CHAPTER 22

Cumulative Impacts

CALVERT TO KAGARU ENVIRONMENTAL IMPACT STATEMENT

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

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22. Cumulative impacts

22.1 Overview

This chapter provides a summary of the cumulative impact assessment (CIA) undertaken for the Calvert to Kagaru Project (the Project).

When numerous projects occur within close proximity to each other, they can cause cumulative impacts. It is a requirement of the Project's Terms of Reference (ToR) that cumulative impacts associated with the Project are considered.

Cumulative impacts may:

- Differ from those of an individual project when considered in isolation
- Be positive or negative
- Differ in severity and/or duration depending on the spatial and temporal overlap of projects occurring in an area.

Cumulative impacts can:

- Occur at a local, regional or national level
- Accumulate over time
- Exacerbate the intensity, scale, frequency or duration of impacts in isolation or in combination with other known existing or planned projects.

The CIA includes consideration of:

- Projects that have been approved but construction has not commenced
- Projects that have commenced construction
- Projects that have completed construction since 16 June 2017, when the Project was declared a 'coordinated project' under the provisions of the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act)
- Projects that are currently being assessed as coordinated projects.

For the purpose of this assessment, the CIA area is defined as the spatial area of influence (AOI), which is determined by the specific nature of the environmental aspect being assessed.

Three types of AOI have been considered:

- Derived by assessment: the AOI is determined for each environmental aspect (including social and economic aspects) by the corresponding impact assessment, as undertaken to address the relevant component of the ToR
- Administrative: the AOI is determined by recognised administrative boundaries
- Designated area: the AOI is determined by the recognised physical operational extent of the Project.

The impact assessment for each environmental aspect and the supporting technical reports provide an assessment of each potential impact after initial and proposed mitigation measures are applied. These assessments have informed the preparation of the CIA. The CIA also draws on the impact assessments of projects within the AOIs, or with intersecting AOIs, of the environmental aspects assessed.

Further details of the assessment methodologies used to assess individual environmental aspects are presented in the relevant chapters and technical reports of this Environmental Impact Statement (EIS).

22.2 Scope of chapter

The purpose of the CIA is to present clear and concise information on the cumulative impacts of specific environmental aspects that could occur as a result of the Project's development in conjunction with other identified existing or proposed developments.

Projects included in the CIA are listed in Section 22.4 and meet either one or more of the selection criteria listed below:

a) Are currently being assessed under Part 1 of Chapter 3 of the *Environmental Protection Act 1994* (Qld) (EP Act) and, as a minimum, have an initial advice statement available on the Department of Environment and Science (DES) website

b) Have been declared a 'coordinated project' by the Coordinator-General under the SDPWO Act and an EIS is currently being prepared or is complete, or an initial advice statement is available on the Department of State Development, Tourism and Innovation (DSDTI) website

c) May use resources located within the region (including materials, groundwater, road networks or workforce) that are the same as those to be used by the Project

d) Could potentially compound residual impacts that the Project may have on environmental aspects.

A search of publicly available information was also undertaken to identify projects where there is the potential to compound residual impacts on environmental aspects.

Projects and operations located in the AOI for the CIA were excluded from the cumulative impact assessment if they:

- Were completed prior to 16 June 2017, when the Project was declared a 'coordinated project' under the provisions of the SDPWO Act
- Are current operational projects, commercial or agricultural operations.

These projects and operations are considered part of the 'existing environment' and are addressed in the impact assessments in Chapter 8 to Chapter 21.

The CIA also excludes proposed projects that have not been developed to the point that their environmental assessment process has not been made public.

Section 22.4 includes a list of projects that were considered but excluded due to the criteria listed above.

22.3 Methodology

22.3.1 Approach

The approach used to identify and assess potential cumulative impacts is summarised below.

- A review of potential impacts identified within Chapter 8 to Chapter 21 of this EIS
- A register of assessable projects was collated with timelines to identify the temporal relationship between projects
- Where there is a potential overlap in impacts (either spatially or temporally), a CIA was undertaken to determine the nature of the cumulative impact
- Wherever possible, the assessment methods have been quantitative in nature; however, qualitative assessment methods were also used:
  - Where quantitative assessment was possible, the significance of potential impacts was assessed in accordance with the same criteria or guidelines as adopted by the relevant technical study in Chapter 8 to Chapter 21
  - Where impacts could only be expressed qualitatively, the probability, duration, and magnitude/intensity of potential impacts was considered in conjunction with the sensitivity and value of the receiving environment
- An assessment matrix (refer Section 22.3.2) was used to determine the significance of potential cumulative impacts
- Where cumulative impacts were deemed to be of 'medium' or 'high' significance, additional mitigation measures were proposed beyond those already proposed by the relevant technical studies.

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.

22.3.2 Assessment matrix

Following the identification of potential cumulative impacts, relevance factors (low, medium or high) were assigned to each potential impact in accordance with the assessment matrix presented in Table 22.1. Relevance factors account for:

- Probability of impact—what is the likelihood of the impact occurring?
- Duration of impact—how long will the impact occur for? For example, operation will be for a long time; therefore, it will have a high impact.
- Magnitude/intensity of impact—how big will the impact be on the sensitive receptor being considered?
- Sensitivity of receiving environment—how sensitive is the receptor being impacted? For example, is the receptor endangered?

TABLE 22.1: ASSESSMENT MATRIX

Impact characteristic	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

The sum of the relevance factors was then used to determine the impact significance and corresponding consequence of the impact as summarised in Table 22.2.

For example, if a potential impact was considered to have a probability of impact of 1, duration of impact of 2, magnitude/intensity of impact of 1 and a sensitivity of receiving environment of 2, the significance of impact would be 6 (1+2+1+2 = 6) and the impact would be considered of 'low significance'.

TABLE 22.2: IMPACT SIGNIFICANCE

Impact significance	Sum of relevance factors	Consequence
Low	1–6	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.
Medium	7–9	Mitigation measures are likely to be necessary and specific management practices to be applied. Specific approval conditions are likely. Targeted monitoring program required, where appropriate.
High	10–12	Alternative actions should be considered and/or mitigation measures applied to demonstrate improvement. Specific approval conditions are required. Targeted monitoring program is necessary, where appropriate.

The outcome of the significance assessment indicates whether identified impacts can use standard mitigation measures (low), should develop specific mitigation measures (medium) or alternatives are to be considered (high). The key mitigation measures to reducing the potential cumulative impacts of the Project that are identified within this chapter are presented within the mitigation measures sections of Chapter 8 to Chapter 21 and within Chapter 23: Draft Outline Environmental Management Plan. When assessing potential impacts from other projects (refer Section 22.4) it is reasonably assumed that the projects will abide by the conditions of their approval from the relevant regulator and so have a similar level of impact mitigation to the Project.

22.4 Assessable projects

Based on the criteria listed in Section 22.2, the projects that have been included in the CIA are summarised in Table 22.3. Projects excluded from the CIA are listed in Table 22.4.

The location of each included project is shown in Figure 22.1, while Table 22.5 presents the anticipated construction timing of each of the assessable projects in relation to the Project.

TABLE 22.3: PROJECTS INCLUDED IN THE CUMULATIVE IMPACT ASSESSMENT

Project and proponent	Location	Description	Source	Project status	Construction dates and jobs	Operation years and jobs	Selection criteria[1]	Relationship to the Project
Kagaru to Acacia Ridge and Bromelton (K2ARB) (ARTC)	Rail corridor from Kagaru to Acacia Ridge and Bromelton	Enhancing and connecting the existing rail corridor (approximately 49 km) from north-east of Kagaru to Acacia Ridge and from south of Kagaru to Bromelton.	Application for coordinated project status currently under consideration by the Coordinator-General	Proponent awaiting coordinated project decision by the Coordinator-General	2023 to 2025 Jobs TBA	> 50 years Jobs TBA	c)	Potential overlap of construction for C2K and K2ARB
Helidon to Calvert (H2C) (ARTC)	Rail alignment from Helidon to Calvert	The H2C project will include the following: ▸ 47 km single-track, dual-gauge freight rail line to accommodate double-stack freight trains up to 1,800 m long ▸ Tunnel through the Little Liverpool Range ▸ Construction of rail infrastructure, culverts, bridges, viaducts and crossing loops ▸ Connection to the existing West Moreton Railway Line ▸ Ancillary works including road and public utility crossings and realignments.	**eisdocs.dsdip.qld.gov.au/Inland%20Rail%20Helidon%20to%20Calvert/IAS/h2c-initial-advice-statement.pdf**	Proponent currently preparing EIS	2021 to 2026 Average 193 full-time construction jobs	> 50 years Jobs 20 full-time equivalent (FTE)	b) and c)	Potential overlap of construction for H2C and C2K
Greater Flagstone Priority Development Area (PDA) (QLD Government)	Located within Logan City, west of Jimboomba and the Mount Lindesay Highway, along the Brisbane–Sydney rail line	When fully developed, it is anticipated that the Greater Flagstone PDA will provide approximately 50,000 dwellings to house a population of up to 120,000 people.	**dsdmip.qld.gov.au/edq/greater-flagstone.html**	PDA declared by the Queensland Government on 8 October 2011	2011 to 2041 Jobs TBA	TBA	c) and d)	Potential overlap of construction times, demand for resources and traffic volumes in the Kagaru area and vegetation clearing

