CHAPTER 05

Project Description

INLAND RAIL—BORDER TO GOWRIE 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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5. Project Description

This chapter describes the Inland Rail—Border to Gowrie Project (the Project), the subject of this draft EIS.

5.1 Overview of the Project

The Project is a 216.2 km section of new single-track railway between the NSW/QLD border and Gowrie, in Queensland. The Project is comprised of 7 km of standard-gauge rail (1,435 mm) and 209.2 km of dual standard/narrow-gauge rail (1,435 mm standard and 1,067 mm narrow). The new railway will be positioned within approximately 145 km of new rail corridor (greenfield) and approximately 71.2 km of existing rail corridor (brownfield), currently used by QR's South Western Line and Millmerran Branch Line.

The Project commences at Ch 30.60 km (North Star to NSW/QLD Border (NS2B)) at the NSW/QLD border, the median point of the Macintyre River, approximately 18 km southeast of Goondiwindi. The Project runs northeast via Yelarbon, Inglewood, Millmerran, Pampas, Brookstead, Pittsworth, Southbrook and the Toowoomba Wellcamp Airport to Ch 206.95 km at Gowrie Junction, northwest of Toowoomba.

The Project is one of the missing links within the Inland Rail Program. As part of the broader Inland Rail Program, the Project provides a more direct route between Melbourne and Brisbane in comparison with the existing inland and coastal road and rail networks, and meets the Federal Government's objective of providing a long-term rail solution for competitive freight movement. Further details on the justification for the Project are provided in Chapter 2: Project Rationale.

At the commencement of operation, the Project will accommodate the use of double-stacked 1,800 m long trains, with future provision to accommodate trains up to 3,600 m.

5.1.1 Project terms

Throughout this draft EIS, the Project is described in terms of:

- Study area
- Focused area of investigation
- Rail corridor
- Project footprint, including permanent and temporary components
- Impact assessment area.

The study area that was identified during the concept planning phase of the Project and provided to the Australian Rail Track Corporation (ARTC) by the Federal Government is nominally 2 kilometres (km) wide. The study area formed the basis of ARTC's application to the Queensland Coordinator-General for gazettal of the Project as a 'coordinated project' under the *State Development and Public Works Organisation Act 1971* (QLD), as documented in the initial advice statement (IAS) (ARTC, 2018a).

In mid-2018, the community requested ARTC to provide more clarity about how the Project will impact landowners. In response to the community's request, ARTC identified the focused area of investigation from preliminary results of planning, environmental and engineering investigations. The focused area of investigation, although narrower than the 2-km wide study area in most parts, varied in width depending on the location, constraints and results from the initial design investigations.

Further, more detailed technical investigations enabled the final rail corridor (nominally 40 m wide, dependent on landform and infrastructure) to be identified. If the Project is approved to proceed, it is ARTC's intention that the nominated rail corridor be gazetted as future railway land by the Queensland Government.

The Project footprint is the land required to accommodate all permanent and temporary components of the Project, being:

- Permanent footprint: land required to accommodate rail infrastructure, road infrastructure, earthworks, rail maintenance access roads and drainage. These components are described in Section 5.2.
- Temporary footprint: land required to accommodate temporary construction-phase activities, facilities and movements. These components are described in Sections 5.3 and 5.4.

The impact assessment area is defined as the wider area including and surrounding the Project, with the potential to be directly or indirectly affected by the Project (for example, by noise and vibration, visual or traffic impacts). The actual size and extent of the impact assessment area varies according to the nature and requirements of each specific matter. The impact assessment area adopted for the assessment of each specific matter is defined in the corresponding chapters, Chapter 7 to Chapter 20.

5.1.2 Relationship to other Inland Rail projects

The Project is one of 13 projects that make up the Inland Rail Program for the delivery of 1,700 km of freight rail line. It is one of five Inland Rail projects in Queensland. The Project connects directly to the NS2B project in the south and the Gowrie to Helidon (G2H) project in the northeast.

Refer to Chapter 2: Project Rationale for more detailed discussion regarding the relationship of the Project to other projects, including those in the Inland Rail Program.

5.1.3 Corridor selection

The nominated rail corridor, as shown on design drawings in Volume 3 of the draft EIS, is the product of corridor selection studies, multi-criteria analysis and iterative optimisation and refinement through the development of the reference design. The corridor selection process considered the following aspects:

- Compliance with the Basis of Design (refer Section 5.2.1)
- Maximising use of existing rail corridors
- Minimising use of private land
- Minimising severance of land parcels
- Avoiding sensitive environmental and social areas
- Avoiding challenging topography and geological conditions
- Minimising the number of watercourse crossings
- Minimising the number of interfaces with existing infrastructure
- Minimising impact to existing commercial and agricultural operations
- Optimising railway operation.

Alternative route options considered for the Project are discussed in Chapter 2: Project Rationale.

5.1.4 Key components

Key components of the Project can be attributed to either the construction or operational phase. The key components of the Project during the pre-construction and construction phases are summarised in Table 5.1 and the key components of the operational phase are summarised in Table 5.2.

Quantities specified here are reflective of the reference design for the Project and may be subject to change through the detail design and construction process.

TABLE 5.1 KEY REFERENCE DESIGN COMPONENTS (PRE-CONSTRUCTION AND CONSTRUCTION PHASES)

Component	Quantity
Non-resident workforce accommodation camps	3
Bridge laydowns	35
Track laydown areas	39
Cut volume (total)	12,525,037 cubic metre (m^3) (rail and road)
Maximum cut depth	29.7 m
Fill volume (total)	12,250,669 m^3 (rail) 1,096,670 m^3 (road)
Maximum fill depth	24.5 m
Bridge crossings	34
Bridge length (total)	11,653 m
Culverts	Reinforced concrete box culverts: 928 cells in 120 locations Reinforced concrete pipes: 1,553 pipes in 212 locations
Concrete batching plants	2 sites nominated. Only one expected to be required.
Flash-butt welding facilities	1 site nominated. If a second is desirable, opportunities to share the flash-butt welding facility established for the adjoining G2H project will be explored.
Refuelling	150,000 litres (L) storage capacity, distributed across 12 sites.

TABLE 5.2 KEY REFERENCE DESIGN COMPONENTS (OPERATIONAL PHASE)

Component	Quantity
Rail length (Ch 30.60 km (NS2B) to Ch 206.95 km)	Standard gauge: 7.0 km Dual gauge: 209.2 km Total: 216.2 km

Rail interfaces (tie-ins):
▸ QR South Western Line:
  ▸ Connection at Kildonan, towards Goondiwindi
  ▸ Connection at Whetstone, towards Warwick
  ▸ Turnouts to existing sidings and loops (six locations).
▸ QR Millmerran Branch Line:
  ▸ Connection at Millmerran
  ▸ Connection at Yarranlea
  ▸ Turnouts to existing sidings (two locations)
	12

State-controlled road interfaces: ▸ Active level crossing ▸ Grade separation: rail-over-road ▸ Grade separation: road-over-rail	7 roads in 9 locations 2 5 2

Local government road interface treatments:
▸ Goondiwindi Regional Council
  ▸ Passive level crossing
  ▸ Active level crossing
  ▸ Grade separation: rail-over-road
  ▸ Grade separation: road-over-rail
▸ Toowoomba Regional Council
  ▸ Passive level crossing
  ▸ Active level crossing
  ▸ Grade separation: rail-over-road
  ▸ Grade separation: road-over-rail
	
	8
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	1

Crossing loops	5, located as follows: ▸ Loop 1—Yelarbon ▸ Loop 2—Inglewood ▸ Loop 3—Kooroongarra ▸ Loop 4—Yandilla ▸ Loop 5—Broxburn

The Project crosses the full width of 15 major waterways (stream order ≥ 3) and 66 minor waterways (stream order < 3). The major waterways that are crossed by the Project are as follows:

- Grasstree Creek—at Ch 13.5 km
- Pariagara Creek—at Ch 67.2 km
- Cattle Creek—at 88.2 km
- Back Creek—at Ch 97.4 km
- Bringalily Creek—at Ch 97.4 km
- Nicol Creek—at Ch 104.3 km
- Back Creek drainage feature—at Ch 126.7 km and Ch 127.9 km
- Condamine River (Main Branch)—at Ch 142.9 km
- Condamine River (North Branch)—at Ch 148.7 km
- Umbiram Creek drainage feature—at Ch 185.9 km
- One Mile Creek drainage feature—at Ch 191.8 km
- Westbrook Creek—at Ch 188.7 km and Ch 197.2 km
- Dry Creek—at 197.8 km

The Project does not include a full-width crossing of the Macintyre River and therefore it is not included in this tally.

The Project traverses, in part, floodplains associated with the following watercourses:

- Macintyre River
- Macintyre Brook
- Pariagara Creek
- Cattle Creek
- Native Dog Creek
- Bringalily Creek
- Nicol Creek
- Back Creek
- Condamine River
- Westbrook Creek and Dry Creek
- Gowrie Creek.

There are no Wetlands of International Importance (Ramsar wetlands) within 10 km of the Project footprint. Multiple palustrine wetlands along the Project alignment have been identified in the Queensland Referable Wetland Mapping as being of high ecological significance, as recognised under the Environmental Protection Regulation 2019 (EP Regulation). The high ecological significance wetlands in proximity to the Project are associated with Brigalow Creek, Canning Creek and the Condamine River. While the wetlands are in proximity to the Project, there is limited intersection between the Project footprint and any high ecological significance wetland.

The key features of the Project are shown in design drawings presented in Volume 3 of this draft EIS. Each of the key components during construction and operation are described further in Section 5.3 to Section 5.7.

5.1.5 Environmental design

Environmental design requirements were considered and assessed through the corridor selection process for the Project (refer Section 5.1.3). Corridor selection accounted for environmental constraints in the identification of options and subsequent multi-criteria analysis (refer Chapter 2: Project Rationale).

For the reference design, criteria (refer Section 5.2.1) were established to guide design development, while avoiding or minimising environmental and social impacts. Development of the reference design has progressed in parallel with the impact assessment process. As a result, design solutions for avoiding, minimising or mitigating impacts have been incorporated into the reference design as appropriate and where possible.

Potential impacts that have been avoided or mitigated through the development of the reference design are identified in the impact assessment discussions included in Chapter 7 to Chapter 20 of this draft EIS.

Environmental design requirements for the Project are presented in Chapter 22: Outline Environmental Management Plan.

5.1.6 Cost and timing

The estimated capital expenditure for the Project is approximately $1.1 billion (ARTC, 2019)[1]. This is due to its length, total earthworks, number of road–rail interfaces and structures, particularly those that are required to cross the Condamine River floodplain.

The anticipated timing of phases for the Project are shown in Table 5.3. Early works are scheduled for commencement in 2021, with construction scheduled to be completed by the beginning of 2026. Inland Rail, and the Project, are scheduled to be operational in 2026.

TABLE 5.3 ANTICIPATED TIMING OF PROJECT PHASES

Year	2020		2021				2022				2023				2024				2025				2026		
Quarter	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
Detail design																									
Pre-construction and early works																									
Construction																									
Commissioning																									
Operation																									

1. The EIS includes an estimated capital cost profile of approximately $1.1 billion, consistent with the Inland Rail Programme Business Case (ARTC, 2015a) and is an estimate of direct construction costs—including, but not limited to: delivering environmental and heritage commitments; fencing and earthworks; tunnels and tunnel services; formation and roadworks; structures; track works (loops and crossings); delivery works (incidentals and utilities); and supply of track, sleepers and turnouts.
The Project is expected to represent an investment of up to $1.4 billion—this figure includes both direct construction costs and indirect costs. Indirect costs include items such as: design services, Contractor overhead and margins, contingency, and escalation. The total investment figure also includes ARTC Program costs such as project management, train control systems, property requirements and insurances. The total investment figure makes provision for expected Project contingency and risk.
Further detail on the economic impact assessment is located in Chapter 16: Economics and Appendix V: Economic Impact Assessment Technical Report.

5.1.7 Property and tenure

The rail alignment has been intentionally located to use the existing South Western Line and Millmerran Branch Line rail corridors where possible, minimising the extent of 'new' properties to be acquired. Between the NSW/QLD border and Gowrie the permanent footprint for the Project encompasses, in whole or in part, 440 properties and 34 easements. The temporary footprint encompasses, in whole or in part, 542 properties and 43 easements. The easements encroached on by the Project footprint have been established for one or more of the following purposes:

- Of right of way for access
- For drainage or sewerage reticulation
- For water storage/supply
- For electricity transmission.

The extent of the area associated with these properties and easements within the Project footprint, as well as tenure and existing land uses of these properties is shown in Appendix V: Impacted Properties.

The Project has the potential to result in direct and permanent impacts to land use and tenure within the Project footprint, with the majority of impacts occurring on commencement of land acquisition and construction. Potential impacts to land use and tenure associated with the Project are assessed in Chapter 7: Land Use and Tenure.

5.1.8 Potential sensitive receptors

Sensitive receptors can be a place, natural feature, structure, person or organism that is susceptible to impact. Throughout this draft EIS, sensitive receptors are identified for the purpose of establishing the likelihood and consequences of potential impacts. Sensitive receptors differ between specific matters. For example, a sensitive receptor to operational railway noise impacts will be different to a sensitive receptor for groundwater impacts. As a result, sensitive receptors have been identified for each specific matter, where relevant, and are discussed in the corresponding chapters of this draft EIS.

5.2 Reference design

The following section describes the key components of the reference design for the Project.

Design drawings for the Project are presented in Volume 3 to this draft EIS to provide locational context for the Project components described in this section.

5.2.1 Basis of Design

The key characteristics of the Inland Rail Program service offering are reliability, price, transit time and availability. To help achieve this service offering ARTC has developed a Basis of Design to provide consistent design requirements and parameters across the Inland Rail Program. The standardised design criteria provide guidance for consistent design, ensuring an asset is delivered that meets business and operational requirements.

The Basis of Design acts as a primary point of reference for the design of the Project, forming a baseline for design criteria and design standards. The Basis of Design consists of a series of performance specifications relating to Project design components. Performance specifications for Inland Rail and the Project are summarised in Table 5.4.

TABLE 5.4 PERFORMANCE SPECIFICATIONS FOR INLAND RAIL AND THE PROJECT

Attribute	Specification
Reference train	
Intermodal	▸ 21-tonne axle load (TAL), 115 kilometres per hour (km/h) maximum speed, 1,800 m length (initial) ▸ 2.7 horsepower per tonne (hp/tonne) power:weight ratio
Bulk freight	25 TAL (initial), 80 km/h maximum speed, length determined by customer requirements within maximum train length
Operational specification	
Freight train transit time (terminal to terminal)	Target is driven by a range of customer preferences; but, less than 24 hours from Melbourne to Brisbane for the intermodal reference train Flexibility to provide for faster (higher power:weight ratio) and slower (lower power:weight ratio) services to meet market requirements
Gauge	Standard (1,435 mm) with dual standard/narrow (1,435 mm/1,067 mm) gauge in appropriate Queensland sections
Maximum freight operating speed	115 km/h at 21 TAL
Maximum axle loads (initial)	▸ 21 tonnes at 115 km/h ▸ 23 tonnes at 90 km/h ▸ 25 tonnes at 80 km/h
Maximum train length	1,800 m (initial), with potential for operation of 3,600 m trains
Minimum design standards	
General alignment standards	
Design speed	115 km/h
Maximum grade	▸ 1:100 target, 1:80 maximum (compensated) ▸ 1:200 maximum at arrival or departure points at loops
Curve radius	1,200 m target, 800 m minimum
Flood immunity	Track drainage must have the capacity for a 1% AEP without overtopping the formation
Medium speed alignment standards (mountainous terrain)	
Design speed	80 km/h minimum
Maximum grade	▸ 1:100 target, 1:50 maximum (compensated) ▸ 1:200 maximum at arrival or departure points at loops
Curve radius	800 m target, 400 m minimum
Corridor width	40 m minimum
Rail	Minimum 53 kg/m on existing track; 60 kg/m on new or upgraded track
Concrete sleepers	Rated to 30 TAL
Sleeper spacing	▸ 667 mm spacing (1,500/km)—existing track ▸ 600 mm (1,666/km)—new corridors/track or re-sleepering existing track
Turnouts	Rated at track speed on the straight and 80 km/h entry/exit on the diverging track
Crossing loops (initial)	▸ 1,800 m (clearance point to clearance point) plus signalling overlap ▸ No level crossing across loops or within road vehicle sighting distance from loops
Future proofing	
Train length	To provide for future extension of maximum train length to 3,600 m
New structures	Capable of 30 TAL at 80 km/h minimum
Formation	Formation on new track suitable for 30 TAL at 80 km/h
Crossing loops	Loops designed and located to allow future extension for 3,600 m trains
Reliability and availability	Competitive with road

5.2.2 Rail

The Project includes the establishment of 216.2 km of new single-track railway, consisting of 7 km of standard-gauge rail (1,435 mm) and 209.2 km of dual standard/narrow-gauge rail (1,435 mm/1,067 mm). Figure 5.1 shows a typical section for a standard-gauge ballasted track. Figure 5.2 shows a typical section for a dual-gauge ballasted track.

The 7 km of standard-gauge rail is a continuation of track from the NS2B project and extends from the QLD/NSW border to the connection point with the South Western Line at Kurumbul. The remainder of railway for the Project will be dual standard/narrow-gauge to enable interoperability with the existing QR network.

The Project requires establishment of approximately 145 km of new rail corridor (greenfield) and use of approximately 71.2 km of existing rail corridor (brownfield), specifically the South Western Line and the Millmerran Branch Line, which are components of QR's South Western System. The Millmerran Branch Line is currently non-operational south of Brookstead as a result of damage sustained in the 2010/11 flood events.

Brownfield corridor refers to locations where the Project is generally coincident with existing rail corridors. This does not mean that the railway is located wholly within the existing rail corridor. Corridor widening and/or curve easing is generally required to meet the requirements of the ARTC Basis of Design, resulting in some works outside the extent of the existing rail corridors.

The locations of greenfield and brownfield sections of rail corridor for the Project are summarised by chainage in Table 5.5 and are shown in Figure 5.3. Track and corridor metrics for the Project are summarised in Table 5.6.

