail.

Projects excluded from the cumulative impact assessment are:

- ▶ Existing projects within the proposal study area. These projects are considered part of the 'existing environment' in Chapters 11 to 25 of this EIS. They have already been accounted for in the impact assessment of the proposal.
- ▶ Proposed projects that have not been developed to the point that their environmental assessment process has been made public.

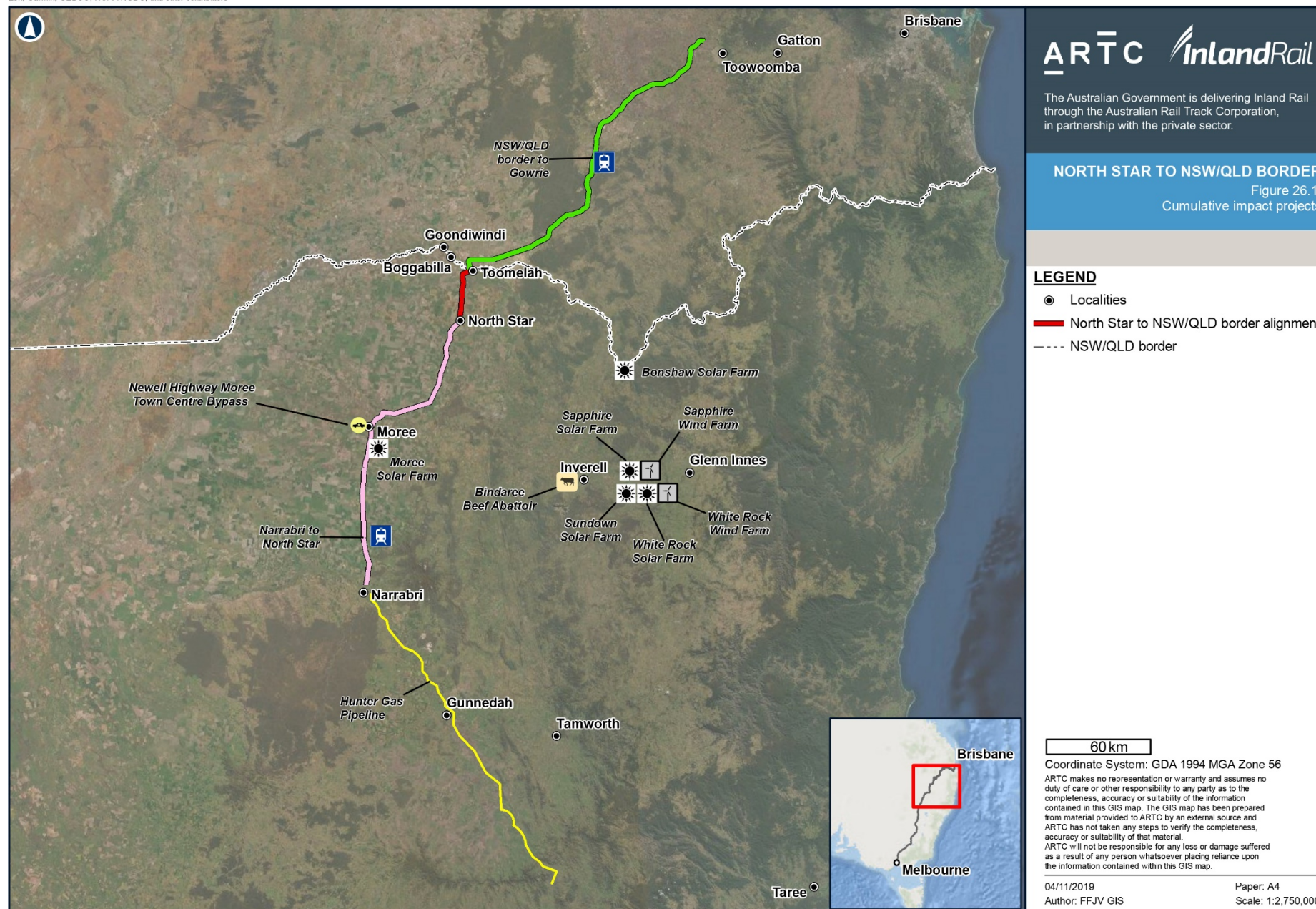
Based on the above criteria, the projects that have been included in the cumulative impact assessment are summarised in Table 26.4. The location of each project is shown in Figure 26.1