Project and proponent	Location	Description	Source	Project status	Construction dates and jobs	Operation years and jobs	Selection criteria[1]	Relationship to the Project
Bromelton State Development Area (SDA) (QLD Government)	South of Kagaru in Bromelton	Delivery of critical infrastructure within the Bromelton SDA will support future development and economic growth. This includes a trunk water main and the Beaudesert Town Centre Bypass. This infrastructure provides opportunities to build on the momentum of current development activities by major landowners in the SDA.	**statedevelopment.qld.gov.au/resources/project/bromelton/bromelton-sda-development-scheme-dec-2017.pdf**	The current version of the Bromelton SDA Development Scheme was approved by Governor in Council, December 2017 The Development Scheme is managed by the Coordinator-General	2016 to 2031 Jobs TBA	TBA	c) and d)	Ongoing development north of Kagaru in the Bromelton SDA could result in a conflict for construction resources and see an increase of traffic volumes in the Kagaru area and vegetation clearing
Ripley Valley PDA (QLD Government)	Approximately 5 km south-west of the Ipswich CBD and south of the Cunningham Highway	The Ripley Valley PDA covers a total area of 4,680 ha and is an opportunity to provide approximately 50,000 dwellings to house a population of approximately 120,000 people. It is located in one of the largest industry growth areas in Australia and offers opportunities for further residential growth to meet the region's affordable housing needs.	**dsdmip.qld.gov.au/edq/ripley-valley.html**	PDA declared by State Government on 8 October 2011	2009 to 2031 Jobs TBA	TBA	c) and d)	Development could result in potential conflict for construction resources and see an increase in vehicle traffic and vegetation clearing
South West Pipeline: Bulk Water Connection to Beaudesert (Seqwater)	East of Kagaru, running north from Beaudesert	The proposal is investigating a bulk water pipeline connection from the Southern Regional Water Pipeline to Beaudesert, connecting Beaudesert to the South East Queensland Water Grid. The pipeline will pass through the site of the future Wyaralong Water Treatment Plant.	**buildingqueensland.qld.gov.au/projects/south-west-pipeline-bulk-water-connection-to-beaudesert/**	Currently completing Detailed Business Case	2021 Jobs TBA	TBA	c)	Potential conflict with demand for construction resources

Project and proponent	Location	Description	Source	Project status	Construction dates and jobs	Operation years and jobs	Selection criteria[1]	Relationship to the Project
Royal Australian Air Force (RAAF) Base Amberley future works (Department of Defence)	RAAF Base Amberley	White paper dedicated future upgrades to RAAF Base Amberley at a cost of $1 billion.	**defence.gov.au/id/_Master/docs/Economic/KPMGRAAFAmberleyReport.pdf**	N/A	2016 to 2022 7,000 jobs	TBA	c)	Ongoing development at RAAF Base Amberley may see an increase in road traffic with heavy vehicles and further increase as C2K construction occurs as well as vegetation clearing
Cross River Rail (QLD Government)	Brisbane City	A new north–south rail line connecting Dutton Park to Bowen Hills under the Brisbane River and CBD.	**statedevelopment.qld.gov.au/assessments-and-approvals/cross-river-rail-project.html**	EIS Complete New lapsed date for the Coordinator-General's EIA evaluation report on 31 December 2025 at the time of writing.	2019 to 2025 1,547 jobs	> 50 years 576 jobs	c) and d)	Cross River Rail is located approximately 43 km from C2K at Kagaru. Cross River Rail is unlikely to result in material cumulative environmental impacts; however, depending on timing there may be competition for construction workers.
Remondis Waste to Energy Facility (Remondis)	Swanbank Industrial Estate	Remondis has announced plans to build a $400 million waste-to-energy facility in Swanbank, south of Ipswich.	**statedevelopment.qld.gov.au/assessments-and-approvals/remondis-waste-to-energy-facility.html**	Proponent awaiting draft terms of reference for EIS	2021–2024 200 jobs	TBA 80 jobs	a), b) and c)	Potential conflict with demand for construction resources

Table notes:

a) Currently being assessed under Part 1 of Chapter 3 of the *Environmental Protection Act 1994* (Qld) and, as a minimum, have an initial advice statement available on the DES website.

b) Have been declared a 'coordinated project' by the Coordinator-General under the SDPWO Act and an EIS is currently being prepared or is complete, or an initial advice statement is available on the DSDTI website.

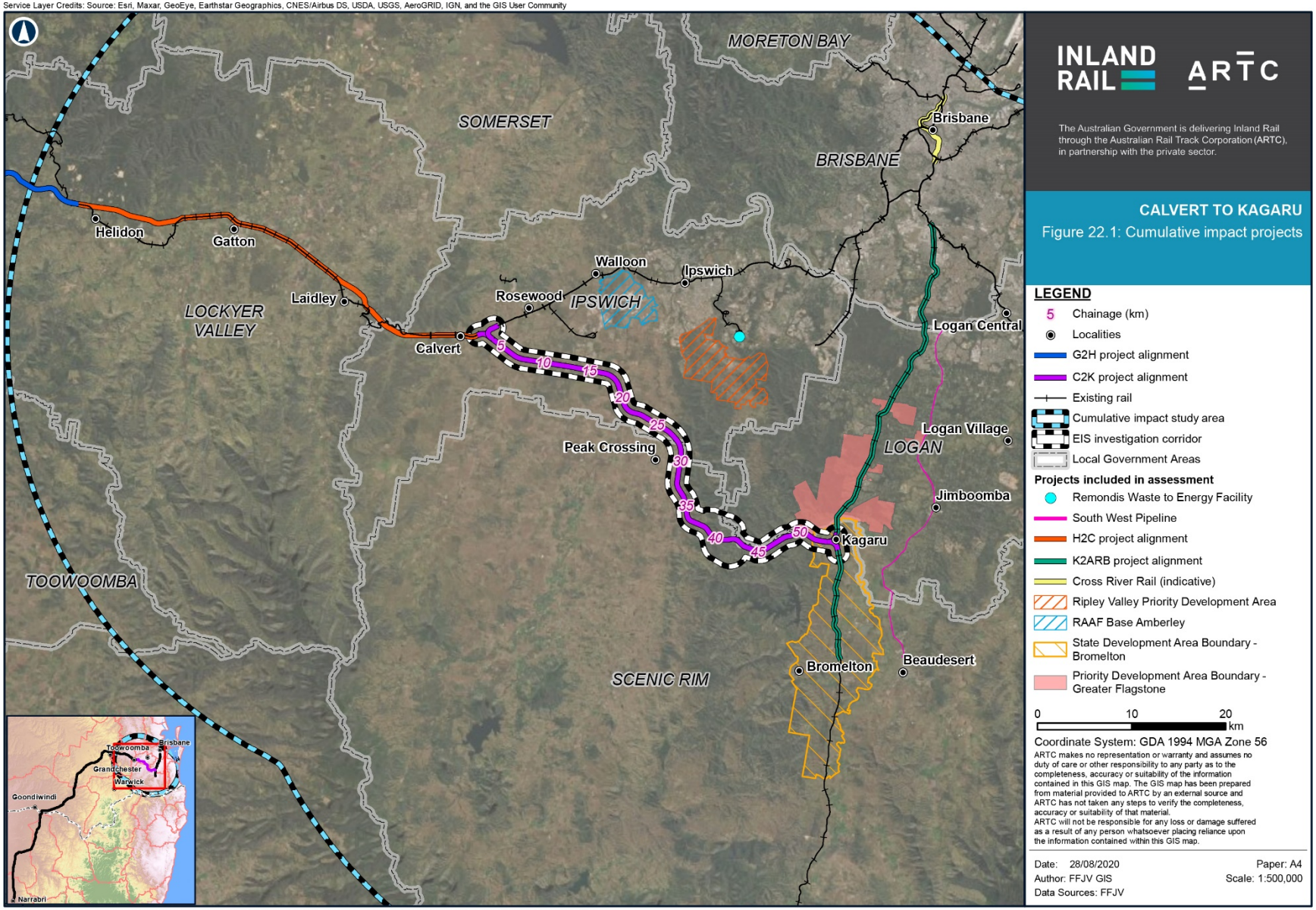
c) May use resources located within the region (including materials, groundwater, road networks or workforces) that are the same as those to be used by the Project.

d) Could potentially compound residual impacts that the Project may have on environmental aspects.

TABLE 22.4: EXCLUDED PROJECTS

Project and proponent	Location	Description	Source	Project status	Reason for discounting from cumulative assessment
Salisbury to Beaudesert Rail Connection (Department of Transport and Main Roads)	Salisbury to Beaudesert	The Salisbury to Beaudesert Rail Corridor Protection alignment (approximately 54 km) is located between Salisbury and Beaudesert in Brisbane's south-west region. The initiative proposes future essential public transport infrastructure for development areas in the Greater Brisbane South West urban growth corridor.	**dsdmip.qld.gov.au/infrastructure/infrastructure-australia.html**	Project listed on Queensland Infrastructure Priority List—EIS not yet initiated	The aim of this project is to identify and preserve a corridor. It is not expected to be constructed prior to 2026. The potential operational cumulative impacts from this project on the Project will be considered during the Salisbury to Beaudesert impact assessment.
Cunningham Highway—Yamanto to Ebenezer (Department of Transport and Main Roads)	Cunningham Highway near Yamanto and Amberley	Upgrade of the Yamanto and Amberley intersections with the Cunningham Highway, and construction of a new two-lane deviation off the highway connecting with the northern end of Amberley Road. In addition, a range of safety works will be undertaken along the route that could include safety barriers, channelised right-turn intersection upgrades, wide centreline treatment to separate opposing traffic, and overtaking lanes.	**tmr.qld.gov.au/Projects/Name/C/Cunningham-Highway-Amberley-Intersection-Upgrade**	Project listed on Queensland Infrastructure Priority List—EIS not yet initiated Not funded	Minimal information available and is, at this point in time, an initiative, not a project
Ebenezer Regional Industrial Area (Department of infrastructure and Planning)	South of Ipswich on a 5,000 ha site	The area has been declared under the QLD Government's *South East Queensland Regional Plan 2009–2031* as a regional development area. To accommodate manufacturing and logistics businesses as well as difficult-to-locate, large footprint industries.	**statedevelopment.qld.gov.au/resources/factsheet/cg/ebenezer-structure-plan-factsheet.pdf**	Not available	Limited publicly available information. The area is declared under the Regional Plan with limited additional information available
Willowbank Raceway Upgrade (Willowbank Raceway)	Willowbank Raceway	Upgrades to raceway to occur through 10-year funding agreement between Ipswich City Council and Supercars.	**dsdmip.qld.gov.au/infrastructure/infrastructure-australia.html**	Not available	Not considered due to the lack of publicly available information and the size of the project
Western Ipswich Bypass (Department of Transport and Main Roads)	West Ipswich	Future State-controlled road connecting the Cunningham Highway to the Brisbane Valley Highway.	**tmr.qld.gov.au/Projects/Name/I** **tmr.qld.gov.au/Community-and-environment/ Planning-for-the-future/Preserved-transport-corridors/Western-Ipswich-Bypass**	Not available	Not considered due to the lack of publicly available information