TABLE 5.5 CHAINAGE RANGES OF GREENFIELD AND BROWNFIELD SECTIONS OF RAIL CORRIDOR

Chainage from (km)	Chainage to (km)	Length (km)	Gauge	Greenfield/Brownfield
30.60 (NS2B)	37.60 (NS2B)	7.00	Standard	Greenfield
37.60 (NS2B)	44.55	46.81	Dual	Brownfield—South Western Line
44.55	137.98	93.43	Dual	Greenfield
137.98	162.41	24.43	Dual	Brownfield—Millmerran Branch Line
162.41	206.95	44.54	Dual	Greenfield

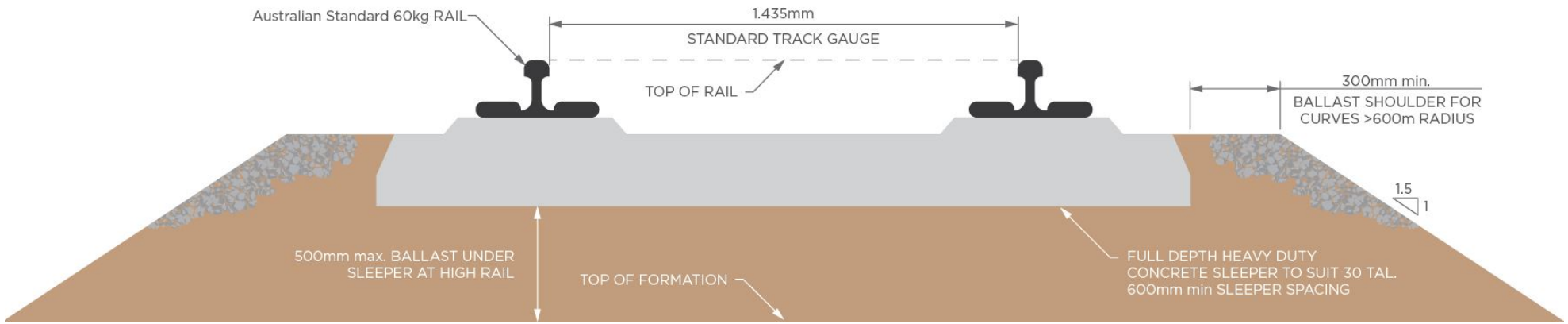

FIGURE 5.1 TYPICAL STANDARD-GAUGE BALLASTED TRACK CROSS-SECTION

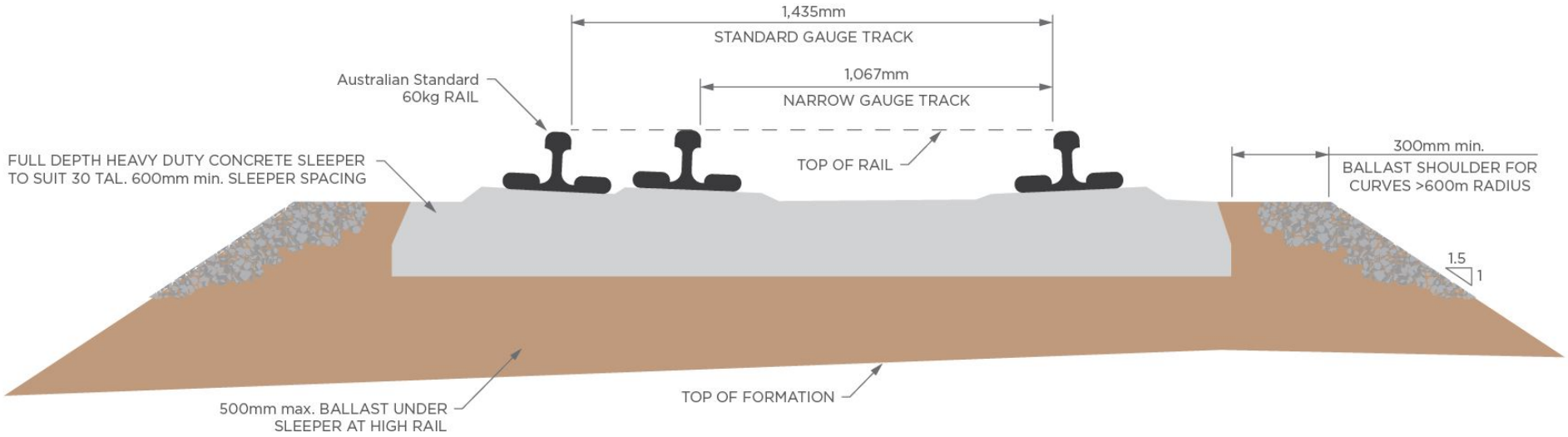

FIGURE 5.2 TYPICAL DUAL-GAUGE BALLASTED TRACK CROSS SECTION

TABLE 5.6 TRACK AND CORRIDOR METRICS

Track and corridor aspects	Length (km)
Total length of mainline track	216.2
Total standard gauge track	7.0
Total dual gauge track	209.2
Total greenfield corridor length	145.0
Total brownfield corridor length	71.2
Total length of crossing loops (five)	11.0

The track structure will be a ballasted track system (including bridges) consisting of continuously welded rail, resilient fasteners, rail pads and concrete full-depth sleepers at 600 mm centres.

The ballast depth below the low rail will be a minimum 250 mm and will not exceed 500 mm, with minimum 300 mm shoulder width for lateral restraint (refer Figure 5.1 and Figure 5.2).

The various elements of the track are further described in Table 5.7.

FIGURE 5.3 GREENFIELD AND BROWNFIELD SECTIONS OF THE PROJECT RAIL CORRIDOR

TABLE 5.7 ELEMENTS OF THE TRACK

Elements	Description and purpose
Rails	▸ Continuously welded 60 kg/m steel rails. ▸ Due to there being fewer joints, trains can travel faster on continuously welded steel rails than on jointed rails. Continuously welded rails also require less maintenance.
Fasteners	▸ Fasteners are the method of fixing the rails to the sleepers.
Rail pads	▸ Rail pads are plastic or rubber mats that are inserted between the rails and the sleepers. Their purpose is to evenly distribute the load from passing trains onto the sleepers. ▸ Rail pads also act to reduce noise and vibration impacts from passing trains.
Sleeper	▸ Concrete rectangular sleepers, laid perpendicular to the rails. ▸ Sleepers distribute the load from passing trains to the ballast and subgrade. They also function to hold the rails upright and keep them spaced to the correct gauge.

Ballast	▸ Ballast typically consists of crushed stone that is packed between, below and around the sleepers.
	▸ The purpose of the ballast is to:
	  ▸ Bear the load from the sleepers
	  ▸ Hold the track structure in place as trains pass by
	  ▸ Facilitate the drainage of water
	  ▸ Keep down vegetation that might interfere with trains passing by.

Formation Also referred to as the 'subgrade'	▸ The formation consists of a layer of general fill, a layer of structural fill and a capping layer (restricts the upward migration of wet clay and silt). ▸ The depth of formation varies with local topography and railway height. ▸ The typical structure of formation is illustrated in Figure 5.4.

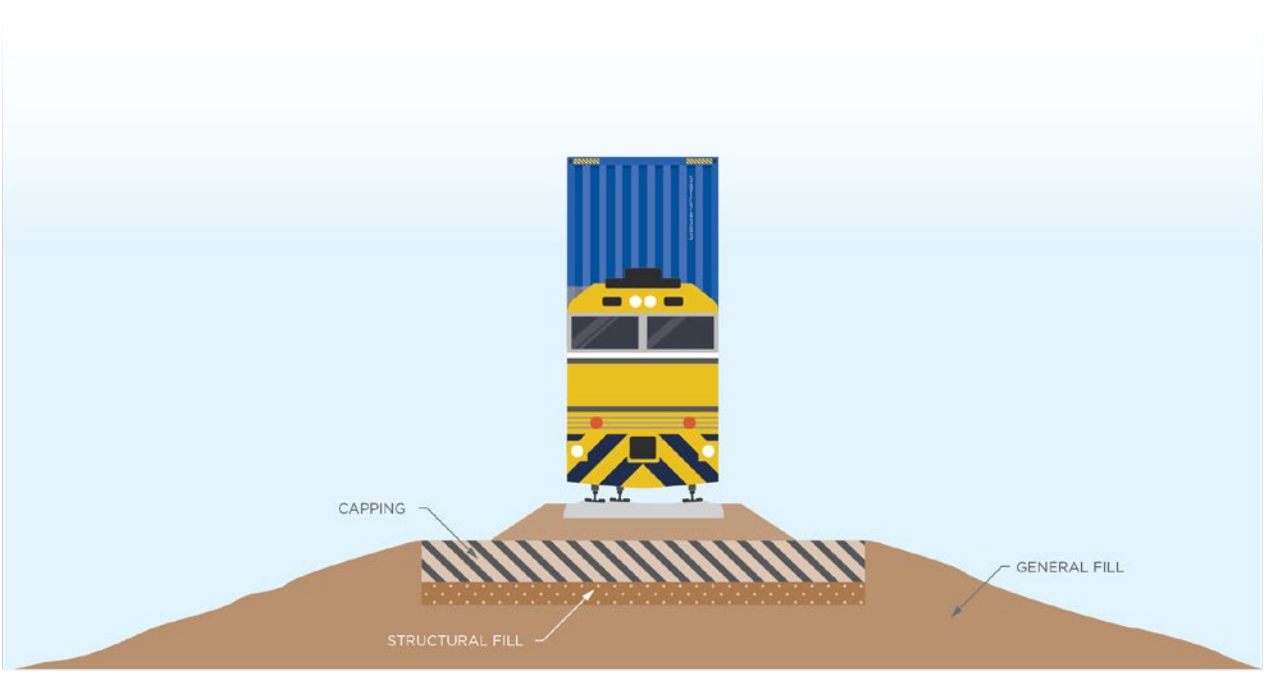

FIGURE 5.4 STRUCTURE OF THE FORMATION

Within brownfield segments, the Project will require connection (turnout) onto and upgrade of Queensland Rail's (QR) South Western Line and Millmerran Branch Line. Upgrade works will include the removal of existing narrow-gauge track (rail and sleepers) and the construction of new formation and dual-gauge track within the existing rail corridor. Discussion is provided in Section 5.4.12 on the construction approach to establishing new formation where existing rail formation is located (brownfield segments).

The lengths of Project interface with these existing railways are summarised in Table 5.8.

TABLE 5.8 SUMMARY OF INTERFACES WITH EXISTING QUEENSLAND RAIL INFRASTRUCTURE

Proposed interface with Queensland Rail corridor	Approximate length (km)
Upgrade of South Western Line to a dual-gauge track	46.8
Upgrade of Millmerran Branch Line to a dual-gauge track	24.4

The staging of works within existing rail corridors and the management of potential impacts will be the subject of an interface agreement between ARTC and QR. It is currently assumed that ARTC will be able to occupy sections of existing rail corridor through a temporary possession agreement for extended periods to avoid the need for constrained, short-term possession works. This construction staging approach within existing rail corridors will be confirmed during the detail design phase of the Project, through discussion and agreement with QR.

5.2.3 Crossing loops

Crossing loops are places on a single-line track where trains in opposing directions can pass each other. These are double ended and connected to the main track at both ends. Crossing loops are typically a little longer than any of the trains that might need to cross at that point. In operation, one train enters a crossing loop through one of the turnouts and idles at the other end, while the opposing train continues along the mainline track to pass the now stationary train.

The Project includes five new crossing loops. The selection of crossing loop locations was informed by operational modelling for the Inland Rail Program and has taken into consideration proximity to sensitive receptors, interferences with existing infrastructure and flexibility for future extension. The proposed locations for the crossing loops are:

- Yelarbon—Ch 16.3 km to Ch 18.5 km (future-proofed to Ch 20.3 km to accommodate 3,600 m trains)
- Inglewood—Ch 50.2 km to Ch 52.4 km (future-proofed to Ch 54.2 km to accommodate 3,600 m trains)
- Kooroongarra—Ch 89.2 km to Ch 91.4 km (future-proofed to Ch 93.2 km to accommodate 3,600 m trains)
- Yandilla—Ch 129.8 km to Ch 132.0 km (future-proofed to Ch 129.3 km and to Ch 133.3 km to accommodate 3,600 m trains)
- Broxburn—Ch 174.9 km to Ch 177.1 km (future-proofed to Ch 178.9 km to accommodate 3,600 m trains).

The loops would be constructed as new sections of track roughly parallel to the main track. They would each be 2,200 m long to initially accommodate 1,800 m trains. Crossing loops have been positioned to enable future extension to accommodate 3,600 m trains.

Crossing loop tracks have currently been assumed at 4.5 m spacing from the main track and incorporate a 250 m maintenance siding to enable maintenance of rollingstock without obstructing the track. Each maintenance siding is orientated such that the maintenance vehicles would exit the siding on a falling grade. A typical layout of a crossing loop is shown in Figure 5.5.

FIGURE 5.5 TYPICAL LAYOUT OF A CROSSING LOOP

5.2.4 Turnouts

Turnouts are switches that allow a train to be guided from one section of track to another. The anticipated locations for turnouts are detailed below:

- South Western Line connection at Kildonan, towards Goondiwindi:
  - The Project connects with the South Western Line at Kildonan, at approximately Ch 37.6 km (NS2B). A dual-gauge turnout with a narrow-gauge turnout leg will be installed for the Project to connect to the existing narrow-gauge South Western Line in the westerly direction towards Goondiwindi. The connection to the South Western Line has been optimised to reduce the impact on adjacent agricultural land.
- South Western Line connection at Whetstone, towards Warwick:
  - The Project deviates from the existing South Western Line at Whetstone (Ch 44.5 km). A dual-gauge turnout with narrow-gauge turnout leg will be installed for the Project to connect to the existing narrow-gauge South Western Line in the easterly direction towards Warwick.
- Millmerran Branch Line connection at Millmerran:
  - A narrow-gauge turnout will be provided to connect the Project to the Millmerran Branch Line at Ch 138.0 km for trains running in the Gowrie to NSW/QLD border direction. The connection of the narrow-gauge Millmerran Branch Line to the Project mainline will be achieved via a dual-gauge turnout with narrow-gauge turn-off leg.
- Millmerran Branch Line connection at Yarranlea:
  - A narrow-gauge turnout will be provided to connect the Project to the Millmerran Branch Line at Ch 165.7 km for trains running in the NSW/QLD border to Gowrie direction. The connection of the narrow-gauge Millmerran Branch Line to the Project mainline will be achieved via a dual-gauge turnout with narrow-gauge turn-off leg.
- Existing QR sidings:
  - Where the Project replaces the existing QR line, connections are provided to existing sidings and an existing crossing loop. These connections will be achieved with dual-gauge turnouts with a narrow-gauge turn-off leg. Turnouts to existing sidings and loops are listed in Table 5.9.

TABLE 5.9 TURNOUTS TO EXISTING QUEENSLAND RAIL SIDINGS AND LOOPS

Location	Description	Turnout type
Ch 6.1 km	Kurumbul Loop	Dual to narrow gauge
Ch 6.6 km	Kurumbul Siding	Dual to narrow gauge
Ch 6.9 km	Kurumbul Loop	Dual to narrow gauge
Ch 26.1 km	Yelarbon Loop	Dual to narrow gauge
Ch 26.5 km	Yelarbon Siding	Dual to narrow gauge
Ch 27.0 km	Yelarbon Loop	Dual to narrow gauge
Ch 152.9 km	Brookstead Siding East	Not provided as this siding is not currently used for rail operations, and may cause conflict with the proposed GrainCorp access road A future turnout is possible but would need to consider interaction with the GrainCorp access road
Ch 153.1 km	Brookstead Siding West	Dual to narrow gauge

5.2.5 Bridges

Bridge structures are required so that water, vehicles and, in some cases, stock and pedestrians may cross the proposed rail corridor. Bridge structures may either be rail-over-watercourse or road, or road-over-rail, depending on local topology and rail or road alignment requirements.

The Project involves the construction of 34 new bridge structures. These structures are summarised in Table 5.10. The Project does not involve the reinstatement or reconstruction of any existing bridge structures.

TABLE 5.10 SUMMARY OF BRIDGE STRUCTURES FOR THE PROJECT

Crossing type	Number
Rail-over-road	11
Rail-over-watercourse	20[1]
Road-over-rail	3

Table note:
1. Includes one bridge that also goes over a road.

The type of bridge proposed for a location depends on a range of factors, including the local topography, road usership, rail and road alignments at the crossing point and access requirements. Bridges have been provided at all major watercourse crossings along the Project alignment to minimise impacts to flow regimes and to avoid having to divert watercourses.

The new bridge structures are typically founded on piled foundations supporting in situ reinforced concrete substructures. Bridge superstructures are typically formed from pre-stressed concrete (PSC) girders (either PSC slabs or PSC Super-T) with in situ concrete decks incorporating walkways, guardrails and barriers as appropriate. The bridges are of various lengths and spans to suit the Project alignment and topography.

A typical section of a pier with a PSC Super-T girder is illustrated in Figure 5.6. A typical section of a pier with a PSC slab span girder is illustrated in Figure 5.7.

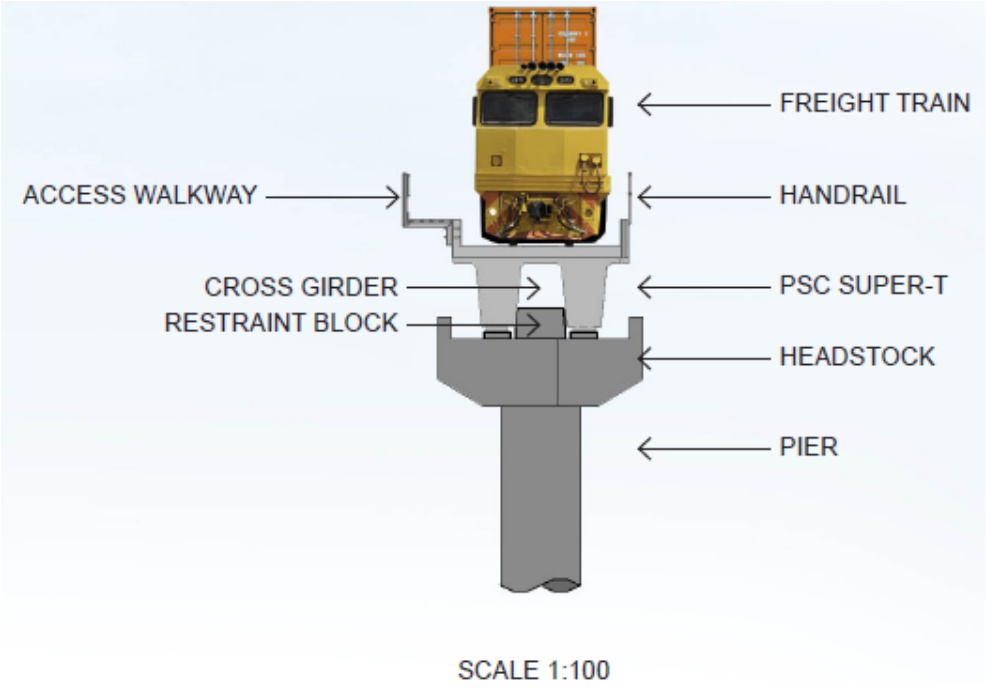

FIGURE 5.6 TYPICAL PIER WITH PRE-STRESSED CONCRETE SUPER-T GIRDER

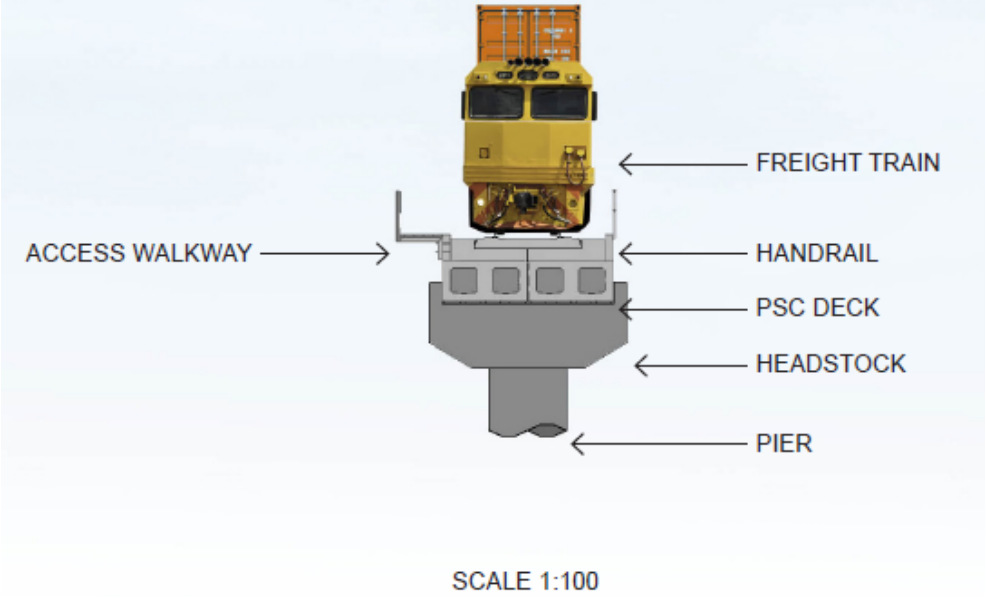

FIGURE 5.7 TYPICAL PIER WITH PRE-STRESSED CONCRETE SLAB SPAN

5.2.5.1 Road bridges

New road-over-rail bridges are summarised in Table 5.11. A typical section of a road-over-rail bridge structure is illustrated in Figure 5.10.