TABLE 26.4 PROJECTS INCLUDED IN THE CUMULATIVE IMPACT ASSESSMENT

Project and proponent	Location	Description	EIS status	Construction dates	Construction jobs	Operation years	Operation jobs	Selection criteria	Relationship to the proposal
Border to Gowrie—Inland Rail (ARTC)	NSW/QLD border to Gowrie Junction in Queensland	Approximately 146 km of new dual-gauge track and 78 km of upgraded track from the NSW/QLD border, near Yelarbon, to Gowrie Junction, north-west of Toowoomba	Project referred to Australian Government Minister for the Environment and Energy	2021 to 2025	1,600	–	TBA	a)	Potential overlap on construction commencement for Border to Gowrie and finalisation of North Star to Border Inland Rail projects
Narrabri to North Star—Inland Rail (ARTC)	Narrabri (NSW) to the village of North Star in NSW	An upgrade to approximately 188 km of track within the existing rail corridor and construction of approximately 1.6 km of new rail corridor	Proponent reviewing submissions	Mid 2018 to 2020	TBA	–	TBA	a)	Potential overlap of finalisation of construction of inland Rail Narrabri to North Star project and commencement of North Star to Border construction
Moree Solar Farm	10 km south of Moree, off the Newell Highway in Northern NSW	Construction of a 56 MWac/70.1 MWdc single axis tracking solar PV facility. Construction works currently involve installation of a framing system, which consists of BladePiles and NexTracker tracking systems, JA Solar photovoltaic modules, DC and AC wiring of electrical equipment, 22/66 kV onsite substation and a 66 kV transmission line	Approved by the NSW Minister for Planning on 17 July 2011	2018 to 2022	1,050	–	10–12	b)	Potential increase of traffic on the Newell Highway. Construction of Moree Solar Farm is scheduled around the peak visitation to Moree in autumn
Newell Highway Moree Town Centre Bypass	Moree	Construction of a 4.4 km two-lane bypass of the Moree town centre	Approved by the NSW Minister for Planning on 20 July 2004. Latest modification approved 7 July 2010	–	–	–	–	b)	Potential increase of traffic on the Newell Highway

Project and proponent	Location	Description	EIS status	Construction dates	Construction jobs	Operation years	Operation jobs	Selection criteria	Relationship to the proposal
Bindaree Beef Abattoir — rendering plant and bio-digester plant	Bindaree Beef Abattoir, Inverell	The proposed project involves the installation of a wastewater treatment system (bio-digester) and new render plant facility to reduce odour and carbon emissions at its existing abattoir site. The bio-digester generates a bio-gas from waste and wastewater which would then be re-used at the site.	Approved by the NSW Minister for Planning on 10 December 2014	12 months construction. Start date unknown	60	–	–	b)	Potential conflict or demand for construction resources if projects overlap. Increase of traffic volumes on the Gwydir and Newell Highway.
Queensland –Hunter Gas Pipeline	Wallumbilla to Newcastle	420 km high pressure gas transmission pipeline from the Wallumbilla Gas Hub in South Central Queensland to the existing Sydney–Newcastle pipeline at Hexham in New South Wales.	Project determined under Part 3A —now transitioned to SSI	From approval, approximately 8 months of construction	600	–	150	b)	If construction occurs at the same time, there is potential for increase in traffic using similar routes and demand for construction resources and personnel.
White Rock Solar Farm	20 km south-west of Glen Innes, 40 km east of Inverell NSW	Establishment of a 20 MW solar farm and associated infrastructure.	Approved by the NSW Minister for Planning 14 June 2016	Construction forecast to take 6 months	50	25	TBA	b)	Potential increase in road traffic on the Gwydir Highway and the Newell Highway.
White Rock Wind Farm	20 kilometres south-west of Glen Innes, 40 km east of Inverell NSW	Stage 2 of White Rock Wind Farm upgrades will consist of up to 48 turbines, producing up to 202 MW of clean renewable electricity.	Approved by the NSW Minister for Planning on 10 July 2012	Late 2018	100	30	20	b)	Potential increase in road traffic on the Gwydir Highway and the Newell Highway.
Sundown Solar Farm	South of Gwydir Hwy, 30 km east of Inverell (NSW)	The project consists of a large-scale solar photovoltaic generation facility, including battery storage and associated infrastructure, with an estimated maximum capacity of up to 600 MW, enough to power over 250,000 homes.	SEARs issued by NSW Department of Planning, Industry and Environment	2019 to 2023	–	–	–	b)	Potential increase in road traffic on the Gwydir Highway and the Newell Highway.

Project and proponent	Location	Description	EIS status	Construction dates	Construction jobs	Operation years	Operation jobs	Selection criteria	Relationship to the proposal
Bonshaw Solar Farm	Bruxner Highway, 16 km south of Bonshaw and 66 km north of Inverell (NSW)	GAIA Australia is proposing to develop a large-scale solar photovoltaic generation facility and associated infrastructure with a capacity of 500 MW	SEARs issued by NSW Department of Planning, Industry and Environment	Mid 2019 to 2021	–	25	–	b)	Potential increase of traffic on the Bruxner Highway. North Star to Border alignment crossed the Bruxner Highway. Deconfliction at construction times may be required.
Sapphire Solar Farm	Project in the Kings Plains, Wellingrove and Sapphire areas, approximately 28 km east of Inverell and 18 km west of Glen Innes	A 200 MW hybrid solar and battery power facility	Approved by the NSW Minister for Planning on 16 August 2018	2019 to 2020	200	25	150	b)	Potential increase of traffic on the Gwydir and Newell Highway.
Sapphire Wind Farm	Project in the Kings Plains, Wellingrove and Sapphire areas, approximately 28 km east of Inverell and 18 km west of Glen Innes	Construction of a 238 MW to 425 MW capacity wind farm (between 125 and 159 turbines)	Approved by the NSW Minister for Planning on 26 June 2013	TBA	–	–	–	b)	Potential increase of traffic on the Gwydir and Newell Highway.



26.4 Cumulative impacts and risks

The outcomes of the cumulative impact assessment for the proposal are summarised below.