Project and proponent	Location	Description	Source	Project status	Reason for discounting from cumulative assessment
Bus and Passenger Rail Connection to Brisbane (QLD Government)	Occurring Rosewood to Ipswich and Ripley to Ipswich	New express link passenger rail from Rosewood and Ripley to Ipswich.	**tmr.qld.gov.au/~/media/Projects/C/Connecting%20SEQ%202031/final/connecting_seq2031_Part_A.pdf**	Identified in *Connecting SEQ 2031* (Queensland Government, 2011)	Not considered due to the lack of publicly available information
Port of Brisbane Strategic Access Study (Infrastructure Australia)	Port of Brisbane	Infrastructure Australia has identified that by 2045 the Port of Brisbane container trade is expected to increase by 300% creating a constraint due to the lack of a dedicated freight rail connection. A solution is expected to be required in the next 5–10 years.	**portbris.com.au/getmedia/8d74ab43-203b-46a1-a7c8-81106b3e8cb0/2019-03-04-PBPL-Master-Plan-2018-2048-FINAL.PDF**	Identified by Infrastructure Australia	Not considered due to the lack of publicly available information
Inland Rail Brisbane intermodal terminal business case (Brisbane Inland Rail Intermodal Terminal)	Acacia Ridge	Development of an intermodal terminal in Brisbane to support the Inland Rail Project.	**investment.infrastructure.gov.au/projects/ProjectDetails.aspx?Project_id=100572-18QLD-MRL**	Major Project Business Case (Department of Infrastructure, Transport, Regional Development and Communications)	Not considered due to the lack of publicly available information
Ipswich to Springfield Public Transport Corridor Study (Department of Transport and Main Roads (DTMR))		DTMR has planned and preserved land for a proposed passenger rail line extension between Ipswich and Springfield, via Ripley.	**tmr.qld.gov.au/Projects/Name/I/Ipswich-to-Springfield-Public-Transport-Corridor-Study**	Corridor Study	Not considered due to the lack of publicly available information
Willowbank Industrial Park (QLD Government)	Adjacent to the Cunningham Highway at Willowbank	Due to the diminishing supply of industrial land within the Western Corridor, the Department of State Development, Tourism and Innovation propose to establish an industrial precinct on 548 ha of land at Willowbank.	**industrial.edq.com.au/?name=Future-industrial-estate-releases**	Willowbank Stage One was approved by Ipswich City Council in 2017 (Council ref: CA-1469/2013)	The type of industry and number of buildings that are expected to occupy the industrial precinct is currently unknown. The timing and staging of the development are also not currently clear.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MORETON BAY
SOMERSET
BRISBANE
LOCKYER VALLEY
IPSWICH
LOGAN
TOOWOOMBA
SCENIC RIM
Brisbane
Helidon
Gatton
Laidley
Walloon
Ipswich
Rosewood
Calvert
Logan Central
Logan Village
Peak Crossing
Jimboomba
Kagaru
Bromelton
Beaudesert
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15
20
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30
35
40
45
50
Toowoomba
Grandchester
Warwick
Goondiwindi
Narrabri
INLAND RAIL
ARTC
The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation (ARTC), in partnership with the private sector.
CALVERT TO KAGARU
Figure 22.1: Cumulative impact projects
LEGEND
Chainage (km)
Localities
G2H project alignment
C2K project alignment
Existing rail
Cumulative impact study area
EIS investigation corridor
Local Government Areas
Projects included in assessment
Remondis Waste to Energy Facility
South West Pipeline
H2C project alignment
K2ARB project alignment
Cross River Rail (indicative)
Ripley Valley Priority Development Area
RAAF Base Amberley
State Development Area Boundary - Bromelton
Priority Development Area Boundary - Greater Flagstone
0
10
20
km
Coordinate System: GDA 1994 MGA Zone 56
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TABLE 22.5: CUMULATIVE PROJECT TIMING

Project	Estimated construction timeframe	Overlap in construction periods by project year							
		1	2	3	4	5	6	7–10	11–20
The Project (Calvert to Kagaru)	2021–2026								
H2C	2021–2026								
K2ARB	2023–2025								
Greater Flagstone PDA	2011–2041								
Bromelton SDA	2016–2031								
Ripley Valley PDA	2009–2031								
South West Pipeline	2021								
RAAF Base Amberley future works	2016–2022								
Cross River Rail	2020–2025								
Remondis Waste to Energy Facility	2021–2024								

22.5 Potential impacts

A project's cumulative impacts are likely to occur at the construction, operation and decommissioning phases. These impacts could be temporal in nature (e.g. traffic or workforce) or spatial (e.g. habitat loss or soil disposal locations). The initial phase (construction) is typically more likely to have the most material impact as the project is new to the location and the amount of disturbance and activity to get the Project established is at a peak. Once the project is established (operational) there are no longer any footprint impacts and the operational impacts associated with environmental aspects such as visual, surface water etc. are stabilised and below that at the peak of construction.

It is for this reason that the CIA has focused on the construction phase of the Project and its potential cumulative impacts as detailed below. An exception to this is operational noise and air that are considered separately within this chapter and aspects such as economics and social that have also included post-construction impacts in their assessment.

22.5.1 Land use and tenure

It is recognised that the Project will contribute to cumulative impacts on land use particularly in relation to land acquisition and changes in land use. In particular, these impacts relate to the removal of agricultural land for development of the rail corridor.

The AOI for cumulative land use and tenure impacts was defined by placing a 2 km buffer around the proposed alignment for the Project. This radius was chosen because direct and indirect land use and tenure impacts are considered localised to the area within which a project is occurring. Based on this criterion, the subset of projects included in the assessment of cumulative impacts on land use and tenure is:

- K2ARB
- H2C
- Greater Flagstone PDA
- Bromelton SDA
- Ripley Valley PDA.

Although projects across the region may have different land use and tenure impacts to the Project, it was considered that the key potential impacts that are likely to be common to all are:

- Loss of Class A and Class B agricultural land, and land within an Important Agricultural Area (IAA)
- Disruption to agricultural operations
- Sterilisation of mineral and petroleum resources
- Impacts on accessibility within the wider road network and to private properties
- Temporary disruption to services and utilities.

Using the methodology described in Section 22.3, the cumulative land use and tenure impacts of the Project are expected to be of **low significance** (refer Table 22.6).

The following factors contributed to this assessment:

- There is limited potential for cumulative impacts given the relatively limited land use and tenure impacts associated with the Project
- The permanent disturbance footprint is predominately located within the Southern Freight Rail Corridor (SFRC), consistent with State land use planning expectations for the area
- The K2ARB project and the H2C project immediately adjoin the Project and are expected to have similar land use and tenure impacts
- While the other projects are large-scale major land development projects and could potentially generate a cumulative impact on land use and tenure, their impacts are considered to be localised.

TABLE 22.6: CUMULATIVE IMPACT ASSESSMENT FOR LAND USE AND TENURE

Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance
Loss of agricultural land, loss of land within an IAA, and disruption to agricultural operations	Probability of the impact	1	6	Low
	Duration of the impact	3		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	1		
Sterilisation of mineral and petroleum resources	Probability of the impact	1	6	Low
	Duration of the impact	3		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	1		
Impacts on accessibility within the road network and to private properties, and temporary disruption to services and utilities	Probability of the impact	2	6	Low
	Duration of the impact	2		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	1		

22.5.2 Land resources

The cumulative impacts of the identified assessable projects in the vicinity of the Project may contribute to impacts on land resources if not managed appropriately. Based on the assessment of land resources in the land resources study area (refer Chapter 9: Land Resources), the risk of the Project impacting on land resources is low.

Five of the projects presented in Table 22.3 have been identified as having the potential to contribute to cumulative impacts on land resources and were considered as within the AOI. These include:

- K2ARB
- H2C
- Greater Flagstone PDA
- Bromelton SDA
- Ripley Valley PDA.

The assessable projects mostly comprise rail and road upgrades and high-density industrial infrastructure development. Due to their location in distant sub-catchments, these projects are considered unlikely to cumulatively impact on land resources within the land resources study area. The aspects of spoil management and disposal are considered in the waste and resource management section (refer Section 22.5.14).

Although projects across the region may have different land resource impacts to the Project, the following impacts are likely to be common to each project, if not managed appropriately:

- Disturbance (and possible disposal) of existing contaminated land
- Leaks or spills leading to migration of contaminants
- Disturbance of acid sulphate soils (ASS)
- Salinity and sodicity
- Changes to landform and topography
- Increase in erosion leading to increased total dissolved solids (TDS) in run off
- Increase in weed migration.

Provided all of assessable projects apply appropriate mitigation measures, the overall significance of cumulative impacts during the construction, operation and decommissioning phases of the Project is expected to be of low significance and it is unlikely that long-term cumulative impacts would occur (refer Table 22.1). The key factors that contributed to this assessment are the distributed nature of the assessable projects, and the likely stability of project landforms during the operation phase.

TABLE 22.7: CUMULATIVE IMPACT ASSESSMENT FOR LAND RESOURCES

Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance
Inappropriate characterisation of soil conditions	Probability of the impact	1	6	Low
	Duration of the impact	2		
	Magnitude/intensity of the impact	2		
	Sensitivity of the receiving environment	1		
Disturbance to existing contaminated land and ASS	Probability of the impact	1	6	Low
	Duration of the impact	2		
	Magnitude/intensity of the impact	2		
	Sensitivity of the receiving environment	1		
Contamination due to leaks or spills	Probability of the impact	1	6	Low
	Duration of the impact	2		
	Magnitude/intensity of the impact	2		
	Sensitivity of the receiving environment	1		
Development of salinity and sodicity	Probability of the impact	2	6	Low
	Duration of the impact	2		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	1		
Changes to landform and topography	Probability of the impact	2	6	Low
	Duration of the impact	2		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	1		
Increased erosion leading to increased TDS in runoff	Probability of the impact	2	5	Low
	Duration of the impact	1		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	1		
Increased in weed migration	Probability of the impact	1	4	Low
	Duration of the impact	1		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	1		

22.5.3 Landscape and visual amenity

Cumulative impacts to the landscape and visual amenity of the Project 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, including as a result of the introduction of additional visual receptors (including residential receptors) into an area and with potential to view the Project.