TABLE 5.11 SUMMARY OF ROAD-OVER-RAIL BRIDGES

Bridge name	Chainage (km)	Bridge length (m)
Cunningham Highway Bridge	25.6	104
Gore Highway Bridge	153.1	108
Linthorpe Road Bridge	175.9	66

5.2.5.2 Rail bridges

New rail bridges that are proposed to cross watercourses or roads are summarised in Table 5.12. Typical sections of rail bridges are illustrated in Figure 5.8 and Figure 5.9.

TABLE 5.12 SUMMARY OF RAIL BRIDGES

Bridge name	Chainage start (km)	Chainage end (km)	Crossing type	Bridge length (m)
Macintyre River Viaduct	30.5 (NS2B)	30.7 (NS2B)	Watercourse	165
	30.7 (NS2B)	31.1 (NS2B)	Watercourse	435
Macintyre Floodplain #1 Rail Bridge	31.4 (NS2B)	31.6 (NS2B)	Watercourse	140
Macintyre Floodplain #2 Rail Bridge	32.2 (NS2B)	32.8 (NS2B)	Watercourse and road	546
Macintyre Brook Rail Bridge 1	52.4	52.7	Watercourse	207
Macintyre Brook Rail Bridge 2	55.4	55.6	Watercourse	207
Pariagara Creek Rail Bridge	67.2	67.5	Watercourse	345
Cattle Creek Rail Bridge	88.2	88.3	Watercourse	138
Native Dog Creek Rail Bridge	93.8	94.0	Watercourse	184
Bringalily Creek 1 Rail Bridge	97.4	97.7	Watercourse	299
Bringalily Creek 3 Rail Bridge	100.1	100.7	Watercourse	621
Nicol Creek Rail Bridge	104.3	104.4	Watercourse	92
Millmerran–Inglewood Road Rail Bridge #2	115.5	115.6	Road	75
Millmerran–Inglewood Road Rail Bridge #3	126.9	127.1	Road	167
Back Creek Rail Bridge	127.9	128.1	Watercourse	230
Grasstree Creek #1 Rail Bridge	138.0	138.3	Watercourse	336
Grasstree Creek #2 Rail Bridge	138.8	139.3	Watercourse	952
Condamine River #1 Rail Bridge	141.3	142.0	Watercourse	658
Condamine River #2 Rail Bridge	142.6	145.5	Condamine River	1,918
Condamine River #3 Rail Bridge	145.5	145.1	Condamine River	602
Condamine River North Branch Rail Bridge	147.8	149.3	Condamine River North Branch	1,568
Yarranlea Road Rail Bridge	161.2	161.2	Road	69
Roche Road Rail Bridge	163.2	163.3	Road	121
Oakey Pittsworth Road Rail Bridge	170.9	171.0	Road	69
Lochaber Road Rail Bridge	172.4	172.5	Road	75
Biddeston–Southbrook Road Rail Bridge	183.5	183.7	Road	144
Toowoomba-Cecil Plains Road Rail Bridge	196.1	196.1	Road	92
Westbrook Creek Rail Bridge	197.1	197.4	Watercourse	230
Dry Creek Rail Bridge	197.9	198.0	Watercourse	184
Brimblecombe Road Rail Bridge	198.7	198.8	Road	75
Warrego Highway Rail Bridge	203.0	203.1	Road	132
Chamberlain Road Rail Bridge	204.4	204.5	Road	299

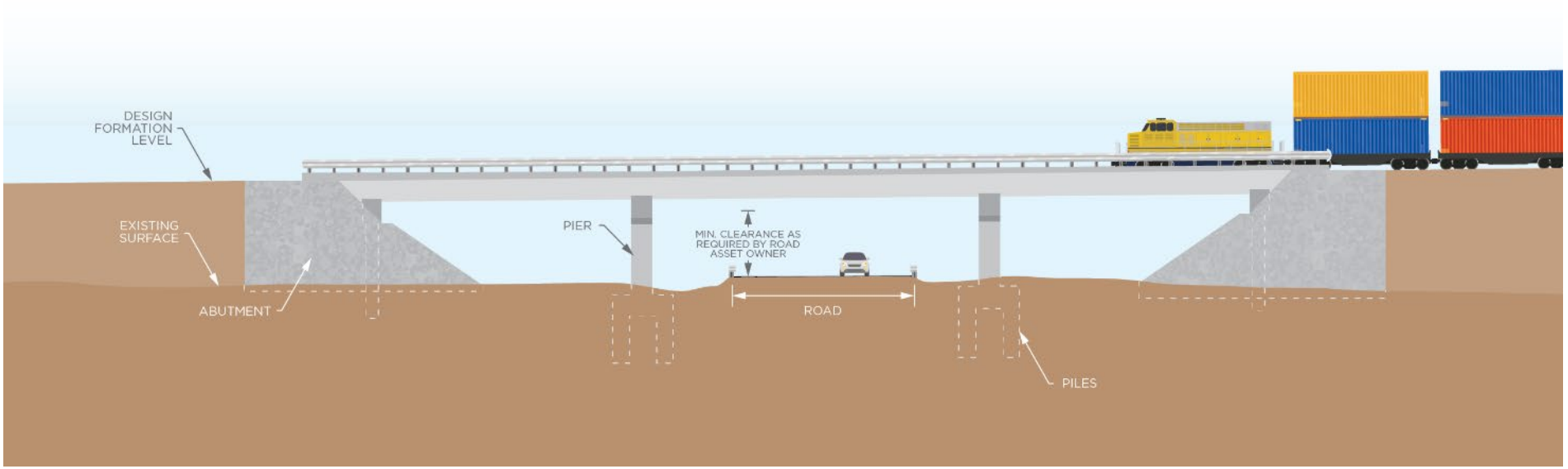

FIGURE 5.8 TYPICAL SECTION OF RAIL-OVER-ROAD BRIDGE STRUCTURE

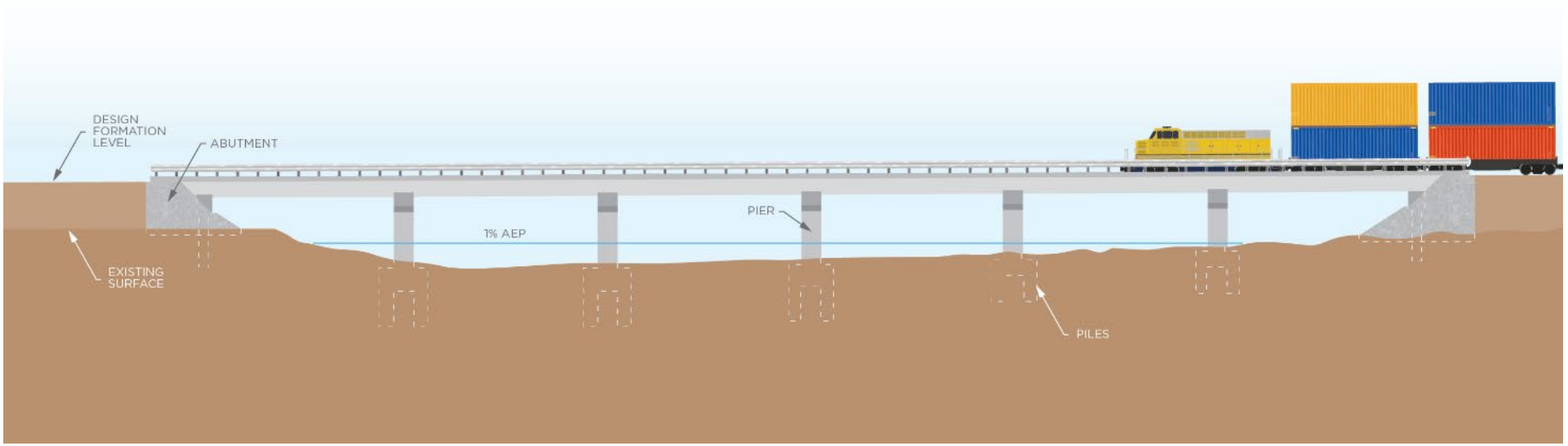

FIGURE 5.9 TYPICAL SECTION OF RAIL-OVER-WATERCOURSE BRIDGE STRUCTURE

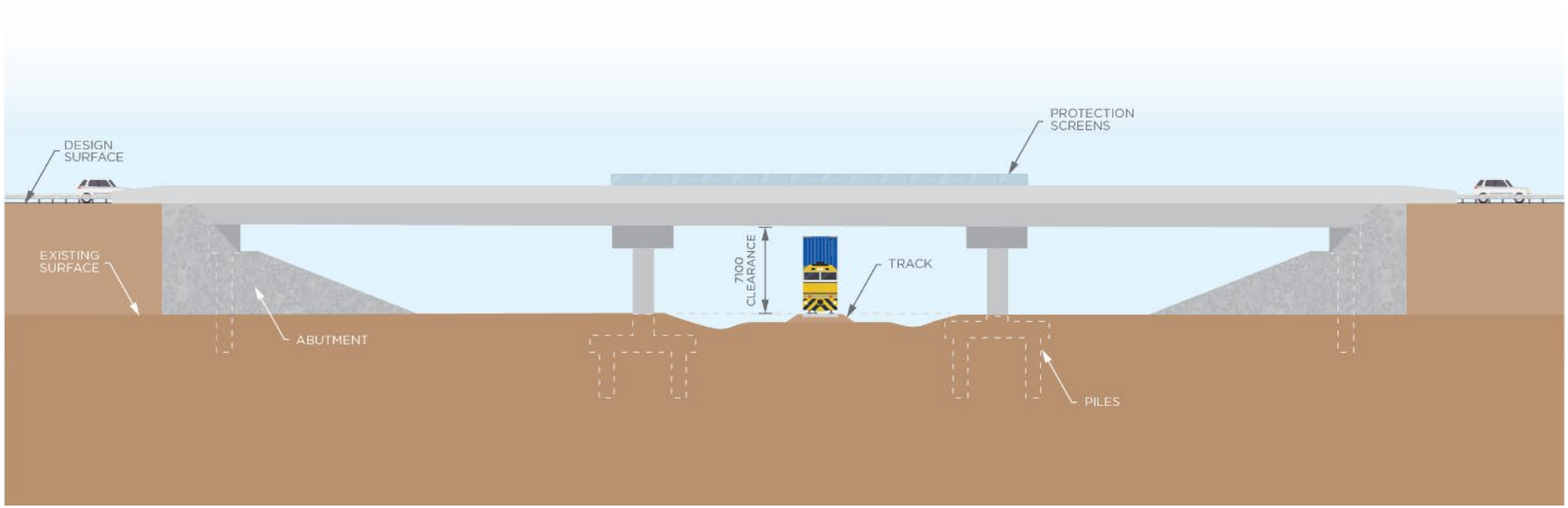

FIGURE 5.10 TYPICAL SECTION OF ROAD-OVER-RAIL BRIDGE STRUCTURE

5.2.6 Drainage infrastructure

5.2.6.1 Cross-drainage

Cross-drainage structures have been incorporated into the reference design where the Project intercepts existing watercourses and other drainage features. The type of cross-drainage structure included in the reference design depends on various factors such as the natural topography, rail formation levels, direction of flow and soil type.

Bridges are proposed at all major waterway crossings to minimise disturbance to the existing flow regime. In some instances, bridges are provided in locations that may have multiple drainage features passing under the rail corridor, such as across the Condamine River floodplain.

Cross-drainage structures, including culverts, have been incorporated into the reference design to enable the Project to achieve the flood immunity specified in the Basis of Design of a 1% AEP event (refer Table 5.4). Culverts incorporated into the design are a mix of reinforced concrete pipe culverts and reinforced concrete box culverts. The location and design of culverts will be refined, if required, during the detail design phase to reflect design changes throughout that process.

A typical section of a cross-drainage culvert is shown in Figure 5.11.

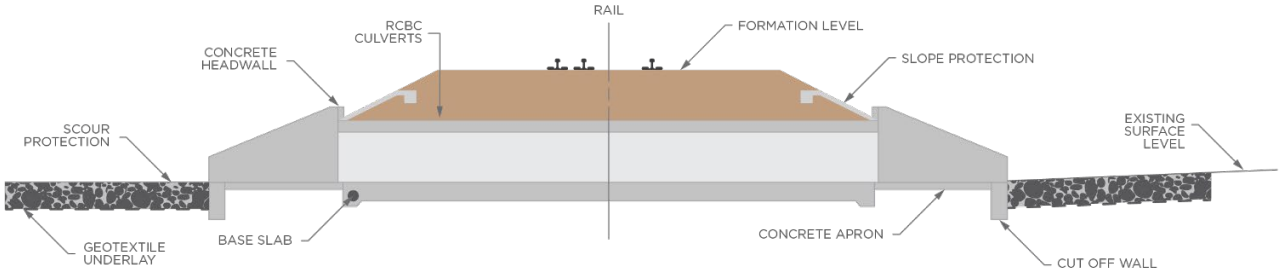

FIGURE 5.11 TYPICAL SECTION OF A CROSS-DRAINAGE CULVERT

Scour protection measures have been included around culvert entrances and exits, on disturbed stream banks and on land bound by a watercourse to avoid erosion. Scour protection or energy dissipation measures have been specifically designed and sized for each culvert location in accordance with *Austroads Guide to Road Design* (AGRD) *Part 5B: Drainage—Open Channels, Culverts and Floodways* (Austroads, 2013b) with consideration for flow velocity, soil type and vegetation cover. Scour protection measures incorporated into the reference design for culverts include:

- Concrete apron
- Concrete wingwalls
- Rock mattress scour protection, with geotextile underlay.

Scour protection measures for culvert outlets have been designed to ensure that the maximum allowable flow velocities in a 1% AEP, as specified in Table 3.1 of AGRD, are not exceeded. Maximum allowable flow velocities in Table 3.1 of AGRD are specific to the soil type at each culvert location, as follows:

- Stable rock—4.5 m/s
- Stones 150 mm diameter or larger—3.5 m/s
- Gravel 100 mm or grass cover—2.5 m/s
- Firm loam or stiff clay—1.2 to 2 m/s
- Sandy or silty clay—1.0 to 1.5 m/s.

The scour protection length and minimum rock size (d50) have been determined from Figure 3.15 and Figure 3.17 in AGRD. All required scour lengths were predicted to fit within the rail corridor.

5.2.6.2 Longitudinal drainage

The purpose of longitudinal or track drainage is to remove water that has percolated through the track ballast, and to divert surface runoff to the nearest bridge or culvert location before it reaches the subgrade. Figure 5.4 shows the typical structure of the subgrade. Without adequate track drainage, the subgrade may become saturated, leading to weakening and subsequent failure of the subgrade.

Two types of track drainage are proposed:

- Embankment drains—longitudinal drains that run parallel to the railway and are located within the rail corridor, at the foot of the railway embankment (refer Figure 5.12)
- Catch drains—longitudinal drains that run parallel to the railway and are located within the rail corridor, on the up-slope side of cuttings (refer Figure 5.13).

Track drainage is proposed at specific locations along the Project alignment where the gradient is steep enough to divert surface runoff to the nearest bridge or culvert location. As with culverts, the design and location of track drainage will be refined, if required, during the detail design phase.

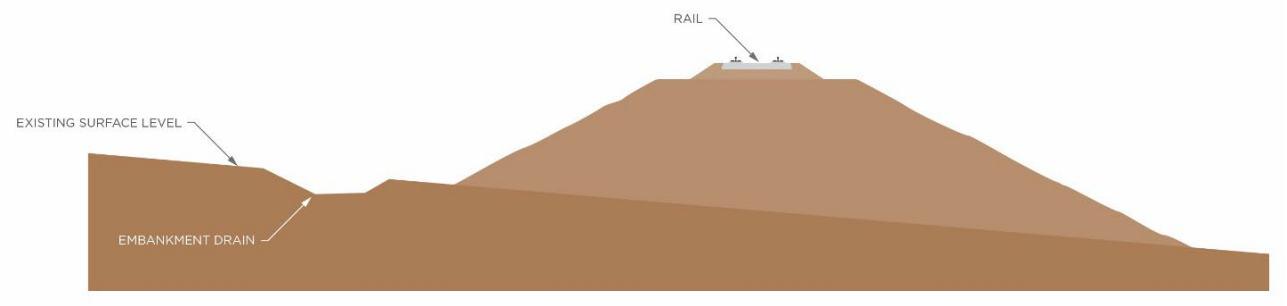

FIGURE 5.12 TYPICAL LONGITUDINAL DRAINAGE FOR RAIL FORMATION ON TOP OF EMBANKMENT

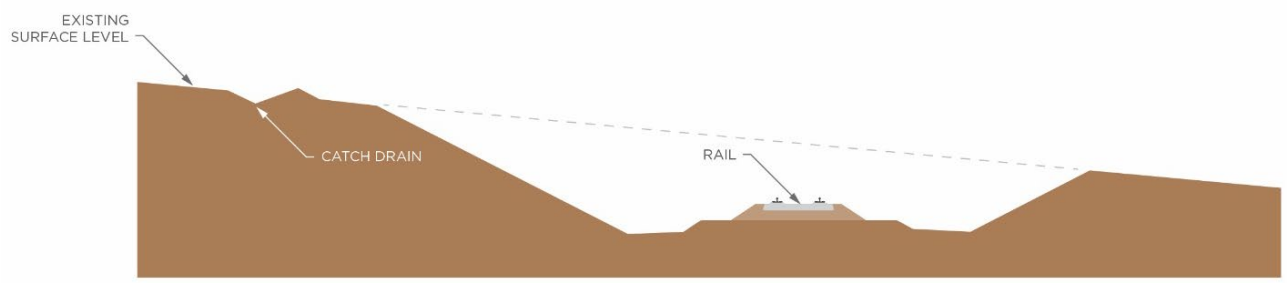

FIGURE 5.13 TYPICAL LONGITUDINAL DRAINAGE FOR RAIL FORMATION WITHIN A CUT

5.2.7 Road–rail interfaces

5.2.7.1 Public road–rail interfaces

Road–rail interfaces are points at which the rail alignment intersects a public road. The Project requires the crossing of State-controlled roads and local government (Goondiwindi Regional Council (GRC) and Toowoomba Regional Council (TRC)) roads. A summary of the number of interfaces with each public road type is presented in Table 5.13.

TABLE 5.13 SUMMARY OF PUBLIC ROAD INTERFACES IN THE REFERENCE DESIGN FOR THE PROJECT

Road type	Number of interfaces[1]
State-controlled	9
Goondiwindi Regional Council	18
Toowoomba Regional Council	26

Table note:
1. Only includes locations where a crossing solution is provided. Excludes interface locations where no crossing is provided in the reference design.