26.4.1 Biodiversity

Chapter 11: Biodiversity describes the landscape features within the proposal area and borrow pits. The cumulative impacts of multiple projects occurring in the vicinity of the subject land will likely include the continued loss of biodiversity in the Brigalow Belt South and Darling Riverine Plains bioregions. This cumulative loss of habitat will place further pressure on local threatened flora and fauna species and ecological communities. The major potential impacts identified as a result of the proposal are common to all projects throughout the region and are therefore considered cumulative in nature.

As a result of the proposal and other similar projects, cumulative impacts of medium and high significance are predicted to occur. The following potential impacts are predicted to result in high impact significance:

- ▶ Habitat loss from vegetation clearing/removal
- ▶ Edge effects
- ▶ Habitat fragmentation
- ▶ Barrier effects
- ▶ Reduction in connectivity of biodiversity corridors.

These cumulative impacts of high significance are predicted to impact the following receptors:

- ▶ Threatened ecological communities (TECs)—*Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Biodiversity Conservation Act 2016* (NSW) (BC Act)
- ▶ Threatened flora and fauna—EPBC Act, BC Act and *Fisheries Management Act 1994* (NSW) (FM Act)
- ▶ Type 1 key fish habitat (FM Act)
- ▶ State significant landscape feature—Great Artesian Basin.

The proposal would not significantly change the overall connectivity of habitats in the region, as most of the proposal sites are in the existing non-operational Boggabilla rail corridor. Fragmentation and connectivity have been considered as part of the biodiversity assessment and the biodiversity offsets calculations. For impacts of medium and high significance identified in the cumulative assessment, mitigation measures will be required, and specific management practices will need to be applied. Specific approval conditions are likely and targeted monitoring programs required.

There is the potential for some proposal activities to have a cumulative, irreversible and/or permanent impact on some ecological receptors, even after the implementation of all mitigation measures, including rehabilitation. Specific activities include site preparation (i.e. vegetation clearing) and civil works (i.e. cutting construction), having residual impacts on receptors such as Brigalow TEC, Poplar box grassy woodland on alluvial plains TEC, *Dichanthium setosum* (Bluegrass), Painted honeyeater (*Grantiella picta*) and Koala (*Phascolarctos cinereus*). In these cases, the residual impact will require environmental offsets should the residual impact be considered significant in accordance with the relevant state and Commonwealth guidelines and policies. Further information on the assessment of cumulative impacts is provided in Appendix B: Biodiversity Technical Report.

26.4.2 Heritage

26.4.2.1 Aboriginal heritage

Chapter 12: Heritage presents a discussion on the existing environment of the proposal site in terms of Aboriginal heritage. Given the general lack of Aboriginal heritage surveys conducted for the wider region, lack of standardisation in site recording and lack of peer validation processes in NSW for the registration of Aboriginal heritage, caution is advised when undertaking cumulative assessments, as they can only ever be useful for cursory appreciations (Godwin, 2011). If impacts (direct or indirect) are to occur to 34 identified Aboriginal heritage sites, this would represent an impact to 20.8 per cent of the total number of Aboriginal heritage sites recorded in the general area.

Relevant topographic and soil mapping for the region were examined to identify areas of comparable value to those in the study area. Areas identified as sharing similar environmental context include unmodified sections of the Macintyre River, and other unnamed creek lines and waterbodies where well-drained soil exists. Based on this evidence, it can be confidently concluded that land outside of the current study area but within the wider region contains a significant, yet unidentified, Aboriginal heritage resource.

Section 2A(2) of the *National Parks and Wildlife Act, 1974* stipulates that protection of the environment and Aboriginal heritage is to be achieved by applying the principles of ecologically sustainable development. Ecologically sustainable development requires the integration of economic and environmental considerations (including cultural heritage) in decision-making processes and, in the context of Aboriginal cultural heritage, can be achieved through the implementation of two key principles: intergenerational equity and the precautionary principle.

Intergenerational equity

Intergenerational equity is the principle whereby the present generation should ensure the health, diversity and productivity of the environment for the benefit of future generations. With regard to Aboriginal heritage, intergenerational equity can be assessed in terms of cumulative impacts to Aboriginal objects and places in a region. Central to any assessment of intergenerational equity is the proposition that regions with fewer Aboriginal objects and places necessarily retain fewer opportunities for future generations of Aboriginal people to enjoy their cultural heritage. Accordingly, information regarding the known and potential Aboriginal heritage resource of a given region is critical to any assessment of intergenerational equity.

To assess intergenerational equity, a comparison of the identified Aboriginal archaeological resource of the study area with that of the surrounding region was undertaken using the results of Aboriginal Heritage Information System (AHIMS) searches. Searches were defined here as an arbitrary 20 km x 20 km (400 km²) area, roughly centred on the study area.

A total of 112 AHIMS sites were identified, with most sites recorded being either culturally modified trees (n=70) or open artefact sites—artefact scatters and isolated artefacts (n=38). These counts are combined with the site counts identified as part of this assessment (refer Table 26.5). From these counts, the total impact to the surrounding Aboriginal heritage resource from the proposal can be calculated. A potential impact to 14.5 per cent of the culturally modified tree resources is expected, while 30.1% per cent of open artefact sites can expect to be impacted. These calculations assume that all sites have the same significance or heritage value.