In terms of temporal impact, it is considered likely that the following projects may all have some overlap in construction periods:

- K2ARB
- H2C
- Greater Flagstone PDA
- Bromelton SDA
- Ripley Valley PDA
- South West Pipeline Bulk Water Connection to Beaudesert
- RAAF Base Amberley future works
- Remondis Waste to Energy Facility.

Due to the overlap in timing, there is likely to be perception in the community of high levels of construction activities occurring in the AOI. The area likely to be most affected is around Kagaru. This area will potentially be (depending on specific project phasing) affected simultaneously by Flagstone PDA, Bromelton SDA, and K2ARB activities. As there are relatively few existing visual receptors in this area and the construction impacts are temporary, the consequence of cumulative impacts during construction in this area is considered of **low significance.**

While there are more existing visual receptors in the west, around Calvert and Rosewood, it is considered that the consequence of cumulative impact of construction activities in this area is also of **low significance** (refer Table 22.8). The main projects in this area are:

- The Ripley Valley PDA project, which is visually separated from the Project by the Teviot Range landscape
- The H2C project, which, in practice, will be viewed as the 'same' project as the C2K Project by affected receptors.

Similarly, there is a relatively high number of visual receptors around Swanbank, Ipswich and Yamanto. An additional project that was considered in the cumulative impacts assessment in this location was the Remondis Waste to Energy Facility and the visual impacts for travellers passing through the area. Due to the distance to the Project and nature of the development, cumulative impacts are considered of low significance.

In terms of spatial impacts, the K2ARB and H2C projects immediately adjoin the C2K Project and will, again, most likely be viewed consistently with the Project.

The South West Pipeline: Bulk Water Connection to Beaudesert has been approved for construction. However, it lies over 5 km from the alignment at its closest point and is also underground, so no cumulative landscape and visual impacts are anticipated.

Overall, it is anticipated that cumulative impacts from interactions with the six projects identified as part of the landscape and visual amenity CIA will be of **low significance**.

With regards to the other projects, it is noted that these are all large-scale major land development projects that will affect many hectares of land with associated landscape and visual impacts. Collectively, these projects will result in a noticeable intensification of built development and extension into the rural and natural landscape character west of Greater Brisbane, particularly in terms of sequential impacts gained while travelling around the region.

Localised areas will also be affected by combined and successive impacts, where the projects will both be visible at the same time—particularly around Kagaru and Willowbank. These projects will also potentially introduce additional visual receptors (residents and workers) into the landscape overlooking the Project. In the context of these projects, the landscape and visual impact of the Project, which occupies a narrow, linear corridor, is considered fairly modest.

The significance of the contribution of the Project to cumulative impact is considered up to **medium significance** for both landscape and visual aspects (refer Table 22.8). Mitigation to address this impact will be as described for the standalone Project (refer Chapter 10: Landscape and Visual Amenity), with other mitigation necessarily needing to be incorporated into other projects to minimise impacts on the railway on properties and open space located near to the Project.

Due to the low level of lighting proposed as part of the Project, there are not anticipated to be any significant cumulative lighting impacts associated with these projects.

TABLE 22.8: CUMULATIVE IMPACT ASSESSMENT FOR LANDSCAPE AND VISUAL AMENITY

Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance
Construction impacts associated with views of increases in: ▸ Construction traffic ▸ Construction areas	Probability of the impact	2	6	Low
	Duration of the impact	1		
	Magnitude/intensity of the impact	2		
	Sensitivity of the receiving environment	1		
Operation impacts associated with combined, successive and sequential views of adjoining projects	Probability of the impact	2	8	Medium
	Duration of the impact	2		
	Magnitude/intensity of the impact	2		
	Sensitivity of the receiving environment	2		
Impacts of night lighting	Probability of the impact	Nil	Nil	Nil
	Duration of the impact	Nil		
	Magnitude/intensity of the impact	Nil		
	Sensitivity of the receiving environment	Nil		

22.5.4 Flora and fauna

The cumulative flora and fauna impacts of multiple projects occurring in the vicinity of the Project will likely include the continued loss of biodiversity in the South East Queensland (SEQ) bioregion. The major potential impacts identified as a result of the Project are common to all of the projects throughout the region and are therefore, by their nature, cumulative. It is for this reason that they were all considered within the AOI for the flora and fauna CIA. The impacts range from short term to long term and will occur in each of the projects considered in this assessment to a greater or lesser extent depending on the nature of the project. The majority of the impacts will be experienced at the construction stage of the developments, but the nature of the impacts mean they will also be experienced when the projects are operational.

The assessment of cumulative impacts on flora and fauna has been considered separately for environmental aspects that are protected by different pieces of Commonwealth and State legislation, including:

- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act)
- *Vegetation Management Act 1999* (Qld) (VM Act)
- *Nature Conservation Act 1992* (Qld) (NC Act).

Potential cumulative impacts include:

- Habitat loss from vegetation clearing/removal
- Fauna species injury or mortality
- Reduction in biological viability of soil to support growth due to soil compaction
- Displacement of flora and fauna species from invasion of weed and pest species
- Reduction in the connectivity of biodiversity corridors
- Edge effects
- Habitat fragmentation
- Barrier effects
- Noise, dust, and light
- Increase in litter (waste).

All projects in Table 22.3 were considered as part of the flora and fauna cumulative impacts assessment, with the exception of the Cross River Rail project and RAAF Base Amberley upgrades. Due to the disturbed nature of the existing environment around the Cross River Rail and RAAF Base Amberley projects, both are unlikely to compound potential impacts on biodiversity within the SEQ bioregion.

The Remondis Waste to Energy Facility has also not been included as part of the cumulative impact assessment for ecological features, as the project is located in a highly disturbed environment and initial investigations indicate that this project will not contribute towards impacts to matters of national environmental significance (MNES).

The results of the significance assessment of the CIA on flora and fauna are presented in Table 22.9.

Impacts on threatened species, including migratory species, communities, remnant vegetation, high-value regrowth vegetation and wildlife habitats, as well as State or regionally significant habitats and ecological corridors were considered of **medium significance**. Impacts on remnant vegetation, high-value regrowth vegetation and least concerned species or priority Back on Track species were considered of **medium significance.** There will be no impact on State or nationally significant wetlands.

TABLE 22.9: CUMULATIVE IMPACTS ON ECOLOGICAL RECEPTORS

Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance
EBPC Act				
Commonwealth significant ecological constraint (community)	Probability of the impact	2	9	Medium
	Duration of the impact	3		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	3		
Commonwealth significant ecological constraint (species)	Probability of the impact	2	9	Medium
	Duration of the impact	3		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	3		
Commonwealth significant ecological constraint (migratory species)	Probability of the impact	1	8	Medium
	Duration of the impact	3		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	3		
Commonwealth significant ecological constraint (internationally significant wetlands)	Probability of the impact	Nil	Nil	Nil
	Duration of the impact	Nil		
	Magnitude/intensity of the impact	Nil		
	Sensitivity of the receiving environment	Nil		
VM Act				
State Significant Ecological Constraint—Remnant vegetation (REs) (Category B)	Probability of the impact	2	9	Medium
	Duration of the impact	3		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	3		
State Significant Ecological Constraint—High value regrowth vegetation (HVR) (Category C)	Probability of the impact	2	8	Medium
	Duration of the impact	3		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	2		
State Significant Ecological Constraint—Matters of State Environmental Significance (MSES) wildlife habitat*	Probability of the impact	2	9	Medium
	Duration of the impact	3		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	3		
State Significant Ecological Constraint—State Significant Wetlands High Ecological Significance (HES)	Probability of the impact	Nil	Nil	Nil
	Duration of the impact	Nil		
	Magnitude/intensity of the impact	Nil		
	Sensitivity of the receiving environment	Nil		
NC Act				
State Significant Ecological Constraint—threatened species	Probability of the impact	2	9	Medium
	Duration of the impact	3		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	3		

Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance
State Significant Ecological Constraint—Special Least Concern and Least Concern species	Probability of the impact	2	7	Medium
	Duration of the impact	3		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	1		
State Significant Ecological Constraint—Priority Back on Track	Probability of the impact	2	7	Medium
	Duration of the impact	3		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	1		
Biodiversity Planning Assessment				
State Significant Ecological Constraint (BPA): State habitat for Endangered, Vulnerable and Near Threatened (EVNT) taxa	Probability of the impact	1	8	Medium
	Duration of the impact	3		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	3		
State Significant Ecological Constraint (BPA): Regional habitat values for EVNT taxa	Probability of the impact	1	7	Medium
	Duration of the impact	3		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	2		
State Significant Ecological Constraint (BPA): State ecological corridors	Probability of the impact	1	8	Medium
	Duration of the impact	3		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	3		
State Significant Ecological Constraint (BPA): Regional ecological corridors	Probability of the impact	1	7	Medium
	Duration of the impact	3		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	2		

Table notes:
* Flora and fauna species that are both MNES and MSES listed species are included as a MSES

As part of the Project impact assessment for ecological aspects, a number of mitigation measures have been proposed (refer Chapter 11: Flora and Fauna). To further mitigate the potential cumulative impacts on the receptors listed above, particularly those identified as having **medium significance**, the other assessable projects will also have to successfully apply similar mitigation measures.

22.5.5 Air quality

The AOI for cumulative air quality impacts is the air quality study area, defined as the area within 2 km of the alignment. The air quality study area includes a total of 548 sensitive receptor locations, which are described in Chapter 12: Air Quality. Air quality objectives must be met at these receptor locations.