For public crossings, ARTC is undertaking, and will continue to undertake, the necessary consultation with the Department of Transport and Main Roads (DTMR) and local governments in relation to the preferred road–rail interface treatments for each location. Part of this process is to work with the relevant road manager to understand the local environment and gather information on future development plans, which can be used to inform the design.

In the development of the proposed road–rail interface treatments, ARTC have taken into consideration State and national guidelines and strategies. Both the Office of the National Rail Safety Regulator (ONRSR) and DTMR have policies that focus on avoiding, where possible, the installation of new level crossings. The *ONRSR Policy: Level Crossings* (ONRSR, 2019a) acknowledges that for lower-risk level crossings, operators may be able to demonstrate that alternative controls minimise the risk to safety *'so far as is reasonably practicable'*, as defined in *ONRSR Guideline: Meaning of duty to ensure safety so far as is reasonably practicable* (ONRSR, 2016b).

The appropriate road–rail interface treatment has been assessed on a case-by-case basis for design purposes with consideration given to current and future use of the existing asset, its location relative to other crossings of the rail corridor and the road and rail geometry at the crossing location. For the purposes of these assessments, a quantitative risk management approach has been adopted consistent with the definition of 'so far as is reasonably practicable'.

While ARTC has sought to limit the number of new level crossings in the reference design, the Project includes lower-risk level crossings where the road–rail interface treatment assessment has concluded that the risk to safety has been minimised 'so far as is reasonably practicable'.

Treatments for public road–rail interfaces can be categorised as:

- Grade separated crossings—road and rail cross each other at different heights so that traffic flow is not affected. Grade separations are either road-over-rail, or rail-over-road.
- Level crossings—road and rail cross each other at the same level. Level crossings have either passive or active controls to guide road users:
  - Passive—have static warning signs (e.g. stop and give way signs) that are visible on approach. This signage is unchanging with no mechanical aspects or light devices.
  - Active—flashing lights with or without boom barriers for motorists, and automated gates for pedestrians. These devices are activated prior to and during the passage of a train through the level crossing.
- Crossing consolidation, relocation, diversion or realignment—existing road–rail interfaces may be closed, consolidated into fewer crossing points, relocated or diverted. Roads will only be closed where the impact of diversions or consolidations is considered acceptable, or where the existing location is not considered safe and cannot reasonably be made safe. Approval for closures, where required, will be progressed in accordance with the requirements of the relevant legislation.

To assess potential level crossing locations, ARTC used a national system called ALCAM (Australian Level Crossing Assessment Model), which considers factors such as future road traffic numbers, vehicle types, train numbers, speeds and sighting distances. Further explanation of the methodology used in determining road–rail interface treatments is included in Chapter 18: Traffic, Transport and Access.

Existing public road–rail interface locations are summarised in Table 5.14, with a description of the proposed treatment included in the reference design for the Project.

TABLE 5.14 EXISTING ROAD–RAIL INTERFACE LOCATIONS AND ROAD CLOSURE LOCATIONS

Road name	Existing Queensland Rail crossing type	Proposed treatment in the reference design
State-controlled roads		
Cunningham Highway (Wondalli Street)	Active level crossing	No crossing provided at this location—relocated
Millmerran–Leyburn Road	Passive level crossing	Active level crossing
Gore Highway	Active level crossing	Grade separation: road-over-rail
Goondiwindi Regional Council		
South Kurumbul Road	Passive level crossing	Active level crossing
Suttons Road	Passive level crossing	Passive level crossing
Springborg Road	Passive level crossing	Passive level crossing
Whetstone Access Road	Passive level crossing	Active level crossing

Road name	Existing Queensland Rail crossing type	Proposed treatment in the reference design
Toowoomba Regional Council		
Hall Road	Passive level crossing	Passive level crossing
Gilgai Lane	Passive level crossing	Passive level crossing
Fysh Road	Active level crossing	No crossing provided at this location—relocated
Elsden Road	Passive level crossing	Active level crossing
Longhurst Road	Passive level crossing	Active level crossing

Road–rail interfaces that are newly created by the Project and the proposed treatments included in the reference design for each are summarised in Table 5.15.

TABLE 5.15 PROPOSED PUBLIC ROAD–RAIL INTERFACES AND PROPOSED TREATMENTS INCLUDED IN THE REFERENCE DESIGN

Road name	Proposed treatment in the reference design
State-controlled roads	
Cunningham Highway (Wondalli Street)	Grade separation: road-over-rail
Millmerran–Inglewood Road	Active level crossing
Millmerran–Inglewood Road	Grade separation: rail-over-road (bridge)
Millmerran–Inglewood Road	Grade separation: rail-over-road (bridge)
Oakey–Pittsworth Road	Grade separation: rail-over-road (bridge)
Toowoomba–Cecil Plains Road	Grade separation: rail-over-road (bridge)
Warrego Highway	Grade separation: rail-over-road (bridge)
Goondiwindi Regional Council	
Stock Reserve	Grade separation: rail-over-road (bridge)
Kildonan Road	Active level crossing
Kildonan Road—Stock Reserve	No crossing provided at this location—relocated
Eukabilla Road	No crossing provided at this location—road diverted/re-aligned
Eukabilla Road	No crossing provided at this location—road diverted/re-aligned
Wondalli–Kurumbul Road	Passive level crossing
Unnamed Road	Passive level crossing
Unnamed Road	Passive level crossing
Springborg Road	No crossing provided at this location—relocated
McDougalls Crossing Road	Active level crossing
Cremascos Road	Active level crossing
Unnamed Road	No crossing provided at this location—consolidated
Unnamed Road	No crossing provided at this location—consolidated
Bybera Road	No crossing provided at this location—relocated
Bybera Road	Passive level crossing
Lovells Crossing Road	Active level crossing
Thornton Road	Active level crossing
Grays Road	Passive level crossing
Wongavale–Yugilbar Road	Passive level crossing
Unnamed Road	Grade separation: rail-over-road (culverts)
Unnamed Road	Active level crossing

Road name	Proposed treatment in the reference design
Toowoomba Regional Council	
Unnamed Road	Passive level crossing
Kooroongarra Road	Passive level crossing
Paton Road	Passive level crossing
Nicol Creek Road	Passive level crossing
Millwood Road	Passive level crossing
Heckendorf Road	No crossing provided at this location—road diverted/re-aligned
Blackwell Road	Active level crossing
Scraggs Road	Passive level crossing
Schwartens Road	No crossing provided at this location—consolidated
Owens Scrub Road	Active level crossing
Lindenmayer Road	Passive level crossing
Harris Road	Active level crossing
Mann Silo Road	Passive level crossing
Yarranlea Road	Grade separation: rail-over-road (bridge)
Roche Road	Grade separation: rail-over-road (bridge)
Murlaggan Road	No crossing provided at this location—relocated
Kahler Road	No crossing provided at this location—consolidated
French Road	No crossing provided at this location—road diverted/re-aligned
Tip Road	Active level crossing
Quibet Road	No crossing provided at this location—road diverted/re-aligned
Dallman Road	No crossing provided at this location—road diverted/re-aligned
Unnamed Road	No crossing provided at this location—road diverted/re-aligned
Lochaber Road	Grade separation: rail-over-road (bridge)
McEwan Lane	No crossing provided at this location—consolidated
Paint Mine Road	No crossing provided at this location—road diverted/re-aligned
Linthorpe Road	Grade separation: road-over-rail
Geitz Road	No crossing provided at this location—consolidated
Linthorpe-Valley Road	Passive level crossing
Bushy Lane	No crossing provided at this location—road diverted/re-aligned
Biddenston–Southbrook Road	Grade separation: rail-over-road (bridge)
Unnamed Road	No crossing provided at this location—road diverted/re-aligned
Purcell Road	Passive level crossing
Athol School Road	No crossing provided at this location—consolidated
Brimblecombe Road	Grade separation: rail-over-road (bridge)
Chamberlain Road	Grade separation: rail-over-road (bridge)
Leesons Road	Active level crossing

The reference design has been developed to remove any short-stacking issues from the proposed alignment through the diversion of the rail alignment or adjacent roads to accommodate the required design vehicle. Short stacking of two performance-based standard (PBS) 3B vehicles, each up to 42 m in length as defined in Table 10 of the *Performance-Based Standards Scheme—Network Classification Guidelines* (National Heavy Vehicle Regulator (NHVR), 2007), has been allowed for in the reference design.

Further consultation with DTMR, GRC, TRC and the local community will confirm the location and preferred treatment for each road–rail interface. The consultation strategy for the Project is described in Appendix C: Stakeholder Engagement Report.

5.2.7.2 Occupational (private) crossings

An occupational crossing provides access between two parcels of land owned by the same landowner that have been divided by a rail corridor. The Project intersects the following private access roads or tracks within the bounds of private properties:

- 153 private, unformed access roads or tracks
- 62 private, formed access roads or tracks.

The final number of occupational crossings on private property will be determined during detail design. ARTC has consulted with impacted landowners to obtain an understanding of property access requirements and to present potential private access solutions based on the reference design. Each property solution will be designed on a case-by-case basis through ongoing consultation with landowners and further design refinement. Consultation to identify potential occupational crossing solutions is described in Appendix C: Stakeholder Engagement Report.

Where level crossings are required, ARTC will consult with landowners to determine the design that best fits their requirements. For example, in areas where landowners use large machinery, the design of the level crossing, including gate widths, crossing surface and approach grades will need to accommodate this. Alternatively, where there is stock on a property, the focus will be on installing appropriate fencing and gates to keep the stock out of the rail corridor.

ARTC will work with each landowner to find access solutions that minimise the number of level crossings for the Project, consistent with the safety objectives of the ONRSR guidelines and policies.

Design and layout of occupational crossing solutions will be determined based on the following considerations:

- Feedback from consultation with landowners on specific property requirements
- Safety standards, including criteria for minimum sight distances for trains and vehicles
- Alternative access arrangements
- Rail design and landform
- Stock movements
- Vehicle access requirements (for example farm machinery, frequency of use).

Typical treatments include:

- Underpass for stock passage or vehicle and machinery use. This will be subject to topography.
- At grade level crossing
- Diversion to adjacent public road/public road crossing.

5.2.7.3 Stock route interfaces

The Project interfaces with the State stock route network, which consists of stock routes and reserves in 12 locations. The State stock route network is primarily used by the pastoral industry as:

- An alternative to transporting stock by rail or road
- Pasture for emergency agistment
- Long-term grazing.

The Department of Natural Resources, Mines and Energy (DNRME) is responsible for providing policy and legislative advice and managing asset maintenance for the State stock route network. Local government is responsible for day-to-day administration and management and some network maintenance of the State stock route network.

The reference design for the Project has endeavoured to maintain the integrity (connectivity and functionality) of the stock route network. In circumstances where the Project has the potential to impact on existing stock routes, ARTC has consulted with DNRME, GRC and TRC to identify potential solutions for the treatment of rail and stock route interfaces.

Locations of stock routes that intersect with the Project are identified in Table 5.16. Connectivity of the local stock route network, with and without the Project, is shown in Figure 5.14 to Figure 5.37.

TABLE 5.16 STOCK ROUTE INTERFACES

Location and Project interface point (approximate chainage)	Stock route ID, type, status and class	Description	Proposed treatment	Figure reference
Kildonan Road Ch 33.1 km (NS2B)	ID: 005GWND Type: Road Status: Open Class: Primary	This stock route follows Kildonan Road. The Project alignment crosses this stock route at Kurumbul.	A rail-over-road crossing of Kurumbul Road will be provided, allowing stock movement to pass under the railway at the same location.	Existing connectivity: Figure 5.14 Future connectivity: Figure 5.15
Rainbow Reserve and Eukabilla Road Ch 33.4 km (NS2B)	ID: RAINBOW RESERVE Type: Reserve Status: Open Class: Primary	This stock reserve encompasses the Rainbow Reserve camping area and Eukabilla Road. The Project alignment enters into this stock reserve at Ch 33.15 km (NS2B) and crosses Eukabilla Road at 33.4 km (NS2B). The Project alignment continues to run parallel to the western edge of the existing Eukabilla Road, within the stock reserve, to Ch 34.9 km (NS2B). At this point it exits the stock reserve.	Eukabilla Road will be realigned to run parallel to the western edge of the new rail corridor, allowing for uninterrupted stock movement from Kildonan Road onto Eukabilla Road. The stock reserve will be otherwise unaffected.	Existing connectivity: Figure 5.16 Future connectivity: Figure 5.17
Wondalli–Kurumbul Road and Yelarbon–Kurumbul Road Ch 7.2 km	ID: 081GWND Type: Road Status: Open Class: Secondary	This stock route is aligned along Wondalli–Kurumbul Road and parallel to Yelarbon–Kurumbul Road, which runs adjacent to the existing South Western Line rail corridor. The Project alignment crosses this stock route at the intersection of Wondalli–Kurumbul Road and Yelarbon–Kurumbul Road.	A passive level crossing will be provided, allowing stock movement across the railway at the same location.	Existing connectivity: Figure 5.18 Future connectivity: Figure 5.19
Yelarbon Ch 25.4 km	ID: 811GWND Type: Road Status: Open Class: Minor and unused	This stock route is aligned with Merton Road, the Cunningham Highway and Yelarbon–Keetah Road. The stock route crosses the existing QR South Western Line at an active level crossing on the Cunningham Highway. The Project will require the closure of the existing active level crossing, to be replaced by a road-over-rail crossing approximately 400 m to the west of the existing crossing point. This road reconfiguration will result in the severance of the current stock route.	Realignment of the stock route to provide continued connectivity between Merton Road and Yelarbon–Keetah Road, via a passive level crossing off Yelarbon–Kurumbul Road. The new rail crossing point would be approximately 640 m west of the existing rail level crossing.	Existing connectivity: Figure 5.20 Future connectivity: Figure 5.21

Location and Project interface point (approximate chainage)	Stock route ID, type, status and class	Description	Proposed treatment	Figure reference
East of Sawmill Road Ch 27.0 km	ID: RESERVE Type: Reserve Status: Open Class: Minor and unused	This is an isolated stock reserve, with no mapped stock route linkages. The stock reserve is bound by the Cunningham Highway to the west and east of Sawmill Road to the north. The Project involves curve easing of east of Sawmill Road, which will encroach by up to 15 m into the north–west corner of the stock reserve. The existing Yelarbon levee extends diagonally across this stock reserve. Modifications to the existing Yelarbon levee, if they are to occur, will temporarily require works within the stock reserve.	The usability of this stock reserve is not expected to be impacted by the Project and therefore no treatment is proposed.	Existing connectivity: Figure 5.22 Future connectivity: Figure 5.23
Lovells Crossing Road Ch 65.8 km	ID: 813GWD Type: Road Status: Open Class: Minor and unused	This stock route follows Lovells Crossing Road. The Project alignment crosses this stock route approximately 3 km north of Inglewood.	A rail-over-road crossing of Lovells Crossing Road will be provided, allowing stock movement to pass under the railway at the same location.	Existing connectivity: Figure 5.24 Future connectivity: Figure 5.25
Millmerran–Inglewood Road (Inglewood) Ch 73.1 km to Ch 76.5 km	ID: 820GWD Type: Road Status: Open Class: Minor and unused	This stock route follows Millmerran–Inglewood Road. The Project alignment crosses this stock route twice in 10 km, once at Ch 75.0 km and again at Ch 85.0 km.	This stock route would be realigned to remain on the eastern side of the rail alignment, thus avoiding the need to provide two separate stock route crossing treatments in close proximity. This treatment approach would provide continued connectivity for stock movement in parallel to Millmerran–Inglewood Road in this area.	Existing connectivity: Figure 5.26 Future connectivity: Figure 5.27
Millmerran-Inglewood Road (Inglewood) Ch 84.2 km	ID: 820GWD Type: Road Status: Open Class: Minor and unused	This stock route follows or runs parallel to the east of Millmerran-Inglewood Road. The Project alignment crosses this stock route at the point of the stock route re-joining Millmerran-Inglewood Road.	An underpass through the railway embankment will be provided to ensure continued connectivity for stock movement along Millmerran-Inglewood Road.	Existing connectivity: Figure 5.28 Future connectivity: Figure 5.29

Location and Project interface point (approximate chainage)	Stock route ID, type, status and class	Description	Proposed treatment	Figure reference
Kooroongarra-Anderson Road Ch 96.1 km	ID: 856TOOW Type: Road Status: Open Class: Minor and unused	This stock route branches off 820TOOW and provides an east-west connection to Stonehenge Road. The Project alignment crosses this stock route at the intersection of Koorongarra-Anderson Road and Millmerran-Inglewood Road.	A passive level crossing will be provided, allowing stock movement across the railway at the same location.	Existing connectivity: Figure 5.30 Future connectivity: Figure 5.31
Millmerran-Inglewood Road (near Heckendorfs Road) Ch 115.5 km	ID: 820TOOW Type: Road Status: Open Class: Minor and unused	This stock route follows Millmerran-Inglewood Road. The Project alignment crosses this stock route approximately 900 m south of the intersection of Heckendorfs Road and Millmerran-Inglewood Road.	A rail-over-road grade separated crossing will be provided, allowing continuation of existing stock movements along Millmerran-Inglewood Road at this location.	Existing connectivity: Figure 5.32 Future connectivity: Figure 5.33
Kooroongarra Road (Commodore Mine) Ch 127.2 km	ID: 820TOOW Type: Road Status: Open Class: Minor and unused	The stock route follows Millmerran-Koorongarra Road and Millmerran-Inglewood Road. This Project alignment crosses this stock route approximately 550 m north of the intersection between Millmerran-Inglewood Road, Millmerran-Koorongarra Road and Schwartens Road.	A rail-over-road grade separated crossing will be provided, allowing continuation of existing stock movements along Millmerran-Koorongarra Road and Millmerran-Inglewood Road at this location.	Existing connectivity: Figure 5.34 Future connectivity: Figure 5.35
Warrego Highway Ch 203.01 km	ID: No ID – Unused Type: Road Status: Open Class: Minor and unused	This stock route follows the Warrego Highway. The Project alignment crosses this stock route approximately 700 m west of the intersection between the Warrego Highway, Chamberlain Road and Jannuschs Road.	A rail-over-road grade separated crossing will be provided, allowing continuation of existing stock movements along the Warrego Highway at this location.	Existing connectivity: Figure 5.36 Future connectivity: Figure 5.37

Location	Interface point (approximate chainage)	Stock route ID	Description	Proposed treatment
Kildonan Road	Ch 33.0 km (NS2B)	005GWND	This stock route follows Kildonan Road and is classified as a primary, open stock route. This stock route is traversed by the Project at Kurumbul.	Underpass
Eukabilla Road	Ch 33.1 km (NS2B)	RAINBOW RESERVE	This stock route is located within the Rainbow Reserve and is adjacent to Kildonan Road corridor. This stock route is classified as a primary, open stock route. This stock route is impacted by the Project to facilitate the relocation of Eukabilla Road for a length of approximately 2.5 km.	Realignment
Wondalli-Kurumbul Road and Yelarbon-Kurumbul Road	Ch 7.2 km	081GWND	This stock route follows Yelarbon-Kurumbul Road, running adjacent to the existing South Western Line rail corridor and is classified as a secondary, open stock route. This stock route is traversed by the Project between Kurumbul and Yelarbon.	Level crossing
Yelarbon	Ch 25.4 km	811GWND	This stock route is located along Cunningham Highway, Merton Road and Wondalli Street, and is classified as a secondary, open stock route. This stock route is traversed by the Project when the stock route crosses the existing South Western Line rail corridor whilst adjacent to the Cunningham Highway.	Realignment and underpass
East of Sawmill Road	Ch 27.0 km	RESERVE	This stock route is located adjacent to east of Sawmill Road and is away from the rail corridor. The stock route is classified as minor and unused. The stock route will be temporarily affected during levee modification across this land parcel.	No treatment
Lovells Crossing Road	Ch 65.8 km	813GWD	This stock route follows Lovells Crossing Road and is classified as minor and unused. This stock route is traversed by the Project at Inglewood.	Underpass
Millmerran-Inglewood Road (Inglewood)	Ch 75.0 km	820GWD	This stock route follows the existing Millmerran-Inglewood Road and is classified as minor and unused. This stock route is traversed by the Project at Inglewood.	Realignment to remain on eastern side of the Project, avoiding the need for a crossing of the Project
Millmerran-Inglewood Road (Inglewood)	Ch 85.0 km	820GWD	This stock route follows Millmerran-Inglewood Road and is classified as minor and unused. This stock route is traversed by the Project at Canning Creek.	Realignment to remain on eastern side of the Project, avoiding the need for a crossing of the Project