TABLE 26.5 ABORIGINAL HERITAGE SITES RECORDED WITHIN 20 KM X 20 KM AROUND THE STUDY AREA

Site type	AHIMS count	Proposal new site counts	Total sites	Total sites directly impacted	Percentage sites impacted
Scarred tree	68	16	83	12	14.5%
Open artefact site	37	35	73	22	30.1%
Aboriginal Ceremony and Dreaming	2	0	2	0	0%
Burial	2	0	2	0	0%
Carved tree	2	0	2	0	0%
Potential archaeological deposit	1	0	1	0	0%
Total	112	51	163	34	20.8%

Precautionary principle

The precautionary principle holds that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing cost-effective measures to prevent environmental degradation. In NSW, the precautionary principle is relevant to potential impacts to Aboriginal cultural heritage in situations where:

- ▶ The proposed development involves a risk of serious or irreversible damage to Aboriginal objects or places or to the value of those objects or places.
- ▶ There is uncertainty about the Aboriginal cultural heritage values or scientific or archaeological values, including in relation to the integrity, rarity or representativeness of the Aboriginal objects or places proposed to be impacted.

In the context of the current assessment, it can be stated that a precautionary approach is used in the impact assessment of the proposal on Aboriginal archaeological resources. This approach is reflected in the proposed management strategy. Further information on the assessment of cumulative impacts is provided in Appendix E: Aboriginal Heritage and Archaeological Assessment.

26.4.2.2 Historical heritage

The historical heritage values of the surrounding region remain largely unquantified. Of the 17 identified historical heritage sites in the study area, 12 (or 70 per cent) will be directly impacted by the proposal, with 13 of the 17 sites being recognised for their immediate local heritage significance. A significant number of these sites will be impacted by the proposal. However, none of these sites have been previously recognised for their heritage value or listed on heritage registers. The proposed mitigation methodology indicates that any impact to the historical heritage values can be managed by the proposal. Having considered any residual impacts as discussed in Chapter 12: Heritage, it was found that the impact significance of cumulative impacts is likely to be low in relation to the proposal with respect to historical heritage. Further information on the assessment of cumulative impacts is provided in Appendix F: Historical Heritage Technical Report.

26.4.3 Surface water and hydrology

26.4.3.1 Surface water

A cumulative impact assessment was undertaken where potential surface water impacts of the proposal were assessed, together with existing or planned surrounding activities. The cumulative impact assessment identified a low impact significance rating due to the physical distance of other projects from the proposal and the adoption and implementation of recommended mitigation measures.

Many of the projects considered in the assessment are not likely to contribute to cumulative impacts to surface waters because of being in distant sub-catchments, the limited extent of earthworks, or non-overlapping timing of construction. The projects with the potential for cumulative impacts include the sections of the Inland Rail immediately north (Border to Gowrie project) and south (Narrabri to North Star project) of the proposal.

The potential cumulative impact relates to saline discharge to proximal watercourses. Overlapping construction activities have the potential to further impact areas with a high-salinity risk rating between the Narrabri to North Star project and Border to Gowrie projects. There is potential for poor erosion and sediment control management to increase potential erosive sodosol discharge. Limited spatial difference between the proposals increases the potential cumulative impact. Overlapping construction activities, which involve clearing vegetation within alluvial-based watercourses, increases the potential for highly localised groundwater rise and salinity risk during high-rainfall events.

With adherence and application of ARTC's erosion and sediment mitigation measures, the impact significance of the potential cumulative impacts during construction is considered low. This can be achieved through the implementation of a Construction Environmental Management Plan (CEMP), which would address discharge to watercourses. The would CEMP also address the implementation of a surface-water quality monitoring program through all phases of the proposal to identify and implement any contingent management measures. This will help to meet the relevant NSW water quality and river flow objectives. Further information on the assessment of cumulative impacts is provided in Appendix G: Surface Water Quality Technical Report.

26.4.3.2 Hydrology

Chapter 13: Surface Water and Hydrology describes hydrology and flooding impact assessment for the proposal. This includes a detailed hydraulic assessment establishing the existing case, followed by consideration of the proposed works and refinement of the major drainage structures to minimise impacts to acceptable levels.

The Office of Environment and Heritage (OEH) models were used as a basis for the hydrology and hydraulic assessment. Consideration of the NSW Border Rivers Floodplain Management Plan requires cumulative impacts to be evaluated. The OEH Border Rivers floodplain model has been used as a basis for this assessment. The model includes approved and existing floodplain developments and therefore cumulative impacts in the floodplain have been addressed.

The hydraulic sub-model was run for the existing and developed cases to inform and assess the potential impacts of the feasibility design on the existing flood regime, and included the proposed rail alignment works. The key findings of the modelling indicate that:

- ▶ No significant changes to peak flood flow distributions are predicted as a result of the developed case.
- ▶ There is little change to the predicted impacts on sensitive receptors as a result of varying the applied culvert blockage allowance between 0 per cent and 50 per cent.
- ▶ As a result of the developed case, there are no impacts greater than 10 mm predicted on habitable dwellings on the floodplain including at the Toomelah Community.

Further information on the assessment of cumulative impacts is provided in Appendix H: Hydrology and Flooding Technical Report.

26.4.4 Groundwater

Chapter 14: Groundwater presents an analysis of the existing environment with regards to groundwater. The area of influence is based on the groundwater impact assessment completed for EIS. Based on this assessment the potential impacts are localised and not to extend beyond the 1 km radius of the proposal site (based on shallow excavations, limited saturated thickness intersected, and low-to-moderate permeability results in a limited zone of influence around cuttings).