The CIA has considered projects located outside the air quality study area which may impact sensitive receptors located within the air quality study area. A total of nine projects have been considered in the CIA for air quality. These projects are either currently operational, will be constructed and or operational during the life of the Project, or are currently going through an approval process.

The environment in which the Project will be constructed and operated is likely to have a number of minor existing regional and local sources of air pollution (both natural and anthropogenic) that emit similar air pollutants as those being assessed. As such, background (existing) estimations of the relevant pollutants in the air quality AOI have already been included in assessments of construction and operational impacts presented in Chapter 12: Air Quality.

Existing significant emission sources in the air quality study area have been identified and reviewed. No existing emission sources require inclusion in the assessment of the operational phase of the Project. An existing quarry, the Boral Purga Quarry, is considered in the assessment of the construction phase of the Project as the operation of the quarry will overlap with the Project's construction. The operation of the quarry will not occur concurrently with the operation of the Project and therefore the quarry has not been considered in the assessment of the operational phase.

In addition to consideration of background air quality and existing emission sources, the air quality assessment of the operational phase of the Project considered cumulative impacts to sensitive receptors by assessing emissions from the adjoining Inland Rail projects (H2C and K2ARB) via detailed dispersion modelling.

The air quality cumulative impacts from the Project have been assessed following the methodology defined in Section 22.3. In Chapter 12: Air Quality, the assessment of cumulative impacts has been undertaken for each of the nine projects individually. This individual project assessment has informed the assessment of the significance of cumulative impacts for the construction and operational phases of the Project, the results of which are presented in Table 22.10. Table 22.10 shows that cumulative impacts are of low significance for both the construction and operational phases.

As discussed in Chapter 12: Air Quality, due to the dispersion of emissions as a result of separation distance and topography, it is expected that emissions from the Remondis Waste to Energy Facility will have negligible impact on air quality at sensitive receptors within the air quality study area and no significant cumulative impacts are anticipated.

While there is potential for the construction of H2C, the Project, and K2ARB to overlap, dust impacts are likely to be localised and managed by ARTC through approved Construction Environmental Management Plans (CEMPs). Mitigation measures for air quality for the construction phase to be included in the CEMPs are recommended in Chapter 12: Air Quality. Chapter 12: Air Quality also recommends mitigation measures and visual and quantitative dust monitoring for sensitive receptors near the Boral Purga Quarry to assist in managing the potential for cumulative impacts at these receptors.

With the exception of the K2ARB, H2C and Boral Purga Quarry projects, no other projects are expected to present risk of significant impacts, and no specific mitigation measures are required to address the cumulative impact of other projects.

TABLE 22.10: CUMULATIVE IMPACT ASSESSMENT FOR AIR QUALITY

Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance
Potential for air quality impacts on 548 sensitive receptor locations from pollutants within approximately 2 km of the Project alignment—Construction	Probability of the impact	2	6	Low
	Duration of the impact	1		
	Magnitude/intensity of the impact	2		
	Sensitivity of the receiving environment	1		
Potential for air quality impacts on 548 sensitive receptor locations from pollutants within approximately 2 km of the Project alignment—Operation	Probability of the impact	1	6	Low
	Duration of the impact	3		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	1		

22.5.6 Surface water quality and hydrology

All of the projects identified in Table 22.3 have been considered as part of the surface water quality CIA as they occur within the surrounding water catchment areas that constitute the AOI. Although these projects may have different surface water quality impacts to the Project, it was considered that the key potential impacts may include:

- Riparian vegetation loss from vegetation clearing/removal
- Potential impacts to aquatic fauna species both through impacts to water quality and waterway barrier works
- Displacement of flora and fauna species from invasion of weed and pest species
- Reduction in the connectivity of waterways
- Increase in erosion and sedimentation in the waterways
- Increase in litter (waste)
- Saline discharge into proximal waterways
- Increase in surface salinity around alluvial waterways.

The cumulative impacts of multiple projects occurring in the vicinity of the Project may contribute to impacts to water quality if not managed appropriately. However, the risk of significant cumulative impacts both in the short term or long term is considered of **low significance** based on:

- The highly ephemeral nature of the majority of waterways in the AOI
- The dispersed nature of these projects
- The likely stable landforms for the operation of these projects.

The assessment of the significance of cumulative impacts relating to surface water quality is presented in Table 22.11. Provided that all assessable projects apply appropriate mitigation measures during construction, including CEMPs and salinity management plans, limited cumulative impacts are expected during the construction, operation or decommissioning phases of the Project.

TABLE 22.11: CUMULATIVE IMPACT ASSESSMENT FOR SURFACE WATER QUALITY

Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance
Riparian vegetation loss from vegetation clearing/removal	Probability of the impact	2	6	Low
	Duration of the impact	1		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	2		
Potential impacts to aquatic fauna species both through impacts to water quality and barrier works, and reduction in the connectivity of waterways	Probability of the impact	1	5	Low
	Duration of the impact	1		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	2		
Displacement of flora and fauna species from invasion of weed and pest species	Probability of the impact	1	5	Low
	Duration of the impact	1		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	2		
Increase in erosion and sedimentation in the waterways	Probability of the impact	2	6	Low
	Duration of the impact	1		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	2		
Increase in litter (waste)	Probability of the impact	1	5	Low
	Duration of the impact	1		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	2		

Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance
Saline discharge into proximal waterways and increases in surface salinity around alluvial waterways	Probability of the impact	2	6	Low
	Duration of the impact	1		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	2		

In order to accurately assess the impacts of the Project, the hydrologic and hydraulic assessment of the Project included all existing infrastructure within the hydrology study area as a base case and then introduced the Project infrastructure (refer Chapter 13: Surface Water and Hydrology). It is against this assessment of potential impacts of the developed case (which inherently included existing cumulative impacts) that appropriate mitigation measures were derived.

The significance of cumulative impacts for hydrology is anticipated to be of **low significance** for two key reasons:

- Due to the nature of the projects considered in this CIA, it is anticipated that this process of identifying and assessing impacts will occur for all projects identified in Table 22.3. That is, each of these projects will be required to mitigate and minimise impacts to acceptable levels.
- In relation to the adjacent H2C and K2ARB projects, potential impacts on hydrology will be accounted for in the design and EIS for these projects, taking into consideration the interface with the Project.
- In addition, the cumulative impact on hydrology from the Project due to the stipulated design requirements will further reduce the potential for impacts on hydrology.

22.5.7 Groundwater

Cumulative impacts to groundwater would most likely occur where multiple projects intersect and/ or extract groundwater from the same shallow aquifer units. The key cumulative impacts that were considered as part of the groundwater CIA were:

- Dewatering of shallow groundwater (very localised)
- Potential impacts on groundwater quality through contamination (spills and leaks from machinery).

Due to the localised nature of potential groundwater impacts associated with this Project, only the adjacent Inland Rail projects (H2C and K2ARB) were included in the groundwater CIA and are considered within the AOI.

There is likely to be overlap of construction activities at the northern and southern extents of the Project with H2C and K2ARB projects. With the implementation of the following mitigation measures, it is considered that localised impacts on shallow groundwater levels due to excavations and spills of contaminants are considered unlikely to be compounded by interactions between these projects:

- Adherence to dewatering and water supply mitigation measures discussed in Chapter 14: Groundwater
- Adherence to the CEMP to respond effectively to groundwater level drawdown triggers
- Implementation of the groundwater monitoring program to identify and respond to triggers being breached
- Adherence to the CEMP to prevent and respond effectively to spills and leaks.

Any extraction of groundwater for construction purposes would be in line with existing water licences that have already had impact assessments undertaken. Construction water has therefore not been considered as part of the cumulative assessment.

As potential cumulative impacts on groundwater are highly localised in nature, the potential for cumulative impacts associated with the Project is considered to be of **low significance** (refer Table 22.12).

TABLE 22.12: CUMULATIVE IMPACT ASSESSMENT FOR GROUNDWATER

Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance
Changes in groundwater levels	Probability of the impact	1	6	Low
	Duration of the impact	2		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	2		
Groundwater quality and contamination	Probability of the impact	1	6	Low
	Duration of the impact	2		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	2		

22.5.8 Noise and vibration

22.5.8.1 Construction

The AOI for cumulative noise and vibration impacts during construction is, similar to air quality, constrained to an approximately 2 km buffer around the Project alignment.

Noise from construction activities being undertaken simultaneously on the adjoining H2C and K2ARB projects has the potential to increase noise levels at nearby sensitive receptor for the Project. The modelling techniques used for the Project assessed the worst-case construction scenarios and L_{Aeq} 15-min levels (refer Chapter 15: Noise and Vibration). Therefore, the expected noise impacts due to cumulative construction activities is not expected to significantly increase the predicted noise levels. Furthermore, fixed infrastructure such as tunnel ventilation and road realignments will not be undertaken in close enough proximity to sensitive receptors for the Project to cause cumulative impacts.

The cumulative impact of noise will be managed by ARTC through approved CEMPs. In addition, any overlap of construction works is likely to be for a limited time period. Therefore, the predicted cumulative noise and vibration impacts during construction of the Project is considered of **low significance** (refer Table 22.13).

TABLE 22.13: CUMULATIVE IMPACT ASSESSMENT FOR CONSTRUCTION NOISE

Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance
Increased noise levels at sensitive receptors	Probability of the impact	2	6	Low
	Duration of the impact	1		
	Magnitude/intensity of the impact	2		
	Sensitivity of the receiving environment	1		

22.5.8.2 Operation

Projects included in the CIA for operational noise are to the two adjacent Inland Rail projects, H2C and K2ARB. During the operation phase of the Project, the primary source of noise for sensitive receptors within the EIS investigation corridor will be from freight trains traveling on the H2C, C2K, and K2ARB alignments.

Noise from freight trains entering and leaving the C2K Project area from the H2C alignment are not expected to result in a cumulative increase in noise levels at sensitive receptors within the C2K EIS investigation corridor. As the majority of rail freight traffic is anticipated to use the Inland Rail corridor, a cumulative increase in daily railway noise from the C2K Project alignment and the QR West Moreton System is not expected.