Location	Interface point (approximate chainage)	Stock route ID	Description	Proposed treatment
Kooroongarra-Anderson Road	Ch 96.1 km	856TOOW	This stock route branches off 820TOOW and provides an east-west connection to Stonehenge Road. The stock route is classified as minor and unused This stock route is traversed by the Project at Canning Creek.	Passive level crossing
Millmerran-Inglewood Road (near Heckendorfs Road)	Ch 115.5 km	820TOOW	This stock route follows Koorongara-Andersons Road and is classified as minor and unused. This stock route is traversed by the Project at Millwood.	Rail over stock route grade separation
Koorongara Road (Commodore Mine)	Ch 127.2 km	820TOOW	The stock route follows the existing Millmerran-Inglewood Road and is classified as minor and unused. This stock route is traversed by the Project at Millwood.	Rail over stock route grade separation
Warrego Highway	Ch 203.01 km	-	This stock route follows the Warrego Highway and connects reserves in the northwest Dalby to Toowoomba to the southeast. The stock route is classified as minor and unused.	No treatment

FIGURE 5.14 EXISTING STOCK ROUTE NETWORK CONNECTIVITY: KILDONAN ROAD, CH 33.1 KM (NS2B)

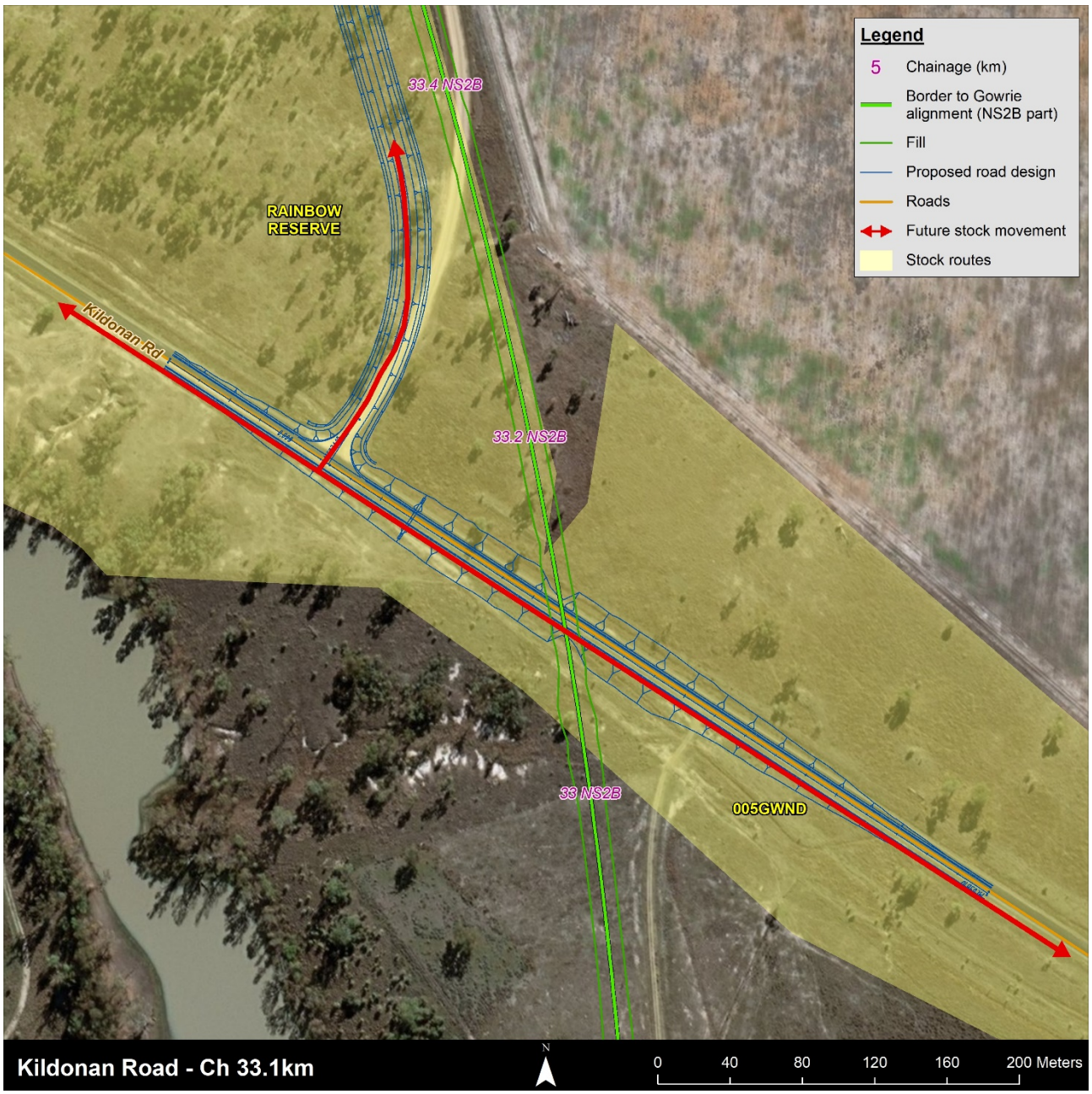

FIGURE 5.15 FUTURE STOCK ROUTE NETWORK CONNECTIVITY, WITH THE PROJECT: KILDONAN ROAD, CH 33.1 KM (NS2B)

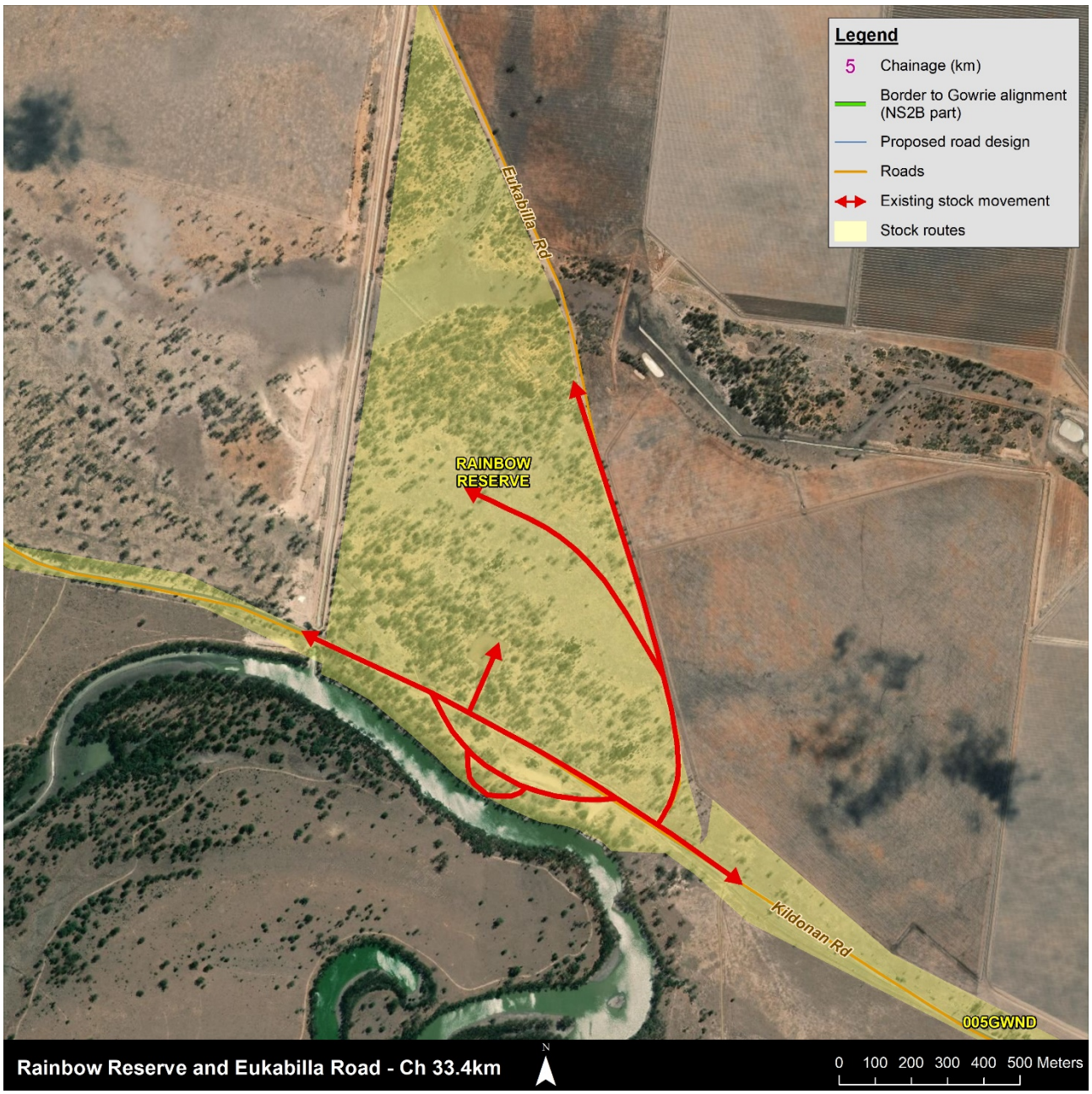

FIGURE 5.16 EXISTING STOCK ROUTE NETWORK CONNECTIVITY: RAINBOW RESERVE AND EUKABILLA ROAD, CH 33.4 KM (NS2B)

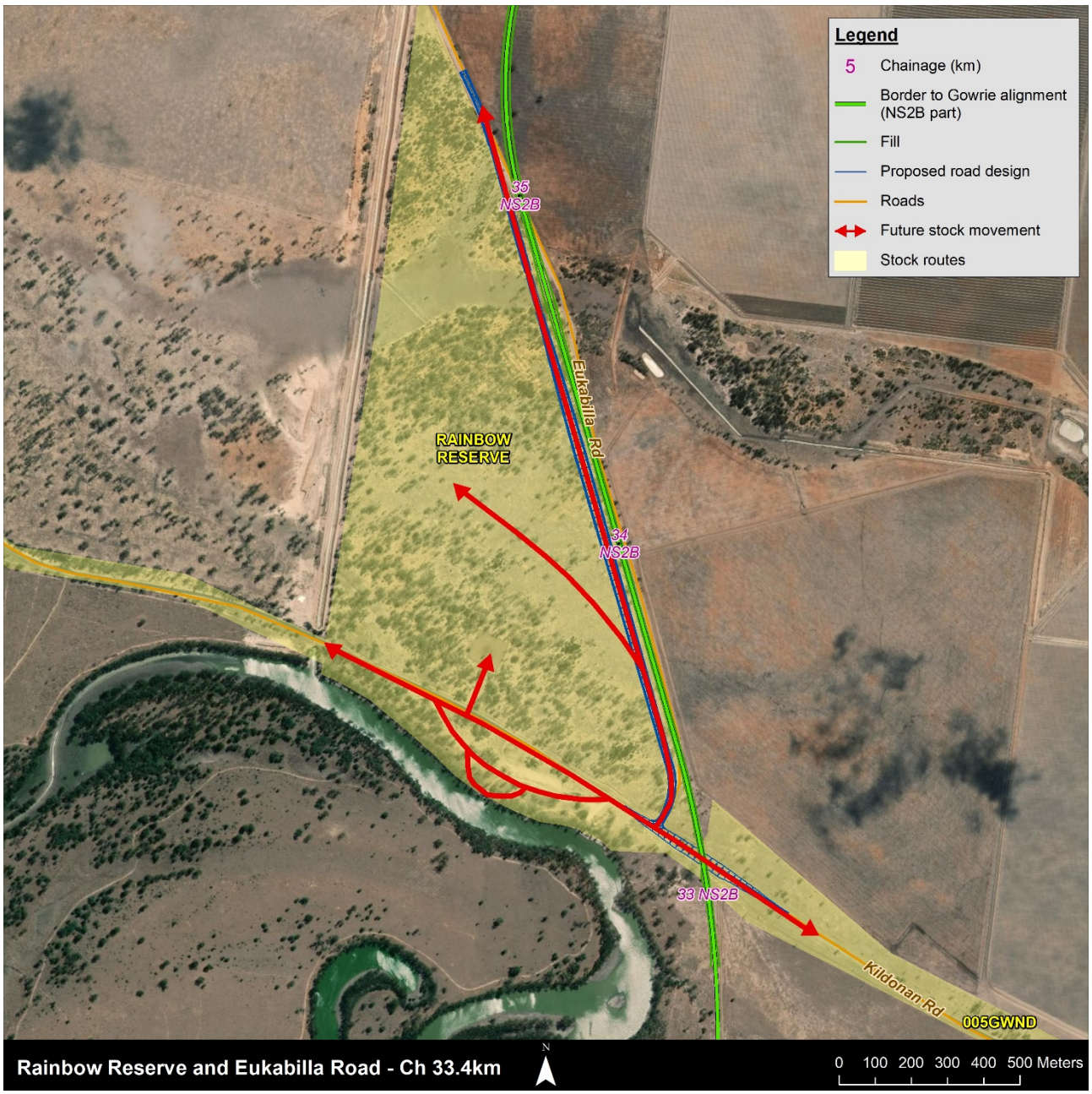

FIGURE 5.17 FUTURE STOCK ROUTE NETWORK CONNECTIVITY, WITH THE PROJECT: RAINBOW RESERVE AND EUKABILLA ROAD, CH 33.4 KM (NS2B)

FIGURE 5.18 EXISTING STOCK ROUTE NETWORK CONNECTIVITY: WONDALLI-KURUMBUL ROAD AND YELARBON-KURUMBUL ROAD, CH 7.2 KM

FIGURE 5.19 FUTURE STOCK ROUTE NETWORK CONNECTIVITY, WITH THE PROJECT: WONDALLI-KURUMBUL ROAD AND YELARBON-KURUMBUL ROAD, CH 7.2 KM