Cenozoic-aged alluvial aquifers are mapped in association with the current major watercourses, such as Macintyre River and Whalan Creek, and antecedent systems that form paleovalley fill and broad alluvial fan systems within and surrounding the proposal. This aquifer is called the NSW Border Rivers—Downstream Keetah Bridge Alluvial Water Source. Other areas of mapped alluvium include narrower units within Mobbindry Creek and Whalan Creek. Subdivision of the alluvium into a shallow Narrabri Formation and deeper Gunnedah Formation is often applied to the alluvium in the Border Rivers region.

Construction activities associated with the adjacent Inland Rail Border to Gowrie and Narrabri to North Star projects have the potential to have cumulative impacts through changes in groundwater levels as well as cumulative impacts on groundwater quality and contamination. The significance of these potential cumulative impacts during construction is considered low. This can be achieved through the implementation of a Construction Environmental Management Plan, which addresses groundwater level drawdown triggers and measures that prevent and effectively respond to spills and leaks. Further information on the assessment of cumulative impacts is provided in Appendix N: Groundwater Technical Report.

26.4.5 Land resources

Chapter 15: Land Resources and Contamination presents an overview of the environmental values associated with geology, topography and soils of the proposal site. The proposal site is characterised by gently undulating topography. The geology of the study area indicates a strong presence of alluvium deposits, which are associated with sediments deposited through the transportation of channelled stream water. Several soil types occur in the proposal site, with vertisols being the dominant soil type along the proposal site.

The potential for loss of soil resources particularly through erosion associated with the proposal, was identified as a potential impact and is considered a risk during construction and decommissioning works. Implementing standard erosion and sedimentation control measures and any additional environmental management plans for the proposal is expected to be able to mitigate this. Excavations could lead to soil inversion. The inversion of alkaline subsoils potentially increases the risk of increased salinity or sodicity issues, groundwater contamination and soil fertility decline. Implementing a Soil Handling and Management Plan and a Salinity Management Plan are expected to mitigate soil inversion impacts. Weed invasion during the construction and decommissioning phases are expected to be mitigated through implementation of a Pest and Weed Management Plan.

Construction and decommissioning activities associated with the adjacent Border to Gowrie and Narrabri to North Star projects have the potential to have cumulative impacts in terms of erosion, soil inversion and weed invasion. It was assessed that the implementation of mitigation measures results in a low residual risk associated with these potential impacts. Consequently, the significance of these potential cumulative impacts during construction and decommissioning is considered low. The proposal would be unlikely to generate impacts at scale that would interact with other projects. Further information on the assessment of cumulative impacts is provided in Chapter 15: Land Resources and Contamination.

26.4.6 Noise and vibration

Chapter 16: Noise and Vibration presents an analysis of the existing environment with regard to noise. To assess cumulative construction noise within the proposal area, other projects planned to be in construction simultaneously with this proposal were identified. The Border to Gowrie and Narrabri to North Star projects were in close enough proximity to influence noise levels at sensitive receivers potentially affected by the proposal.

Simultaneous noise from construction works of the Border to Gowrie and Narrabri to North Star projects has the potential to increase noise levels at nearby sensitive receivers already affected by noise from the proposal. Noise levels as a result of the cumulative impacts could increase by as much as 3 dBA higher than the maximum noise level of either section construction works. Although 3 dBA is generally considered just discernible, the cumulative impact of noise would be managed as far as possible by the contractors to ensure that the potential for adverse impacts at sensitive receivers is minimised. In addition, any overlap of construction works is likely to be for a limited period. The significance of the impacts associated with this is therefore considered low. It is assumed that the operational noise impacts will be minimal, based on the spatial and temporal boundaries of cumulative impact assessment projects relevant to the proposals operational period and sensitive receivers adjacent to the proposal.

Further information on the assessment of cumulative impacts is provided in Appendix J: Construction Noise and Vibration Technical Report.

26.4.7 Air quality

Chapter 17: Air Quality presents an analysis of the existing environment with regard to air quality. The area of influence for cumulative air quality impacts has been derived from the qualitative impact assessment for the construction and the quantitative impact assessment for the operation of the proposal. This area of influence includes 128 sensitive receptor locations and one proposed construction workers' accommodation camp. It is at these receptor locations that air quality objectives per pollutant must be met. All receptors are within 2.5 km of the proposal site.

The environment in which the proposal will be constructed and operated is likely to have several existing regional and local sources of air pollution (natural and anthropogenic) that emit similar air pollutants as those being assessed. As such, background estimations of the relevant pollutants in the study area were made and used in the assessments of construction and operation. However, these background estimations could not consider other projects that, at the time of this assessment, were still being planned or constructed in the region. These projects were further investigated as part of cumulative impact assessment and are detailed in Section 26.3.

The Border to Gowrie and Narrabri to North Star projects have been explicitly included in the operational air quality assessment because they will include the same trains as the proposal. While there is potential for the construction of the Narrabri to North Star project and the Border to Gowrie projects to overlap, dust impacts are likely to be localised to construction site locations and managed by ARTC-approved mitigation measures through relevant construction environmental management plan.

All non-ARTC projects detailed are unlikely to emit pollutants in their operations (i.e. not mining, or heavy industry in nature), or significantly increase pollutant emissions; therefore, dust during construction is likely to be the only potential air quality concern. However, as the proposed locations of the projects being considered in the cumulative impact assessment are more than 50 km away, these potential impacts are expected to be low and outside of the air environment of the proposal or the area of influence.