At the time of writing, the infrastructure design and future railway operations of the K2ARB Project, which include operation of the existing Interstate Line, are being developed by ARTC. An assessment of potential cumulative impacts from operation the C2K and K2ARB Projects will be in the operational noise assessment prepared as part of the EIS for the K2ARB project.

Overall, cumulative noise impacts during operation of the Project are considered to be of **low significance** (refer Table 22.14).

TABLE 22.14: CUMULATIVE IMPACT ASSESSMENT FOR OPERATIONAL NOISE

Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance
Increased noise levels at sensitive receptors	Probability of the impact	2	6	Low
	Duration of the impact	1		
	Magnitude/intensity of the impact	2		
	Sensitivity of the receiving environment	1		

22.5.9 Social

As the Project is part of the larger Inland Rail Program, cumulative social impacts were considered at local, regional and State and national levels. Both positive and negative cumulative social impacts are possible.

22.5.9.1 Local impacts

The local AOI for the assessment of cumulative social impacts is defined as an approximately 5 km buffer around the alignment. This is the area where the physical interface of multiple projects, and the potential for noise and connectivity issues, is most likely to result in material impacts.

Social impacts may occur where the effects of the Project combine with those of other major projects to affect:

- Connectivity between properties and amenity in relation to the adjoining H2C and K2ARB projects
- Short-term impacts on the amenity of rural properties in the Kagaru area, if construction of the South West Pipeline: Bulk Water Connection to Beaudesert coincided with construction of the Project
- Employment opportunity and regional development, in relation to the Bromelton SDA
- Access to skilled labour, in relation to the combined impacts of all projects listed in Table 22.3 on construction labour availability, primarily during Years 1–2 of Project construction
- The Remondis Waste to Energy Facility is proposed for construction on a site located approximately 30 km east of the Project. An overlap in construction schedules occurs, but information on the Remondis project construction traffic routes is not available to provide any indications of potential cumulative impacts.

Projects that have a large workforce drawn from outside the region but that are staying locally, may combine to impact on health services, social infrastructure, housing stocks, perceptions of community safety and other community qualities. The Project is unlikely to make a large contribution to this as the majority of the construction workforce is expected to be drawn from the existing labour force within the region, returning home each night. There is, however, potential for cumulative labour demands in the Project region to require non-local workers to service the Project's construction. This could lead to demands for short-term accommodation or rental accommodation, as well as an increase in workforce spend in the local community.

During consultation to inform this EIS, residents raised concerns about the potential for cumulative noise impacts associated with the Ipswich Motorsport Precinct to affect the amenity of residents in the Willowbank area. Assessment of cumulative construction noise impacts (refer Section 22.5.8.1) did not identify the potential for this to occur.

It is considered that the potential for short-term cumulative impacts on amenity within the local AOI is likely to be of **low significance** as shown in Table 22.15

The Project may contribute to a shortage of construction labour in the Project region, which could also affect local businesses' access to labour. This impact is considered of **medium significance** (refer Table 22.15). Cumulative impacts on short-term accommodation are also possible and were considered as of **medium significance**. This is discussed further in Sections 22.5.9.2 and 22.5.9.3. ARTC proposes to mitigate its potential contribution to cumulative impacts on skilled construction labour availability through contributions to workforce training and development (refer Chapter 16: Social). Additionally, the sequencing of the construction of ARTC projects will assist in reducing the potential impacts to the local employment market.

22.5.9.2 Regional impacts

The Project and a number of the other projects considered in this assessment would draw construction labour from SEQ. If the five Inland Rail projects located in QLD were to be constructed simultaneously and all projects' workforce peaks coincided, they may require a total labour force of some 2,700 people. In the context of SEQ's construction and trades labour force, this is unlikely to cause a significant adverse impact on other industries access to labour. However, if multiple projects from the list presented in Table 22.3 are constructed in the same timeframe as the Project, there may be a significant draw on trades and construction labour in the Ipswich/Scenic Rim/Toowoomba/Logan region. For example, the RAAF Base Amberley upgrade works are underway, with potential future upgrades to provide unspecified numbers of construction and operational roles.

The ongoing development of SDAs and PDAs may also require significant construction labour forces, requirements for labour from these sectors (e.g. heavy and civil construction) will be common with Inland Rail projects.

Assessment of the cumulative impacts of these competing demands would be speculative at best, particularly as construction personnel are highly mobile, but a requirement for up to several thousand construction personnel to work in the Scenic Rim/Ipswich local government areas (LGAs) during 2021–2026 is a possibility, and there is a potential for cumulative labour demands to affect labour availability in several SEQ LGAs. The current shortage of tradespeople and machinery operators is likely to be exacerbated and potentially constrain domestic and business supply of tradespeople.

If the coincidence of construction phases of several major projects strains the capacity of the construction labour force in the region, this may lead to a requirement for large numbers of non-local personnel to stay locally, with consequent cumulative impacts on housing and social infrastructure (particularly in relation to health and emergency services). ARTC will mitigate its contribution to housing requirements through the requirement for construction contractors for each Inland Rail project to provide an Accommodation Management Plan. There is also potential for the co-incidence of major works affecting roads (e.g. H2C, K2ARB and the Southwest Pipeline) to affect travel times and cause driver frustration in the Project area and wider region. This also is unquantifiable, but if it eventuates, it will need to be considered in relation to driver safety and emergency services access.

With respect to the regional settlement pattern, development of the Ripley Valley PDA and Greater Flagstone PDA will see significant cumulative increases to population in the Ipswich and Logan local government areas. Expansion of the RAAF Base Amberley may also influence the settlement pattern, connectivity or amenity in adjoining areas.

The Project also has potential to catalyse the positive impacts of industrial development by attracting rail-dependent industry to locations such as Ebenezer and facilitating development of intermodal freight facilities (e.g. in relation to the Cunningham Highway). Also, by providing a strategic link between Inland Rail and the Interstate Line, the Project has the potential to contribute to attracting rail-dependent industries to the region. There is therefore potential for significant positive cumulative employment opportunities in the Project region.

22.5.9.3 State and national impacts

The Project is part of the larger Inland Rail Program. The Business Case for Inland Rail (ARTC, 2015a) identifies 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, Program-wide, is anticipated at 100 years of operation (2026–2124). The 10-year delivery schedule for Inland Rail would support economic activity in the regions and create regional jobs in QLD, NSW and Vic. during both construction and operations.

The expansion in the construction sector 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 local area.

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, 2015a).

There is also potential for the cumulative impacts of projects including Cross River Rail, Inland Rail, other major infrastructure projects and resource projects to require significant construction workforces within a similar timeframe, leading to cumulative demands on construction labour across QLD and NSW and, potentially, nationally.

There are multiple uncertainties in relation to timing of major projects and labour availability, so a quantitative assessment has not been attempted. However, there is potential for labour to be drawn from other industries and the range of businesses dependent on construction-related skills and labour.

22.5.9.4 Significance rating

Potential social cumulative impacts are evaluated in Table 22.15. Note that short-term impacts on accommodation and amenity have been assessed in relation to the local AOI; however, impacts on skilled construction labour could occur within the local, regional, State and/or national AOIs, as could the cumulative benefits of employment and business supply opportunities.

TABLE 22.15: CUMULATIVE IMPACT ASSESSMENT FOR SOCIAL IMPACTS

Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance
Potential increase in demands for short-term accommodation or rental accommodation within the Project region	Probability of the impact	2	9	Medium
	Duration of the impact	2		
	Magnitude/intensity of the impact	2		
	Sensitivity of the receiving environment	3		
Skilled construction labour availability primarily during Years 1–2, in relation to the other Inland Rail projects and rail projects being constructed in SEQ. This could eventuate on local, regional, State or national scales	Probability of the impact	2	8	Medium
	Duration of the impact	2		
	Magnitude/intensity of the impact	2		
	Sensitivity of the receiving environment	2		
Potential short-term impacts on amenity within the Project region due to coincidence of construction works	Probability of the impact	1	6	Low
	Duration of the impact	1		
	Magnitude/intensity of the impact	2		
	Sensitivity of the receiving environment	2		
Increase in the availability of construction jobs and supply opportunities for local and regional businesses	Probability of the impact	3	8	Medium
	Duration of the impact	2		
	Magnitude/intensity of the impact	3		
	Sensitivity of the receiving environment	2		

22.5.10 Economics

The following impacts have been considered in the cumulative economic impact assessment: labour market impacts, impacts on local businesses, and supply chain impacts. As with cumulative social impacts, cumulative economic impacts have been considered at local, regional and State and national levels. There is some cross-over between the social and economic impacts particularly at the local and regional level and as a result have been presented in both social and economic sections.

22.5.10.1 Labour-market impacts

The concurrent construction of interfacing Inland Rail projects (i.e. H2C, C2K and K2ARB) has the potential to increase the demand for labour in the local and regional economy, particularly for workers with trade and construction skills. The demand for construction workers within a similar timeframe will lead to cumulative demands on construction labour, not only within the local and regional economy, but also across Queensland and potentially nationally.

The subsequent labour-market impact of this cumulative demand to the local and regional economy will be dependent on the workforce profile and construction schedule of the interfacing Inland Rail projects and the state of the labour market at the time of construction. Given the timing and size of the workforce required to construct and operate the interfacing Inland Rail projects, as well as the current shortage of suitably skilled construction workers at a national level due to significant rail-related infrastructure expenditure in QLD, NSW and Vic., this impact has been assessed as **medium significance** (refer Table 22.16). ARTC proposes to mitigate its potential contribution to cumulative impacts on skilled construction labour availability through contributions to workforce training and development (refer Chapter 16: Social).

Where the local labour market pool is insufficient to meet increasing demand, labour may be imported from other regions of QLD and nationally. Under these conditions, the cost of labour may increase the total construction cost of the Project, adversely impacting on the economic return of the Project and impacting local housing availability but bringing additional income to local businesses.