FIGURE 5.20 EXISTING STOCK ROUTE NETWORK CONNECTIVITY: YELARBON, CH 25.4 KM

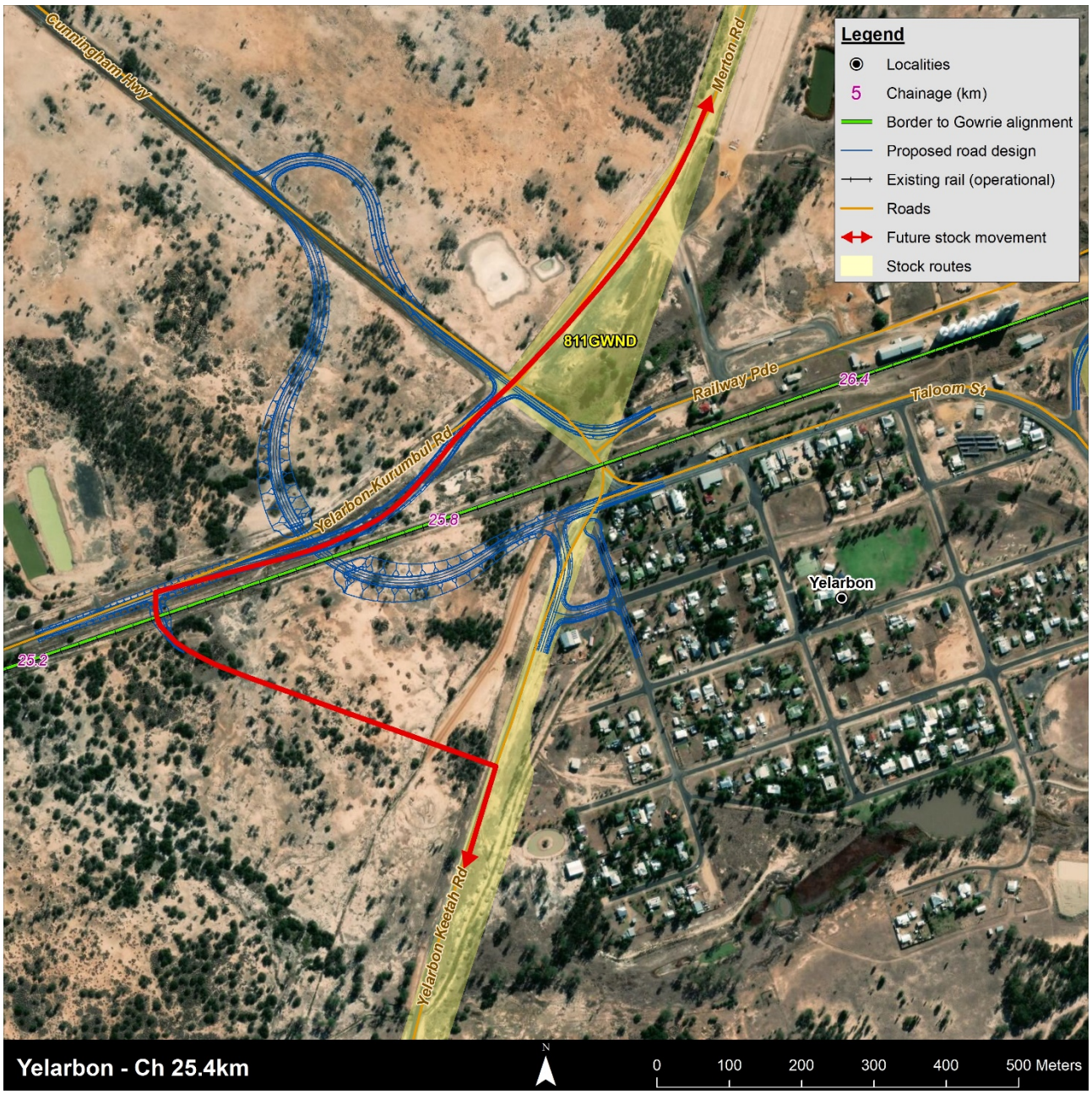

FIGURE 5.21 FUTURE STOCK ROUTE NETWORK CONNECTIVITY, WITH THE PROJECT: YELARBON, CH 25.4 KM

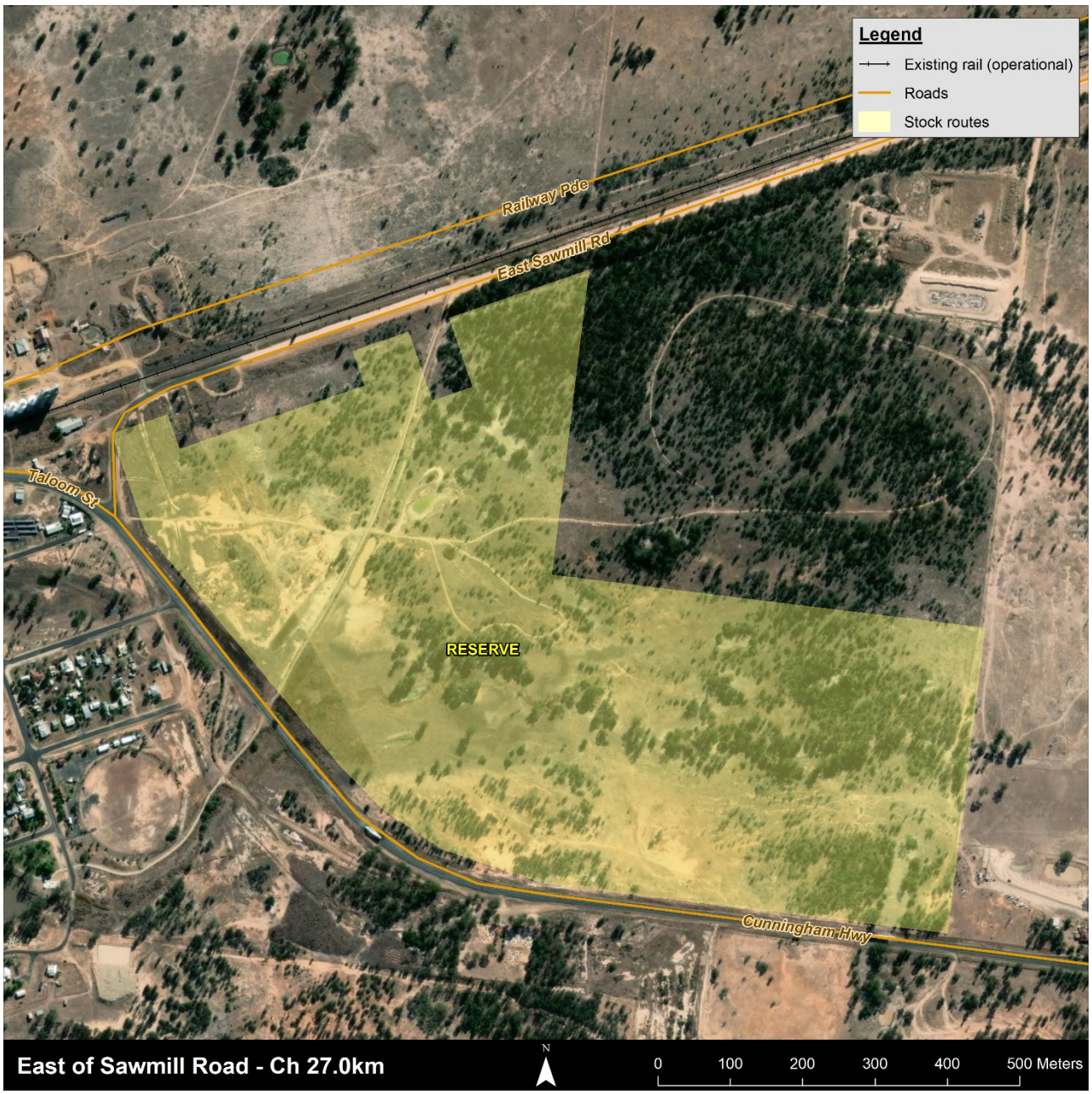

FIGURE 5.22 EXISTING STOCK ROUTE NETWORK CONNECTIVITY: EAST OF SAWMILL ROAD, CH 27.0 KM

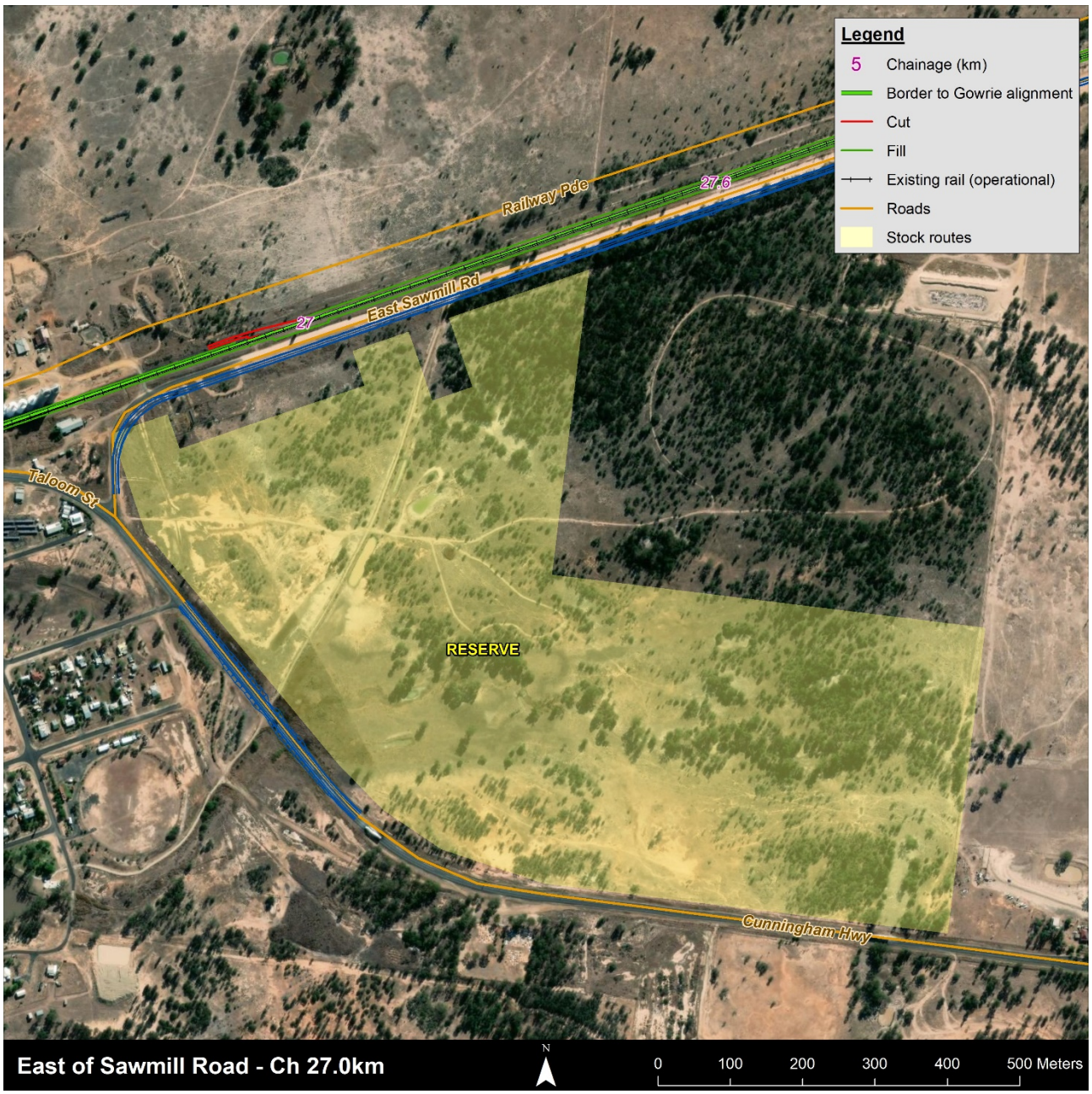

FIGURE 5.23 FUTURE STOCK ROUTE NETWORK CONNECTIVITY, WITH THE PROJECT: EAST OF SAWMILL ROAD, CH 27.0 KM

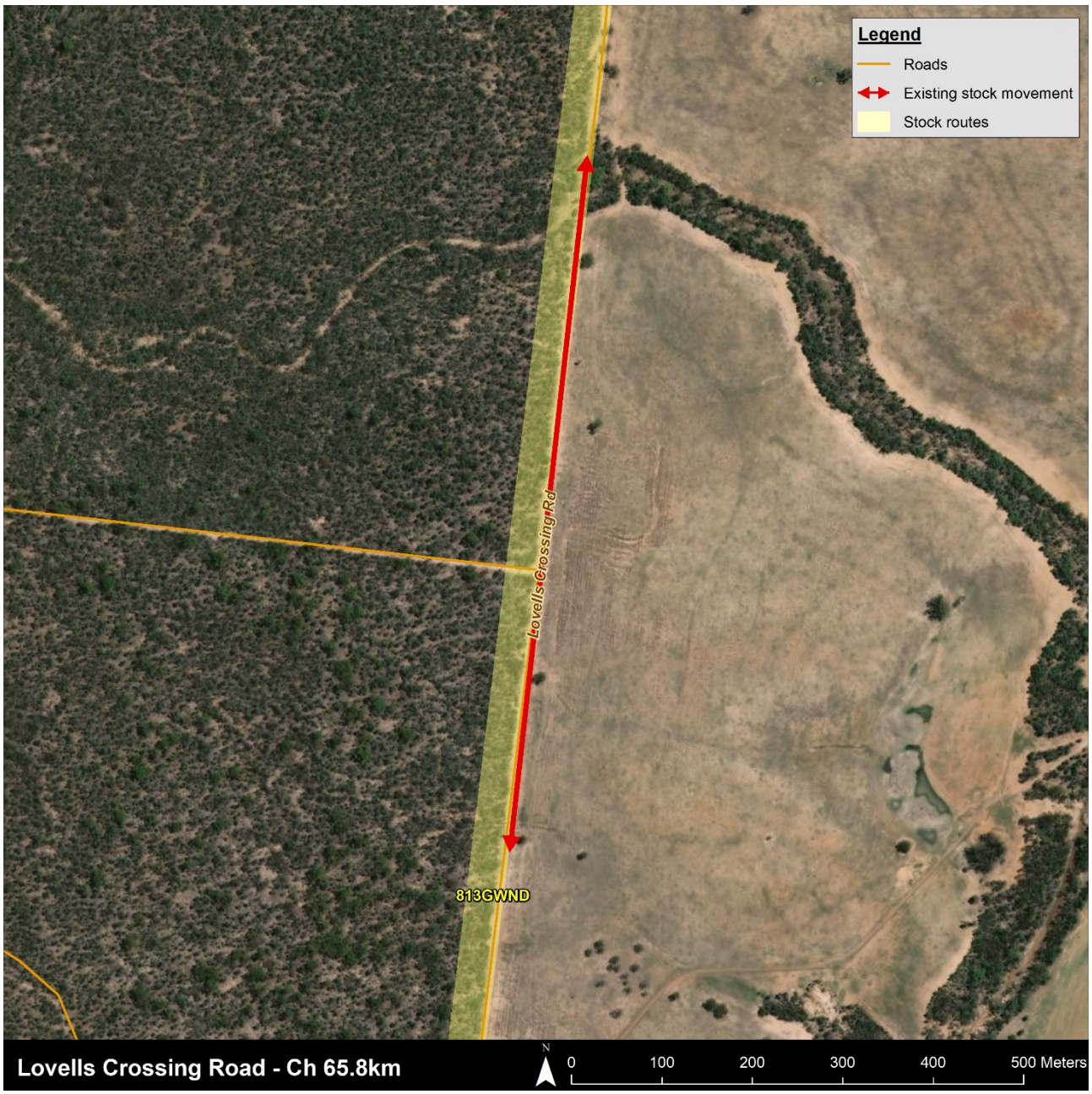

FIGURE 5.24 EXISTING STOCK ROUTE NETWORK CONNECTIVITY: LOVELLS CROSSING ROAD, CH 65.8 KM

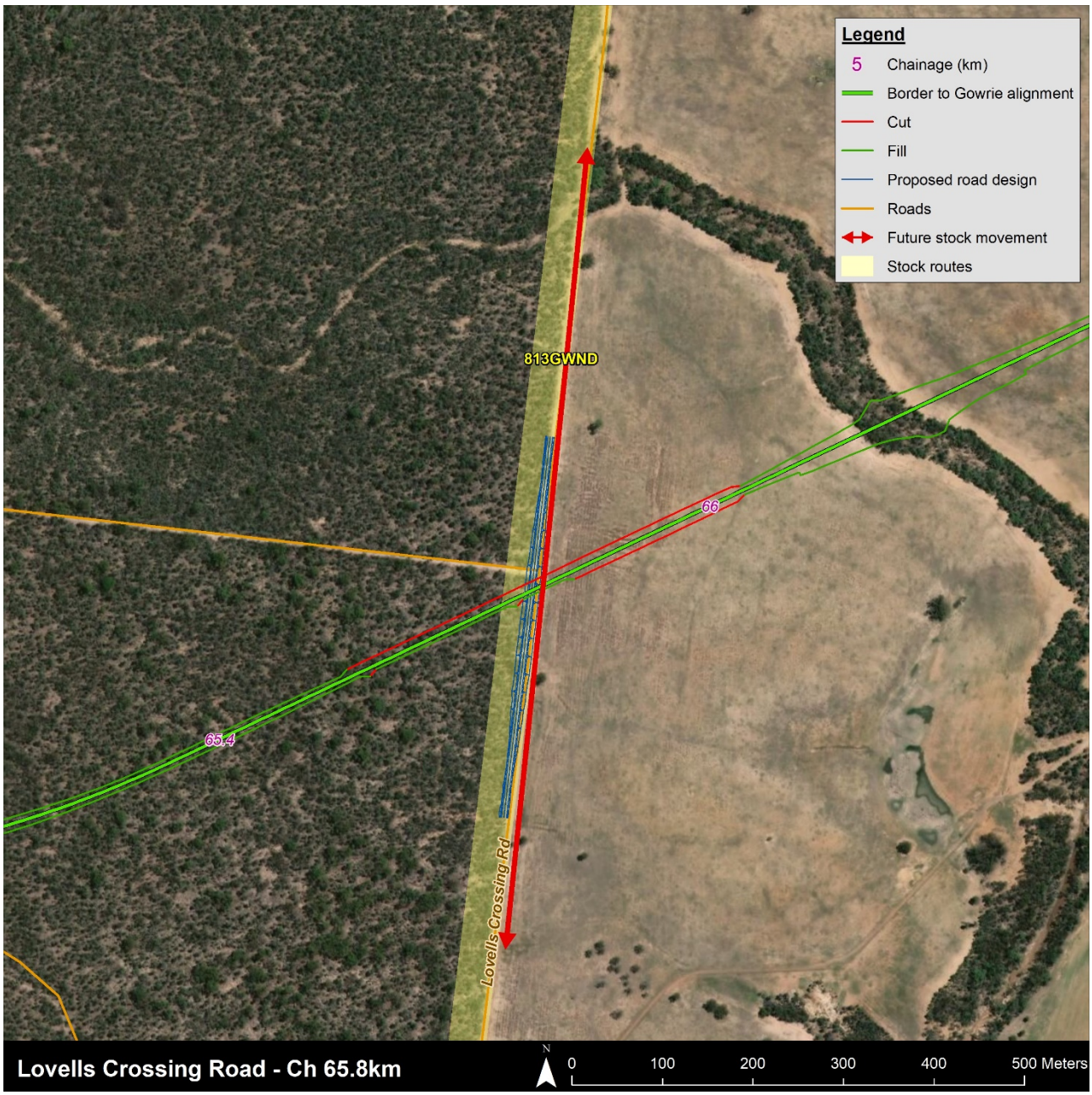

FIGURE 5.25 FUTURE STOCK ROUTE NETWORK CONNECTIVITY, WITH THE PROJECT: LOVELLS CROSSING ROAD, CH 65.8 KM

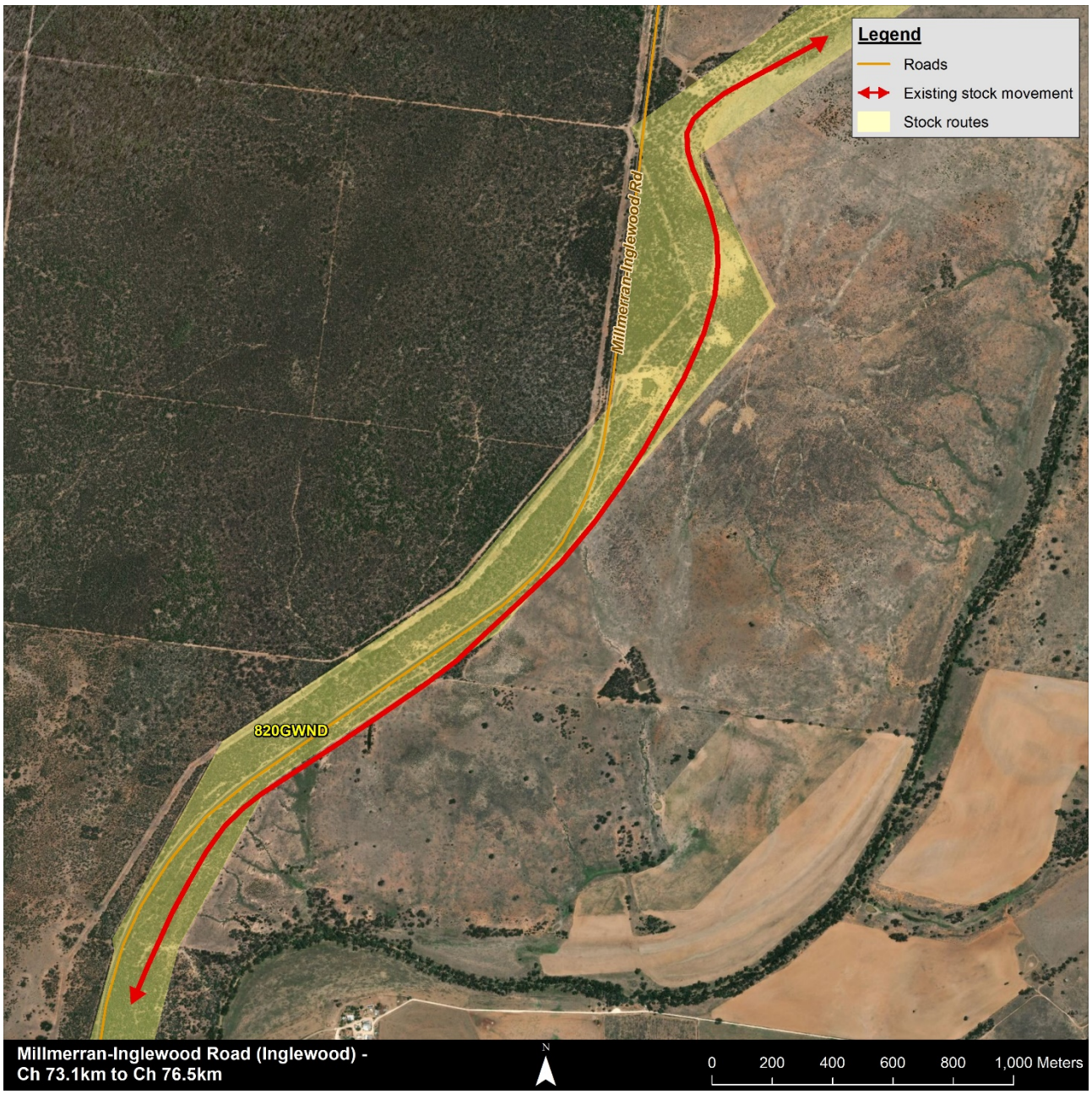

FIGURE 5.26 EXISTING STOCK ROUTE NETWORK CONNECTIVITY: MILLMERRAN-INGLEWOOD ROAD (INGLEWOOD), CH 73.1 KM TO 76.5 KM