Despite their temporary lifetime, establishment and operation of the borrow pits and associated road haulage may occur concurrently with the Projects detailed in Section 26.3. Operation of the borrow pits has the potential to impact sensitive receptors near to the pits and haul routes. However, as the identified projects are located more than 50 km away, the risk of significant cumulative air quality impacts as a result of the operation of borrow pits is negligible. The cumulative impact of the operation of the borrow pits and other proposal-related construction activity has been considered in the construction assessment.

Further information on the assessment of cumulative impacts is provided in Appendix L: Air Quality Technical Report.

26.4.8 Climate change risk and adaptation

Cumulative sustainability and climate change assessments are not relevant to the proposal. The sustainability assessment required by the SEARs is for an assessment of the sustainability of the proposal using the Infrastructure Sustainability Rating Tool and current guidelines and targets, which cannot be applied to a cumulative assessment. In relation to climate change, the risk assessment addresses the SEARs as well as consider the requirements outlined in the Infrastructure Sustainability Council of Australia Rating Scheme (ISCA) (Version 1.2) by assessing the impacts of climate change on the proposal. Further information on the assessment of cumulative impacts is in Appendix Q: Climate Change Risk Assessment Technical Report.

26.4.9 Traffic and transport

The traffic generation from other developments in the region at the planning, design or construction stage were considered in the cumulative impact assessment. There are currently several other developments in the region at planning, design or construction stage (refer Section 26.3) that will generate traffic and the estimations from these developments were considered in the cumulative impact assessment. For the traffic analysis, only developments that have already submitted EIS documentation or supplementary EIS have been considered along with other Inland Rail projects.

The adjacent Inland Rail Border to Gowrie project and GAIA Australia's Bonshaw Solar Farm were assessed as projects where an overlap of construction schedules and proposed primary construction routes might create an increase in construction traffic volumes. Cumulative impacts were assessed to be of medium significance. Mitigation measures are likely to be necessary and specific management practices to be applied. Targeted monitoring program would be required where appropriate. Specific approval conditions are likely to be set. Mitigation measures relating to safety, intersection impacts, link road impacts, pavement impacts, and road-rail interface impacts will be sufficient to mitigate the cumulative impacts as a result of the Border to Gowrie and Bonshaw Solar Farm projects. In addition, for the Border to Gowrie project there will be a coordinated effort to manage the cumulative traffic impacts because the construction activities are likely to be done through contractors managed by ARTC.

The construction of other projects considered in the assessment were not expected to overlap with the construction of the proposal or have indeterminate construction schedules at the time of the assessment. As such, the significance of cumulative impacts was considered low and impacts potentially arising from these could be managed through standard management practices.

Further information on the assessment of cumulative impacts is provided in Appendix M: Traffic Impact Assessment.

26.4.10 Landscape and visual impact

Chapter 21: Landscape and Visual Amenity assessment presents an analysis of the landscape and visual amenity values of the proposal site. The site is situated in a predominantly rural area comprising rural settlements, open wooded and pastoral and agricultural landscapes. The landscape and visual amenity of the area is defined by various landscape character types including vegetated water courses, irrigated croplands, dry croplands and pastures, rural settlement as well as areas of vegetated grazing. The proposal is characterised by a generally low profile and horizontal form for most of its length.

To assess the potential cumulative impacts of the proposal, an area of influence which extends to about 50 km from the proposal site was considered. Beyond this distance, there would be no reasonable expectation of cumulative visual impact being registered by a viewer. Therefore, a number of projects were identified and considered for the cumulative impact assessment but were discounted on the basis of distance from the project or lack of available information. For example, the Newell Highway Moree Town Centre Bypass is located more than 70 km of the southernmost section of the proposal.

Cumulative impacts to the landscape and visual amenity in relation to the proposal will be largely the product of:

- ▶ Temporal construction impacts—presence of construction traffic, workforce and machinery operating on adjoining projects at the same time
- ▶ Spatial operational impacts—the residual impact of the visibility of infrastructure of identified projects to sensitive receptors.

Regarding temporal impact, the Narrabri to North Star and Border to Gowrie projects immediately adjoin the proposal at the southern and northern ends respectively. There is potential overlap of finalisation of Narrabri to North Star construction activities and commencement of the proposal. An overlap of commencement for the Border to Gowrie project and finalisation of construction works of the proposal is also possible. The Newell Highway upgrades may also overlap, resulting in the perception of relatively high amounts of construction activity

within the area of influence. However, as the duration of these activities is low, the impacts are expected to be temporary and there are relatively few sensitive receptors. As such it is considered that the significance of this cumulative impact during construction is low.

Regarding spatial impacts, the Narrabri to North Star and Border to Gowrie projects immediately adjoin the proposal and will, in practice, be viewed as components of the Inland Rail. Additionally, much of the alignment of these projects is located along existing former rail alignments, so the contrast with the current condition will be lower than in a greenfield situation. Overall, therefore, these projects are anticipated to result in a low level of cumulative impact.

Because of the low level of lighting proposed for the proposal, there are not anticipated to be any significant cumulative lighting impacts associated with these projects.

Overall, the cumulative landscape and visual impact in the region is likely to be at most, low, because of the limited number of sensitive receptors near the alignment, the containment of views by the typically flat topography and the distance of other projects from the Inland Rail program.