22.5.10.2 Impacts on local businesses

The expansion in construction activity and employment within the region (with a subsequent increase in temporary and non-resident population) has the potential to increase demand for a range of local infrastructure and services, including housing, health care, childcare, and education. Further, spending on consumer-orientated products by the construction workforce has the potential to benefit local retail businesses by increasing their trading levels.

22.5.10.3 Supply chain impacts

Cumulative supply-chain impacts are likely to be realised where construction timeframes occur concurrently, and comparable material is required (e.g. on the adjacent Inland Rail projects of H2C and K2ARB). Opportunities to supply these projects may include fuels, equipment, borrow and quarried material.

Where materials are sourced within the surrounding regions, increased local expenditure is likely to increase local and regional economic activity. However, should the demand for material surpass the available supply, resulting in a shortage of available material, input costs to the Project may increase due to increased prices of materials. This could drive up the total cost of construction of the Project, and negatively impact on the economic return of the Project.

22.5.10.4 Significance rating

Cumulative economic impacts are evaluated in Table 22.16. Overall, cumulative economic impacts have been assessed as **medium significance**.

TABLE 22.16: CUMULATIVE IMPACT ASSESSMENT FOR ECONOMIC IMPACTS

Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance
Increased demand for local/regional skilled construction labour due to an expansion in construction activity	Probability of the impact	2	8	Medium
	Duration of the impact	2		
	Magnitude/intensity of the impact	2		
	Sensitivity of the receiving environment	2		
Increased demand for local/regional infrastructure and services due to an expansion in construction activity	Probability of the impact	2	8	Medium
	Duration of the impact	2		
	Magnitude/intensity of the impact	2		
	Sensitivity of the receiving environment	2		
Increased demand for local/regional construction materials (e.g. fuels, equipment, borrow and quarried material)	Probability of the impact	1	5	Low
	Duration of the impact	1		
	Magnitude/intensity of the impact	2		
	Sensitivity of the receiving environment	1		

22.5.11 Cultural heritage

22.5.11.1 Non-Indigenous heritage

The potential for cumulative impacts on heritage aspects arises when concurrent or consecutive activities bring about incremental change to heritage places and values. These changes may not be captured in an assessment for any single project, and instead need to be considered on a wider physical and temporal scale (ICOMOS, 2011).

All of the assessable projects identified in Table 22.3 were considered as part of the non-Indigenous heritage CIA for the Project as they were deemed to be within the AOI.

At the time of writing, there was no baseline information available for the K2ARB project. The K2ARB project is a brownfield development and expected to be constructed primarily within a previously disturbed rail corridor. Information on the H2C project was available and has been considered in the cumulative assessment for the Project. There were 56 non-Indigenous heritage sites identified within the cultural heritage study area for the Project (refer Chapter 18: Cultural Heritage) with 30% being impacted. A total of 79 non-Indigenous heritage sites were identified on the H2C project, with 31% being impacted.

The C2K and H2C Inland Rail projects have a similar extent of impact. Depending on the type of mitigation measures implemented, cumulative impacts may result in a change of the character of the region through a reduction in the number and type of historic places, and/or a reduction in the number and diversity of cultural heritage places within the region.

The impacted sites will be subject to a range of potential mitigation measures. Mitigation measures that can be implemented across all of the projects listed in Table 22.3 to minimise the potential cumulative impacts from project interactions on non-Indigenous cultural heritage aspects include:

- Avoidance
- Minimisation
- Archival recording
- Relocation
- Archaeological survey and/or excavation
- Archaeological surface collection.

Based on implementation of the above mitigation measures, the resulting non-Indigenous cumulative impact of the Project is considered of **medium significance** (refer Table 22.17).

TABLE 22.17: CUMULATIVE IMPACT ASSESSMENT FOR CULTURAL HERITAGE

Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance
Loss of cultural heritage sites	Probability of the impact	3	9	Medium
	Duration of the impact	3		
	Magnitude/intensity of the impact	2		
	Sensitivity of the receiving environment	1		

It should be noted that the results of the CIA undertaken for cultural heritage sites and places must be interpreted with caution, not least because they are based (in part) on heritage datasets that are inevitably incomplete and contain various inconsistencies and errors. Godwin (2011), in particular, has questioned the value of CIAs to cultural heritage management in Australia, arguing that the 'fundamentals' necessary for undertaking such assessments simply do not exist. The fundamentals Godwin is referring are robust regional and national data sets for measuring proposed impacts and the determination of acceptable scientific and cultural impact thresholds.

22.5.12 Traffic, transport and access

The potential for traffic generation from other developments in the region at planning, design or construction stages were considered as part of the traffic and transport CIA. This was undertaken to ensure that the combined impacts of the assessable projects (refer Section 22.4) were thoroughly considered, to enable stakeholders to make informed decisions. The AOI for the traffic, transport and access CIA included the road network likely to be affected by more than just the Project. This included the road network envisaged for the transport of workforce, materials and equipment during the construction and operational phases of the Project.

All of the projects listed in Table 22.3 were considered to have potential cumulative impacts in combination with the Project due to overlapping construction schedules leading to increased traffic and congestion on certain roads within the region. The only exception was the Cross River Rail project, which was discounted from the traffic and transport cumulative impact assessment due to the distance between the Cross River Rail and the Project.

Two types of cumulative impacts were included in this assessment:

- Temporal impacts—the potential for works to occur on multiple projects at the same time
- Spatial operational impacts—the potential for works to occur on multiple projects in the same area, that is similar construction routes.

The C2K, K2ARB and H2C projects overlapping construction schedules and proposed construction routes might create increases in construction traffic volumes. However, in relation to the K2ARB project, the impact of construction traffic (i.e. construction traffic routes, estimated construction traffic volumes) was not considered as this level of assessment was yet to be undertaken for this project.

In relation to the Bromelton SDA, work is in progress on this project; however, construction traffic will be marginal as the duration of development for the project spans up to 15 years, and therefore not concentrated when the Project is to be constructed. Similarly, the Greater Flagstone PDA will be constructed in stages spanning up to 30 years, and construction on the Ripley Valley PDA is expected to occur over 22 years. Therefore, traffic impacts from these projects are not likely to be exacerbated by or significantly impact the Project.

In relation to the South West Pipeline: Bulk Water Connection to Beaudesert, an overlap of construction schedules occurs but impact of construction traffic (i.e. construction traffic routes, estimated construction traffic volumes) cannot yet be determined as the project start date is not confirmed.

Upgrade works are in progress at the RAAF Base Amberley; therefore, traffic and transport impacts currently generated by this project have been included in the impact assessment for traffic and transport presented in Chapter 19: Traffic, Transport and Access. In the future, it is anticipated there will be an overlap of construction schedules and therefore cumulative increases in construction traffic volumes.

In relation to the Remondis Waste to Energy Facility, an overlap in construction schedules occurs but the impact of this construction traffic (i.e. construction traffic routes, estimated construction traffic volumes) cannot yet be determined as the proponent is awaiting the draft terms of reference.

As each of these projects have an overlap in construction schedules and potentially proposed construction routes, the cumulative traffic and transport impacts on the wider transport network are considered to be of **medium significance** (refer Table 22.18).

TABLE 22.18: CUMULATIVE IMPACT ASSESSMENT FOR TRAFFIC AND TRANSPORT

Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance
Increase in construction traffic volumes and number of vehicles using the same construction traffic routes	Probability of the impact	3	9	Medium
	Duration of the impact	2		
	Magnitude/intensity of the impact	2		
	Sensitivity of the receiving environment	2		

In relation to the H2C project, the proposed mitigation measures for the Project relating to safety, intersection impacts, link road impacts, pavement impacts and road rail interface impacts are considered sufficient to mitigate for the cumulative impacts that will result from the interaction between these two projects during both construction and operation.

Specific mitigation measures that can be implemented across all of the projects listed in Table 22.3 to minimise the potential exacerbation of impacts on traffic and transport aspects as a result of interactions between the projects include:

- Construction traffic management plans
- Ongoing consultation with affected parties
- Road use management plans
- Travel demand management campaigns.

22.5.13 Hazard and risk

In relation to hazard and risk the projects considered to have a potential for cumulative impacts with the Project have been identified as K2ARB and H2C.

Given the similar nature of the K2ARB, H2C and C2K projects, the key risks considered in the CIA are:

- Loss of containment of dangerous goods during freight transport
- Impacts on the local environment and future projects from the potential use of explosives for tunnel construction
- The other risks identified in Chapter 20: Hazard and Risk were considered in the CIA in other technical areas, for example potential flooding impacts are presented in Section 22.5.6 Surface water quality and hydrology.

22.5.13.1 Loss of containment of dangerous goods

Due to the nature of the potential risks associated with hazardous chemicals, storage of these chemicals can have offsite impacts, depending on the quantities and types of materials to be stored.

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

- Temporal construction impacts: the requirements for dangerous goods laydown areas, sensitivity of environmental conditions (e.g. extreme weather or potential bushfire events) and an increase in workforce and machinery operating on adjoining projects at the same time
- Spatial operational impacts; the residual impact of freighting dangerous goods on Inland Rail to sensitive receptors.

During construction, the expected quantities of hazardous chemicals are not considered sufficient to introduce significant offsite impacts or have the potential to contribute to cumulative impacts at the local, regional or national levels. 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 dangerous goods.

The development of passenger transport trunk infrastructure within the Greater Flagstone PDA may also overlap with the Project resulting in an increase of workforce and transportation of construction materials. However, the duration of these activities will be only temporary and the potential for hazardous chemicals transportation collision, developing into a societal and environmental impact is considered to be of **low significance** (refer Table 22.19).

The potential for cumulative impacts during operations are associated with dangerous goods freight. Freight transport of dangerous goods through the Teviot Range tunnel, rail over road or river bridges and within the vicinity of developing areas of Ripley Valley PDA, Greater Flagstone PDA and Bromelton SDA have the potential for cumulative impacts. The sharing and uses of infrastructure increases the number of interactions between live trains and the local community and the environment, which in turn has the potential to increase the societal risks.