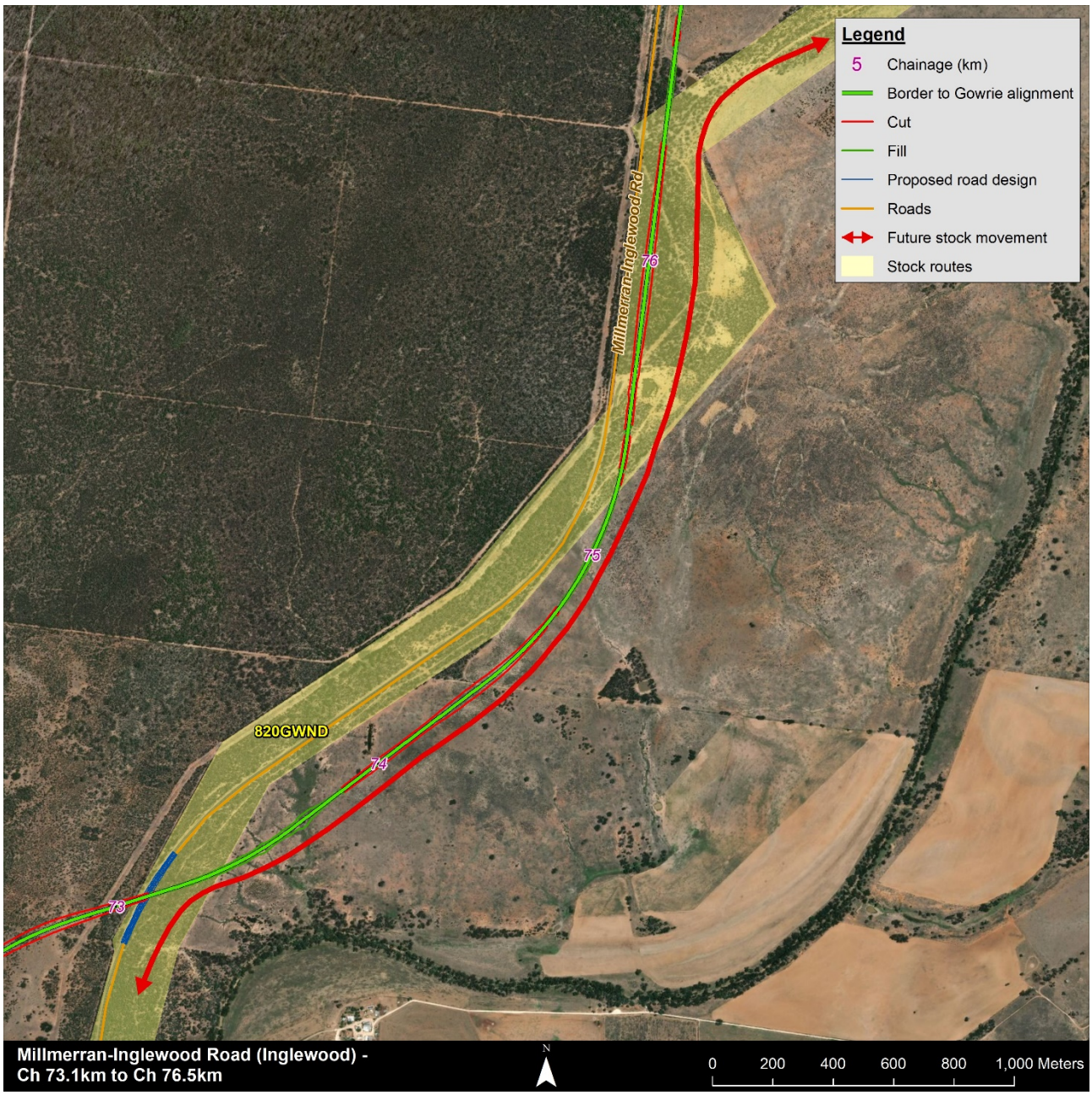

FIGURE 5.27 FUTURE STOCK ROUTE NETWORK CONNECTIVITY, WITH THE PROJECT: MILLMERRAN-INGLEWOOD ROAD (INGLEWOOD), CH 73.1 KM TO 76.5 KM

FIGURE 5.28 EXISTING STOCK ROUTE NETWORK CONNECTIVITY: MILLMERRAN-INGLEWOOD ROAD (INGLEWOOD), CH 84.2 KM

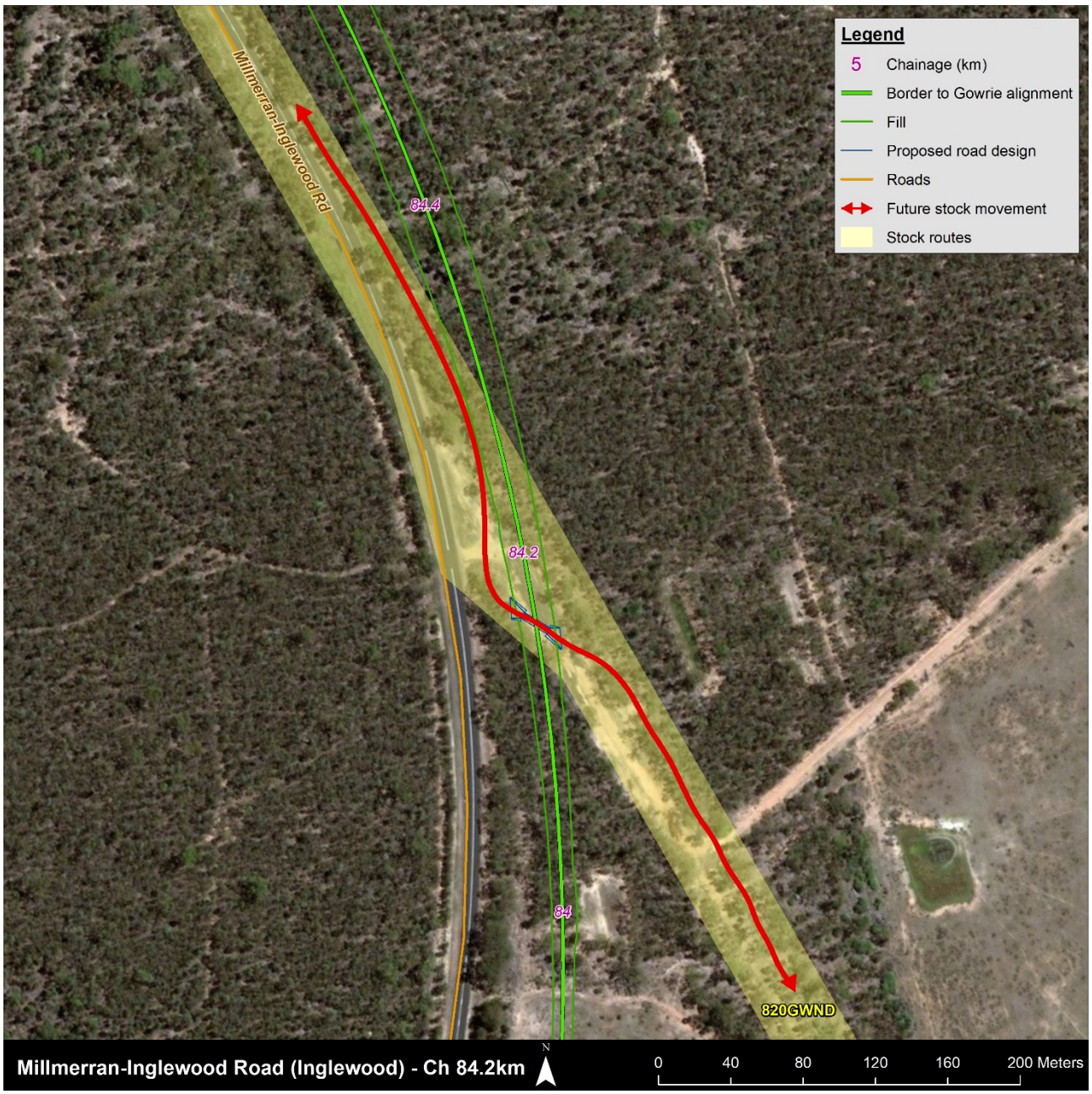

FIGURE 5.29 FUTURE STOCK ROUTE NETWORK CONNECTIVITY, WITH THE PROJECT: MILLMERRAN-INGLEWOOD ROAD (INGLEWOOD), CH 84.2 KM

FIGURE 5.30 EXISTING STOCK ROUTE NETWORK CONNECTIVITY: KOOROONGARRA-ANDERSON ROAD, CH 96.1 KM

FIGURE 5.31 FUTURE STOCK ROUTE NETWORK CONNECTIVITY, WITH THE PROJECT: KOOROONGARRA-ANDERSON ROAD, CH 96.1 KM

FIGURE 5.32 EXISTING STOCK ROUTE NETWORK CONNECTIVITY: MILLMERRAN-INGLEWOOD ROAD (NEAR HECKENDORF ROAD), CH 115.5 KM

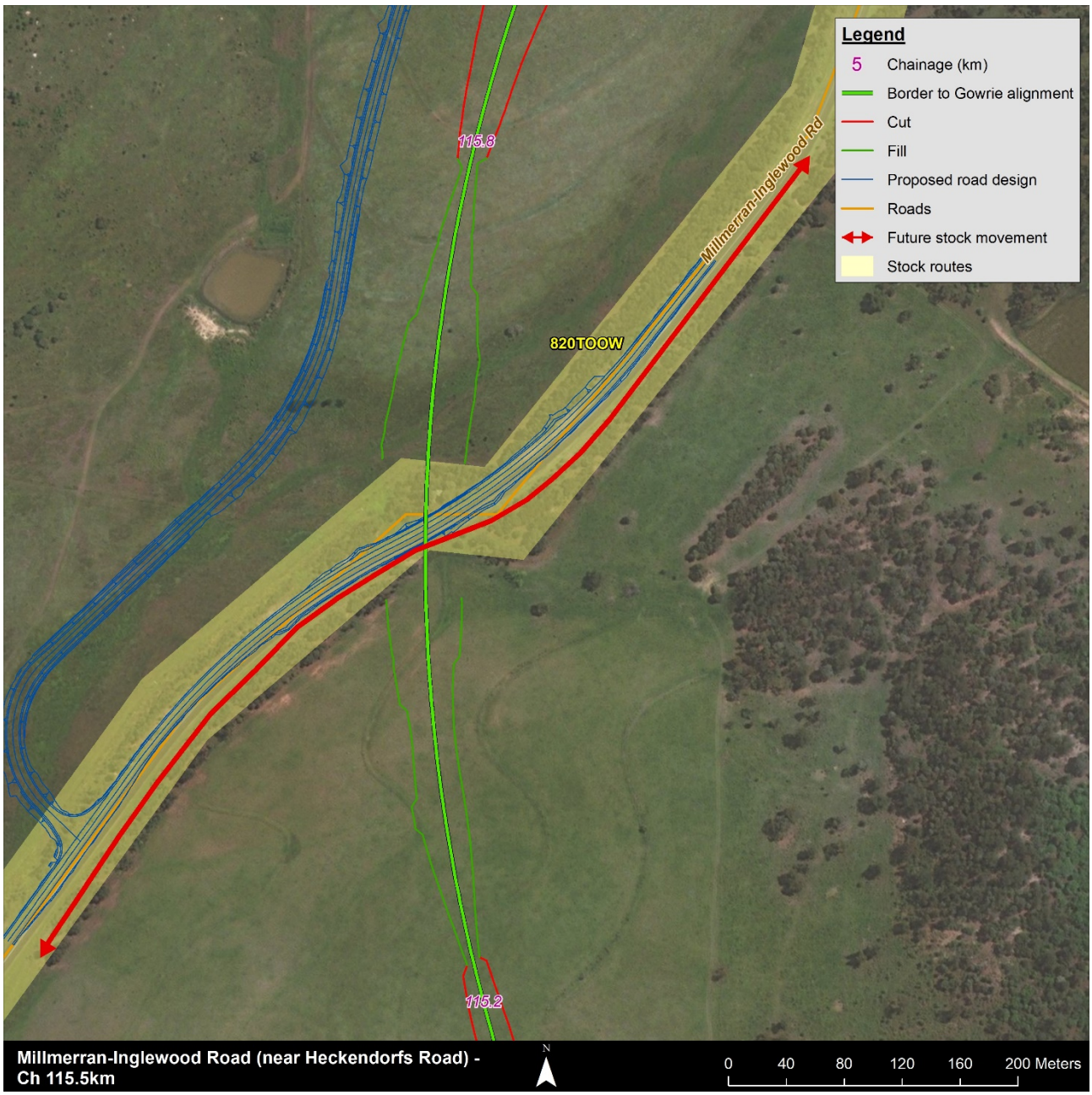

FIGURE 5.33 FUTURE STOCK ROUTE NETWORK CONNECTIVITY, WITH THE PROJECT: MILLMERRAN-INGLEWOOD ROAD (NEAR HECKENDORF ROAD), CH 115.5 KM