Further information on the assessment of cumulative impacts is provided in Appendix P: Landscape and Visual Impact Assessment Technical Report.

26.4.11 Land use and property

Chapter 22: Land Use and Property presents a discussion on the existing environment of the proposal site regarding land tenure and land use. The proposal site occurs in area of predominantly agricultural land use including grazing land and cropping land. Other land uses within the site are transport and communication. The tenure of land is predominantly unknown and is within the existing non-operation Boggabilla rail corridor owned by the NSW Government. Other areas within the proposal site include freehold and a small number of lots used for travelling stock classified as Crown land.

It is recognised that the proposal may impact on agricultural land, as the removal of such land for the purposes of the rail corridor cannot be fully mitigated. However, as the proposal would be undertaken predominantly (81 per cent) within the existing non-operational rail corridor, land use impacts have been minimised. Furthermore, with the application of the identified mitigation measures, the residual land use and tenure impacts of the proposal are expected to be low.

The potential for the impacts of the proposal to interact with those of other development projects in the region is primarily based on their proximity and similarity of project activities. That is, the development projects require land acquisition and change in land use. There is limited potential for cumulative impacts given the relatively limited land use and property impacts associated with the proposal and the separation distance between the proposal and other projects. Furthermore, while the projects could generate a cumulative impact, given the nature of land use and tenure impacts, these are considered to be localised. An interaction of the identified potential impacts with other projects being included in the cumulative impact assessment is unlikely. Having considered any residual impacts as discussed in Chapter 22: Land Use and Property, it was found that cumulative impacts are likely to be low in relation to the proposal with respect to land use and property. Further information on the assessment of cumulative impacts is provided in Chapter 22: Land Use and Property.

26.4.12 Social impact

The social impact assessment for the proposal (refer Chapter 23: Socio-economic Impact Assessment) identified key community values and indicators of their presence within the proposal area. The potential for the proposal to impact on the identified community values were based on an understanding of how a rail infrastructure proposal could impact on regional communities. Specific values that are likely to be affected as a result of cumulative impacts of the proposal and other projects largely relate to amenity and lifestyle. These values refer to the community's enjoyment of both private and public spaces. Aspects that support the rural lifestyle within communities where the proposal is located include a clean and healthy environment, affordable housing, privacy, close community connections, access to local services and community events, and strong community networks.

Construction of the Newell Highway Upgrade (Mungle Back Creek to Boggabilla) is likely to be completed before proposal construction starts and has not been considered in the impact assessment, because the only likely long-term impact is improved traffic safety. The Narrabri to North Star project has been considered in relation to successive (rather than coinciding) impacts.

The only likely cumulative impacts at the local level would be in North Star, where it is likely that sequential construction of the Narrabri to North Star project and the proposal will result in up to four years' construction activity in the North Star area, with increased heavy traffic, large numbers of non-local workers and impacts on local character.

At the regional level, construction of the proposal may coincide a number of Inland Rail projects and/or other major projects in South East Queensland. Assessment of these impacts would be speculative at best, particularly as construction personnel are highly mobile, but a requirement for up to several thousand construction personnel may be experienced in the northern NSW and southern Queensland regions during 2021–2024. If multiple projects are constructed in the same timeframe, there may be a significant demand on trades and construction labour. The expansion of construction activity would support additional flow-on demand through the construction industry supply chain and additional spending on consumer-orientated products by the construction workforce in the proposal region.

The associated supply of construction materials, the development of associated external infrastructure and complementary services will require additional workforce beyond those directly associated with Inland Rail, stimulating jobs and growth in the region (ARTC, 2017).

There is also potential for the cumulative impacts of projects including Cross River Rail, Brisbane Metro, Inland Rail, and other major infrastructure projects to require significant construction workforces within a similar timeframe. This impact would lead to cumulative demands on construction labour across NSW and Queensland and, potentially, nationally. There are multiple uncertainties in relation to timing of these projects, so assessment has not been attempted. There is, however, potential for this to lead to draw from other industries, including agriculture, police and emergency services, and the range of businesses that depend on construction-related skills and labour.

The ARTC *Inland Rail Program Business Case* (2015) identifies that an anticipated additional 16,000 jobs will be required program-wide at the peak of construction, with an average of 800 jobs per annum over the 10-year construction period. An average of 700 additional jobs per annum is anticipated over 100 years of operation. The 10-year delivery schedule would support economic activity in the regions and create regional jobs in Queensland, NSW and Victoria during both construction and operation.

Inland Rail will also have significant economic impacts by providing for more efficient freight transport, supporting existing and new businesses, and resulting in increased road safety, lower congestion and less pollution from road freight. Further information on the assessment of cumulative impacts is provided in Appendix O: Social Impact Assessment Technical Report.

26.4.13 Economics

Several concurrent and overlapping projects have the potential to contribute to cumulative economic impacts alongside those of the proposal. The cumulative stimulus to the economy resulting from the construction and operation of the proposed projects will result primarily in labour market and supply chain impacts. The combined stimulus will create significant demand for additional labour and physical inputs (e.g. material).

The ability of the local economy to respond to the increase in demand for labour will be limited to a large extent by the size of the local labour force and depth of the local economy. Increased local demand is anticipated to arise directly in the form of increased demand for labour and business/industrial services, and indirectly in the form of demand for additional community services and potentially additional housing.