The hazard and risk AOI with respect to the risk of loss of containment of dangerous goods is considered to be limited to within, or in close proximity to, the C2K rail corridor. As such, the non-ARTC projects listed in Table 22.3 are considered to be outside of the AOI. Therefore, the significance of the cumulative impact assessment of loss of containment of dangerous goods associated with the project is also likely to be of **low significance** (refer Table 22.19).

22.5.13.2 Blasting and explosion

The potential use of explosives for construction of the tunnel through the Teviot Range has potential cumulative impacts to the environment. The amount of explosives used, and the timing and duration of blasting are critical to ensure safe and controlled blasting works.

For instance, blasting failures and improperly conducted blasting works have the potential to create unstable land and may cause damage to surrounding structures, including road and rail assets. The presence of controls described in Chapter 20: Hazard and Risk will limit the potential for blasting failures and control the risk of cumulative impacts. A number of non-ARTC projects could potentially coincide during the construction phase of the project; however, due to the anticipated construction dates and the distance between non-ARTC projects and the Project, it can be expected that the cumulative impacts will be of **low significance** (refer Table 22.19).

TABLE 22.19: CUMULATIVE IMPACT ASSESSMENT FOR HAZARD AND RISK

Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance
Loss of containment of dangerous goods	Probability of the impact	1	5	Low
	Duration of the impact	2		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	1		
Blasting failures or improperly conducted blasting works creating unstable land and causing damage to surrounding structures, including road and rail assets	Probability of the impact	1	5	Low
	Duration of the impact	1		
	Magnitude/intensity of the impact	2		
	Sensitivity of the receiving environment	1		

22.5.14 Waste and resource management

The construction of the Project will generate a number of waste streams that will be managed by maximising opportunities to avoid or reduce, re-use and recycle. However, there will be waste streams where this cannot be achieved, and they will be disposed of at appropriately licensed facilities. With the exception of spoil, which is not proposed to be disposed within the existing waste management system that services the region, the waste quantities produced have been assessed as insignificant (i.e. less than 10% increase from the currently produced volumes) and will be managed through the existing system with little to no measurable impact.

The assessment has identified that the Project and neighbouring projects will generate large volumes of spoil as a result of required earthworks and tunnelling activities. It is acknowledged that, in the future, detailed design and execution phases of the Project and adjacent Inland Rail projects there will be opportunities to optimise the use and placement of spoil material outside of the extent of each individual project. As part of this assessment it has been conservatively assumed that each project will manage the spoil in isolation.

The assessment does not advocate the disposal of spoil to existing landfill facilities but seeks the beneficial use of the material for mine/quarry rehabilitation or other suitable use. Spoil may be advantageously used by existing waste management facilities for use as day, interim or final cover soils depending on timing of production and the status of existing stockpiles at these facilities. This will require consultation with operators in proximity to the Project and assessment of their operational needs.

Cumulative impacts arising from waste management activities on surrounding environmental aspects and sensitive receptors will largely be the product of waste disposal adversely affecting airspace consumption of local waste management infrastructure, thereby reducing the local community's access to such services. However, as described above, the effects have been assessed as insignificant in this instance. If spoil is disposed of in existing waste infrastructure, it could detrimentally affect the available airspace; however, if used as cover soils, the impact would be immaterial as this would be an offset for onsite stockpiles and considered part of normal landfill site operations or closure activities.

The projects considered to have a potential for cumulative impacts relating to waste and resource management are those with an overlapping construction timeframe and potential for shared demand on existing waste management facilities.

In this context, the projects that may result in cumulative impacts have been identified as:

- K2ARB—potential for construction and operational phase interactions
- H2C—potential for construction and operational phase interactions
- Remondis Waste to Energy Facility—potential for construction and operational phase interactions.

The K2ARB and the H2C projects are part of the broader Inland Rail Program. Therefore, despite the potential for cumulative impacts on receiving waste management facilities, ARTC will be able to liaise with the relevant operators to negotiate appropriate waste disposal arrangements across the three Inland Rail projects. Therefore, the risk of cumulative impacts from the interaction of these projects is considered to be of **low significance** (refer Table 22.20).

Waste generation during construction of the Remondis Waste-to-Energy Facility is anticipated to be dominated by construction wastes (negligible demolition anticipated) and, in the context of SEQ construction and demolition waste generation, the volume anticipated is expected to be insignificant (<5 per cent). As the construction workforce is expected to be locally sourced, a negligible increase in municipal waste generation would be expected. A benefit of the Remondis facility is that it reduces the volume of waste entering the pre-existing infrastructure (e.g. landfill) and will therefore be reducing pressure on existing landfill airspace constraints. As a result, cumulative impacts related to waste are considered to be **negligible** or **insignificant**.

Similarly, with regard to spoil disposal, it is expected that the construction and execution teams on the neighbouring Inland Rail projects will coordinate to minimise the volume of spoil considered unsuitable for use on the projects and will use it wherever possible within their project footprints. Therefore, the risk of cumulative impacts from the interaction of these projects from a spoil perspective is considered to be of **medium significance** (refer Table 22.20).

The Brisbane City Council-operated Rochedale Landfill is scheduled to close in 2023. As a result, additional pressure will be placed on existing waste management facilities within the waste AOI. It is anticipated that the diversion of waste to Swanbank Waste Management Facility and Ti Tree Bioenergy will increase.

The magnitude of the cumulative impacts of these projects will be refined as the detailed design for each project progresses, post-EIS. When construction facility locations and intensity of use is better understood, the potential waste production may be assessed against proposed receival and disposal locations. The assessment will therefore investigate the waste and resource management infrastructure that is least susceptible to being capacity constrained.

TABLE 22.20: CUMULATIVE IMPACT ASSESSMENT FOR WASTE MANAGEMENT

Impact	Impact characteristic	Relevance factor	Sum of relevance factors	Impact significance
Increased waste generation and airspace consumption of local waste management infrastructure, thereby reducing the local community's access to such services.	Probability of the impact	2	5	Low
	Duration of the impact	1		
	Magnitude/intensity of the impact	1		
	Sensitivity of the receiving environment	1		
Spoil disposal if required outside of the project footprint.	Probability of the impact	3	9	Medium
	Duration of the impact	2		
	Magnitude/intensity of the impact	3		
	Sensitivity of the receiving environment	1		

22.6 Summary of residual cumulative impacts

The CIA of the Project considered nine projects within a wide geographic extent that have the potential to contribute to cumulative impacts. Spatial areas of influence as well as temporal overlaps of project activities were considered for the environmental aspects assessed in Chapter 8 to Chapter 21.

The assessment concludes that the impacts from the Project, combined with other considered existing and proposed projects, have potential cumulative impacts that are considered of **low to medium significance** for the various environmental aspects that were assessed (refer Table 22.21).

TABLE 22.21: PROJECTS INCLUDED IN THE CUMULATIVE IMPACT ASSESSMENT FOR EACH ENVIRONMENTAL ASPECT AND OVERALL CUMULATIVE IMPACT SIGNIFICANCE

Projects included in the cumulative impact assessment for each environmental aspect	Land use and tenure	Landscape and visual amenity	Land resources	Flora and fauna	Air quality	Surface water and hydrology	Groundwater	Construction noise and vibration	Operational noise and vibration	Social	Economics	Cultural heritage	Traffic transport and access	Hazard and risk	Waste and resource management
K2ARB	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
H2C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Greater Flagstone PDA	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓		
Bromelton SDA	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓		
Ripley Valley PDA	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓		
South West Pipeline: Bulk Water Connection to Beaudesert		✓		✓	✓	✓				✓	✓	✓	✓		
RAAF Base Amberley future works		✓			✓	✓				✓	✓	✓	✓		
Cross River Rail										✓	✓	✓	✓		
Remondis Waste to Energy Facility		✓			✓					✓	✓	✓	✓		✓
Overall cumulative impact significance	Low	Med	Low	Med	Low	Low	Low	Low	Low	Med	Med	Med	Med	Low	Med

22.7 Conclusions

The assessment of cumulative impacts has considered all relevant existing and proposed projects for which data was available.

Potential cumulative impacts on environmental aspects were considered of low significance, with the exception of potential cumulative impacts on the following environmental aspects:

- Landscape and visual amenity
- Flora and fauna
- Cultural heritage
- Waste and resource management
- Skilled labour supply
- Traffic and transport.

It is considered that potential cumulative impacts associated with the loss of biodiversity and cultural heritage aspects within the respective AOIs are common to all projects included in the CIA; therefore, these impacts are cumulative by nature. Similarly, projects included in the landscape and visual amenity CIA are likely to exacerbate impacts from the Project through combined, successive and sequential views of adjoining projects.

The potential cumulative impacts associated with spoil disposal when considering the Inland Rail projects in isolation is recognised as being greater than low significance. It is, however, expected that in the detailed design and execution phases, the adjacent Inland Rail projects will coordinate spoil management and reduce the volumes required to be disposed outside the project areas.

The expansion in construction activity and employment within the region (with a subsequent increase in temporary and non-resident population) has the potential to increase demand for a range of local infrastructure and services, including housing, health care, childcare, and education. Further, spending on consumer-orientated products by the construction workforce has the potential to benefit local retail businesses by increasing their trading levels.

All projects included in the CIA have overlapping construction schedules. This is likely to increase traffic and congestion on certain roads within the traffic AOI, as well as decrease the availability of skilled labour over the short term.

Due to the nature of projects included in the CIA (i.e. mostly coordinated or otherwise assessable rail and road upgrades and high-density industrial infrastructure development), it is anticipated that this process of assessing potential cumulative impacts will occur for all projects. That is, each of projects will be required to mitigate and manage potential cumulative impacts to acceptable levels.

The key mitigation measures to reducing the potential cumulative impacts of the Project identified within this chapter are presented within the mitigation measures sections of Chapter 8 to Chapter 21 and within Chapter 23: Draft Outline Environmental Management Plan.

The proposed combined delivery approach for the Gowrie to Helidon, H2C and C2K Projects provides opportunities to coordinate the management of cumulative impacts generated as a result of construction traffic movements, workforce requirements, spoil management and reuse, and identification and protection of environmental offsets. These aspects will be considered collectively across these three projects in future delivery stages.