The geographic distribution and construction profile of the interacting projects indicates that the combined labour demand is unlikely to surpass 1,000 workers from the economic catchment area at any one time (noting that labour demand and the workforce profile across the construction period is unknown for several projects). Given the tight labour market in the region, it likely that the number of new jobs indirectly created through the proposal will be limited by labour market conditions.

Based on current labour market conditions, the economic catchment area is likely to be enough to meet increased demand resulting from the various planned projects. However, this is subject to change given the release of construction and employment data for outstanding projects.

Cumulative supply chain impacts are likely to be realised where construction timeframes occur concurrently and comparable material is required, e.g. the adjacent Inland Rail projects Narrabri to North Star and NSW/Queensland Border to Gowrie projects. Where materials are sourced within the region, this increase in demand is likely to increase local and regional economic activity.

Further information on the assessment of cumulative impacts is provided in Appendix I: Economic Assessment Technical Report.

26.4.14 Loss of containment of dangerous goods

Chapter 24: Hazard and Risk describes the health, safety and environmental hazards and risk associated with the proposal. Because of the potential risks associated with the hazardous chemicals, storage can have offsite impacts depending on the quantities and types of materials. Loss of containment of transport of dangerous goods during freight transport is considered to have a potential for cumulative impacts between the proposal and the local environment or future projects it may potentially interact with.

Cumulative impacts arising from dangerous goods loss-of-containment on surrounding environment and community will be largely the product of:

- ▶ Temporal construction impacts—the requirements for hazardous chemical laydown area, potential bushfire events and increase in workforce and machinery operating on adjoining projects at the same time
- ▶ Spatial operational impacts—the residual impact of freight-dangerous goods on Inland Rail to sensitive receptors.

During construction, the expected quantities of hazardous chemicals are not considered to be sufficient to introduce significant offsite impacts or the potential to contribute to cumulative impacts at the adjacent, regional and national level. Impacts associated with construction storage of hazardous chemicals are expected to be localised to the area of use for the expected quantities and types of chemicals. Natural hazards in the surrounding area, such as bushfire, may increase the risk at site and can negatively impact hazardous chemical storage; however, hazardous chemical storage locations have been located outside bushfire impact areas where possible.

The potential for cumulative impacts during operations are associated with dangerous goods freight. Freight of dangerous goods across significant infrastructure, such as the Gwydir Highway, Newell Highway and Bruxner Way have the potential for cumulative impacts. Sharing land uses and infrastructure increases the interactions between moving trains and the local community and environment, which have the potential to increase the societal risks.

The area of influence with respect to the risk of loss of containment is limited within or near the proposal site. As such, the other non-ARTC projects being considered in the cumulative impact assessment are outside of the area of influence. Overall, the significance of cumulative impact assessment of loss of containment associated with the proposal is likely to be low. Further information on the assessment of dangerous goods is provided in Chapter 24: Hazard and Risk.

26.4.15 Waste and resource management

Chapter 25: Waste and Resource Management describes the expected quantities and characteristics of waste likely to be generated by the proposal. The construction of the proposal would overlap with activities associated with the adjacent Border to Gowrie and Narrabri to North Star projects. Cumulative impacts arising from construction activities could potentially arise if waste streams were not properly managed.

The significance of the potential cumulative impacts during construction is considered low because waste resulting from the construction activities will be managed in accordance with ARTC standard mitigation measures. Mitigation measures will be implemented during the construction as well as operation and maintenance phases. This will encourage diversion from landfill and avoid impacts on environmental values. Avoiding, reducing, re-using or recycling waste is preferred to treating and disposing of waste. Key mitigation measures include:

- ▶ A waste management strategy will be developed as a sub-plan to the construction environmental management plan and will comply with the conditions of approval and all relevant legislation, policies, standards and guidelines. The waste management sub-plan will comply with the conditions of approval and all relevant legislation, policies, standards and guidelines
- ▶ Spoil generated by the proposal will be assessed for re-use as fill material. It may also be used to rehabilitate disturbed areas within the construction footprint
- ▶ All wastes generated by the proposal will be effectively stored, handled, treated, re-used, recycled and/or disposed of lawfully and in a manner that protects environmental values.

Only licensed facilities would be used for waste disposal. A preliminary assessment of the potential disposal and recycling options available within 150 km of the proposal indicates that there is enough capacity for the predicted waste streams and volumes to be disposed of in licensed facilities. Further information on the assessment of cumulative impacts is provided in Chapter 25: Waste and Resource Management.

26.5 Summary of residual cumulative impacts and mitigations

The potential for cumulative impacts between the proposal and other projects is considered low for all aspects except biodiversity, where cumulative loss of habitat will place further pressure on local threatened flora and fauna species and ecological communities. The assessment considered several major projects within a wide geographic extent where the proposal is located. Spatial areas of influence as well as temporal overlaps of project activities were considered for various biophysical, social and economic aspects. Despite the geographic extent of the area considered in this cumulative impact assessment, only a small number of major projects were identified to present cumulative impacts with the proposal.

The assessment concludes that the impacts from the proposal, combined with other existing and proposed projects, have cumulative impacts of low significance in the various biophysical and socioeconomic aspects that were considered, except for biodiversity. Here, there is the potential for some proposal activities to have a cumulative, irreversible and/or permanent impact, even after the implementation of all mitigation measures. In these cases, compensation for residual impact would be needed.