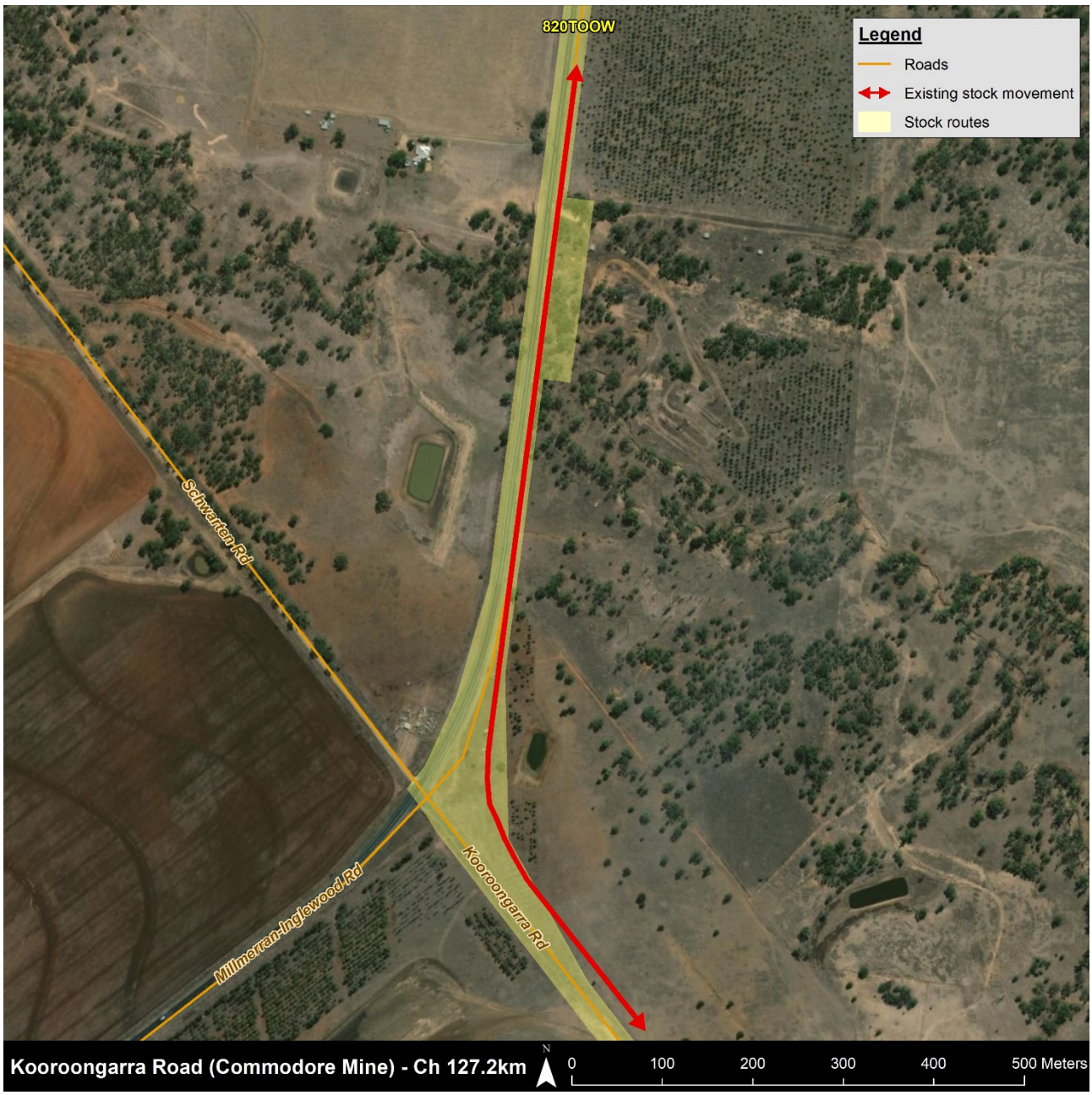

FIGURE 5.34 EXISTING STOCK ROUTE NETWORK CONNECTIVITY: KOOROONGARRA ROAD (COMMODORE MINE), CH 127.2 KM

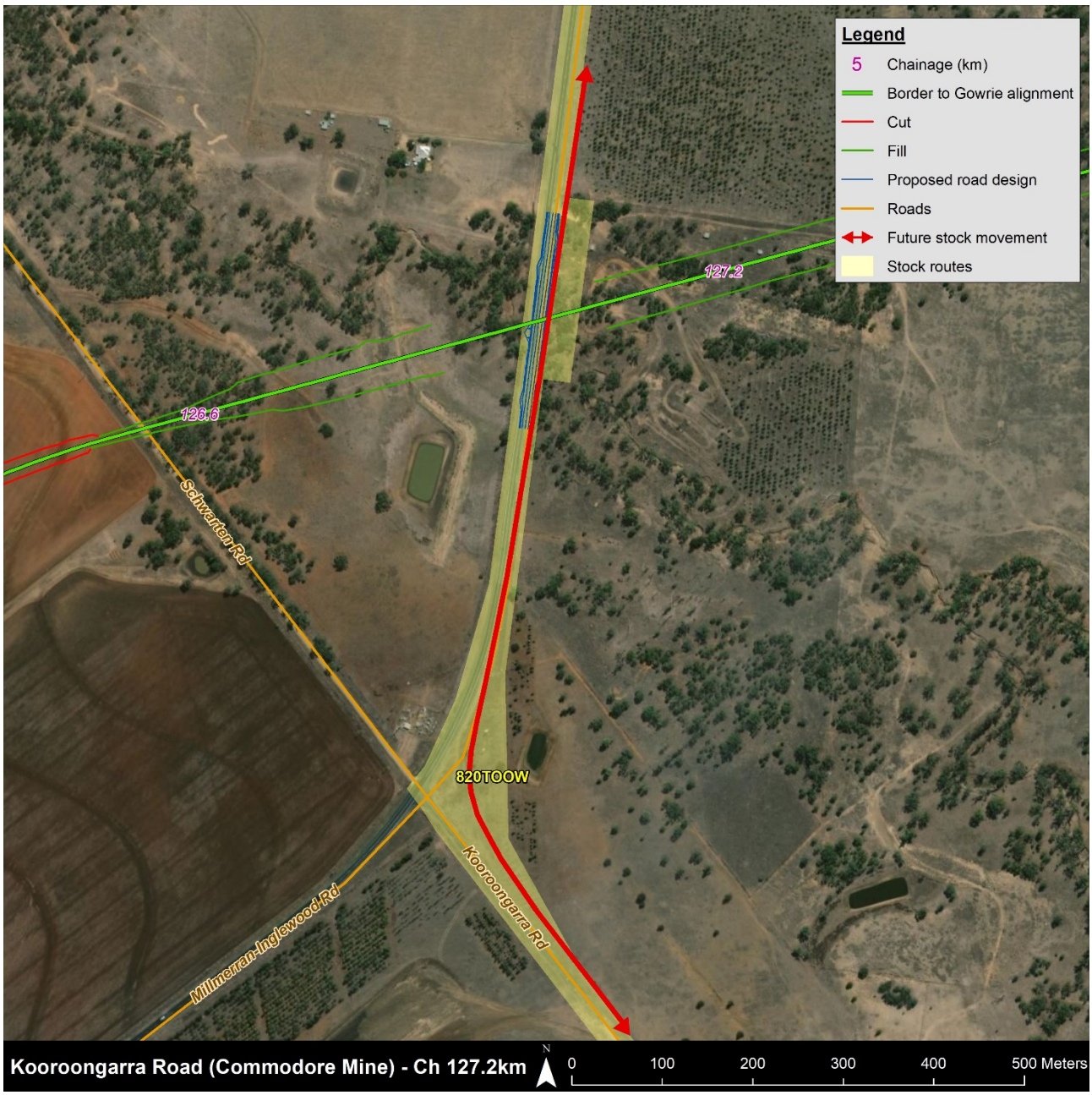

FIGURE 5.35 FUTURE STOCK ROUTE NETWORK CONNECTIVITY, WITH THE PROJECT: KOOROONGARRA ROAD (COMMODORE MINE), CH 127.2 KM

FIGURE 5.36 EXISTING STOCK ROUTE NETWORK CONNECTIVITY: WARREGO HIGHWAY, CH 203.01 KM

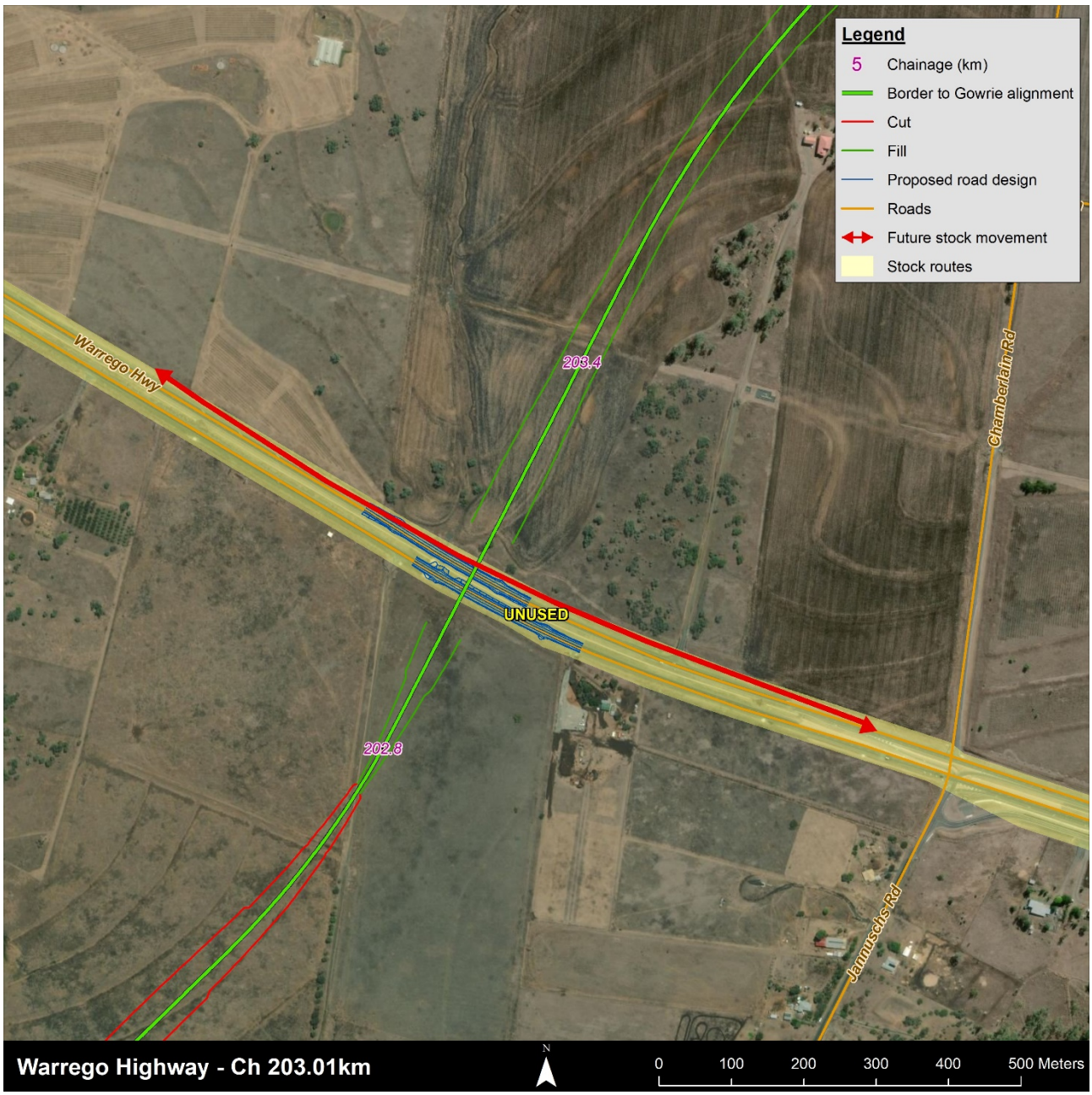

FIGURE 5.37 FUTURE STOCK ROUTE NETWORK CONNECTIVITY, WITH THE PROJECT: WARREGO HIGHWAY, CH 203.01 KM

5.2.8 Rail maintenance access roads

Rail maintenance access roads (RMAR) are required to facilitate maintenance for critical infrastructure (e.g. turnouts), and to provide access for emergency recovery during operation of the railway. Formation level access has been proposed for all turnout locations and, where reasonably practical, for the full extent of crossing loops.

For the considerable number of bridge abutments requiring access for inspection and maintenance, a surface-level access road has been proposed unless there are location-specific reasons for providing a formation-level access road. Where surface level access has been provided, access to the formation level at abutments will be achieved by provision of stairs and use of bridge walkways. This has been proposed to avoid the need to provide turnarounds at each bridge abutment, considerable lengths of formation level roads and ramps, and additional service roads to connect with public roads.

A diagram showing the positioning of a formation level RMAR is shown in Figure 5.38.

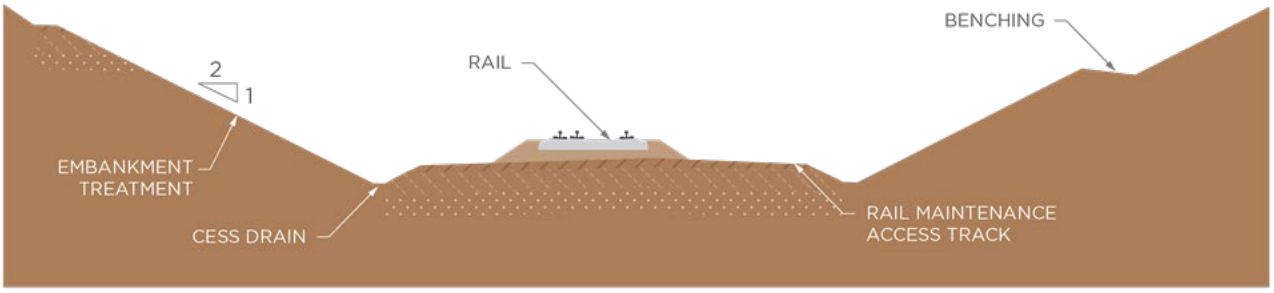

FIGURE 5.38 TYPICAL SECTIONAL DIAGRAM OF RAIL FORMATION SHOWING RAIL MAINTENANCE ACCESS ROAD

5.2.9 Utility/service crossings

The number of utility interfaces identified for the Project, broken down by service type and asset owner, is presented in Table 5.17.

TABLE 5.17 SUMMARY OF IMPACTED UTILITIES BY TYPE OF SERVICE AND ASSET OWNER

Utility/service	APA	Ergon	Essential Energy	Goondiwindi Regional Council	Millmerran Operating Co.	Nextgen	Powerlink	Santos	Telstra	Toowoomba Regional Council	TPG/PowerTel/ AAPT	Total
Communication						69			433		2	504
Electricity		106	25				3					134
Gas	2											2
Oil								1				1
Potable water				1						3		4
Raw water										3		3
Recycled water					6							6
Sewer gravity main				1								1
Sewer rising main										1		1
Total	**2**	**106**	**25**	**2**	**6**	**69**	**3**	**1**	**433**	**7**	**2**	**656**

A preliminary review of the likely utility interface treatment has been completed. Each utility is considered to warrant one of the following general treatment types:

- **Protection**—Impacts to the utility can be avoided through the provision of additional administrative or engineered controls, temporary de-energising of power lines or additional concrete encasement of underground assets.
- **Relocation/realignment**—Impacts to the utility cannot be avoided through modification of design or construction methods. The utility will need to be realigned or relocated from its current position to avoid impact by Project activities.
- **No treatment**—The Project design can be configured to avoid direct impacts to the utility. The utility remains in place and no protection is required.

The potential major utility diversions that may have an impact on construction are listed in Table 5.18.

TABLE 5.18 SUMMARY OF UTILITY INTERFACE TREATMENTS BY SERVICE TYPE

Utility/service	Protection	Relocation/realignment	No treatment	Total
Communication	44	457	3	504
Electricity		95	39	134
Gas	2			2
Oil	1			1
Potable water	1	3		4
Raw water		2	1	3
Recycled water	5	1		6
Sewer gravity main		1		1
Sewer rising main		1		1
Total	**53**	**560**	**43**	**656**

All utility owners have been consulted by ARTC during the reference design process to establish potential interface impacts and to identify initial design solutions. Consultation with utility owners will continue through the detail design phase of the Project to further verify interface impacts and to confirm appropriate interface treatments.

5.2.10 Fencing

5.2.10.1 General approach

Fencing will be provided for the majority of the rail corridor and its primary purpose is to limit access to the railway. Fencing will act to protect adjoining lands from trespass and to prevent stock on such adjoining land from gaining access to the railway. Fencing is to extend between the corridor and lands of owners or occupiers adjoining the railway, with any specific requirements to be designed in consultation with the adjoining landowner.

As the Project comprises substantial greenfield works in rural agricultural and grazing areas, standard rural fencing will typically be provided according to ARTC fencing procedure, Boundary Fencing ETM-17-02 (available on the ARTC Extranet: **extranet.artc.com.au**). Where superior fencing is required (for example where tracks are in close proximity to roads and/or communities, or where trespass is anticipated to occur) a 1.8 m chain link boundary fence may be provided.

Feedback from adjacent landowners indicates that fencing on the Condamine River floodplain:

- Increases the risk of debris being trapped on the fence and causing blockage, potentially exacerbating the risk of flooding impacts and resulting in ongoing maintenance issues
- Can be washed away in flood events, causing issues to downstream properties and infrastructure and subsequently requires re-instatement.

Based on this consultation feedback, fencing of the rail corridor has not been included in the reference design across floodplain areas. Instead, guideposts or other alternative means of protection will be installed at the rail corridor boundary in order to demarcate the rail corridor and prevent access to the rail corridor. The track elevation through these areas will also act as a deterrent to trespass or livestock access to the railway, where this may otherwise occur.

Gates will be provided at suitable corridor entry/exit locations to allow convenient access to infrastructure for maintenance purposes, and at private level crossings and stock crossings.

Fencing returns will be installed at bridge abutments and drainage or fauna crossing culverts. Fencing across small waterways will be designed to avoid storm damage and to retain effective stock control.

5.2.10.2 Fauna fencing and crossings

Maintaining effective fauna movement across the rail corridor has been an important design consideration for the Project. A preliminary fauna movement provision and fencing strategy has been prepared for the Project and is included in Appendix M: Preliminary Fauna Movement Provision and Fencing Strategy.

The purpose of this strategy is to identify fauna movement and fencing opportunities that are to be investigated further during the detail design phase of the Project to confirm the appropriateness of each solution at the nominated location. Fauna movement opportunities that have been identified for the Project are classified as follows:

- At grade crossing, via track crossing
- Overpass, via canopy bridge
- Underpass at rail bridge location.

The opportunity to provide fauna exclusion fencing in association with the above-mentioned fauna crossings has been identified. This fencing would guide animals towards the preferred fauna crossing structure or passage, while reducing their potential to be struck by vehicles or trains.

The confirmation of suitability for each fauna connectivity opportunity will rely on:

- Consultation with adjoining landowners to confirm the acceptability of the proposed connectivity or fencing approach at each nominated location
- Assessment of each opportunity for compatibility with detail design
- Consideration for maintenance constraints that a fauna connectivity or fencing opportunity may introduce.

Where practical, the strategy provides recommendations for conceptual fauna crossing design types and associated fencing with consideration of *Fauna Sensitive Road Design—Volume 2* (DTMR, 2000). The manual provides general guidance and examples of fauna movement strategies for linear infrastructure, and the guidance is readily adapted to rail corridors. Additional expert guidance in relation to specific design features will be sought during the detail design process.

5.2.10.3 Pest exclusion fencing

There are three types of barrier fences that are identified in the *Biosecurity Act 2014* (Qld) for the management of pest animals. These are the wild dog barrier fence, wild dog check fence and the rabbit fence. The Project intersects the wild dog check fence and the rabbit fence.

Wild dog check fences protect areas of grazing and cropping land in southern Queensland from wild dogs. Wild dog check fences do not physically link up to the wild dog barrier fence, however they play an important role in wild dog control in southern Queensland. GRC is responsible for the ongoing maintenance of approximately 283 km of the wild dog check fence.

The Project alignment runs parallel to the existing wild dog check fence from Ch 26.8 km to 43.5 km, it then intersects the wild dog check fence at four locations, Ch 50.1 km, Ch 51.2 km, Ch 54.9 km and Ch 56.0 km. The wild dog check fence will need to be reinstated on the northwest side of the rail corridor boundary in six locations as rectification for severance of this fence, as shown in Table 5.19.

ARTC have commenced consultation with the GRC to determine fencing requirements at these locations. Detail design drawings of ARTC's nominated fencing solution for reinstatement of the wild dog check fence will be submitted to GRC for acceptance prior to works commencing.

The details of ARTC's standard fauna exclusion fence, which will be used as a basis for designing the reinstatement for the wild dog check fence, are shown in Figure 5.39.

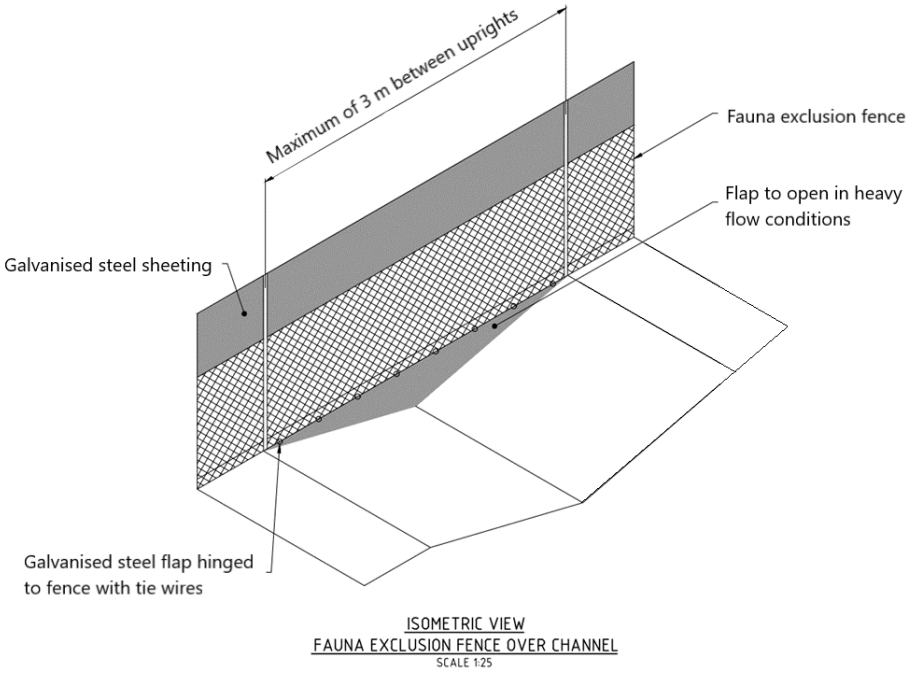

FIGURE 5.39 STANDARD FAUNA EXCLUSION FENCE OVER CHANNEL

The Darling Downs–Moreton Rabbit Board (DDMRB) fence is a 555 km long rabbit-proof fence. The fence is managed and maintained by the DDMRB, stretching from Lamington National Park in the east, to Goombi in the southwest, where it connects to the wild dog barrier fence. The Project intersects the DDMRB fence when traversing through the locality of Clontarf, at approximately Ch 120.2 km. The rabbit fence will need to be reinstated as shown in Table 5.19. In addition, a rabbit trap will be set up in this location.

ARTC have commenced consultation with the DDMRB to determine fencing requirements at this location. Detail design drawings of ARTC's nominated fencing solution at Ch 120.2 km will be submitted to DDMRB for acceptance prior to construction commencing.

TABLE 5.19 FENCING STRATEGY BY CHAINAGE AND LAND USE

From Ch (km)	To Ch (km)	Land use north or west of rail	Fence type north or west of rail	Land use south or east of rail	Fence type south or east of rail
30.6 (NS2B)	2.9	Agriculture and grazing	Standard rural chain wire	Agriculture and grazing	Standard rural chain wire
2.9	25.5	Road corridor (Yelarbon–Kurumbul Road)	Standard rural chain wire	Agriculture and grazing	Standard rural chain wire
25.5	26.4	Community (Yelarbon)	Standard chain link boundary fence	Community (Yelarbon)	Standard chain link boundary fence
26.4	26.8	GrainCorp facility	Guideposts only	Community (Yelarbon)	Standard chain link boundary fence
26.8	30.3	Grazing	Wild dog check fence	East of Sawmill Road	Standard rural chain wire
30.3	37.7	Grazing and agriculture	Wild dog check fence	Grazing and agriculture	Standard rural chain wire
37.7	42.0	Forest	Wild dog check fence	Forest	Standard rural chain wire
42.0	43.5	Forest	Wild dog check fence	Agriculture and grazing	Standard rural chain wire
43.5	50.0	Forest	Standard rural chain wire	Agriculture and grazing	Standard rural chain wire
50.0	51.2	Agriculture and grazing	Wild dog check fence	Agriculture and grazing	Standard rural chain wire
51.2	54.6	Agriculture and grazing	Standard rural chain wire	Agriculture and grazing	Standard rural chain wire

From Ch (km)	To Ch (km)	Land use north or west of rail	Fence type north or west of rail	Land use south or east of rail	Fence type south or east of rail
54.6	56.0	Agriculture and grazing	Wild dog check fence	Agriculture and grazing	Standard rural chain wire
56.0	65.8	Forest	Standard rural chain wire	Forest	Standard rural chain wire
65.8	73.0	Grazing	Standard rural chain wire	Grazing	Standard rural chain wire
73.0	84.0	Road corridor (Millmerran–Inglewood Road)	Standard rural chain wire	Grazing	Standard rural chain wire
84.0	92.0	Road corridor (Millmerran–Inglewood Road)	Standard rural chain wire	Forest	Standard rural chain wire
92.0	95.0	Grazing	Standard rural chain wire	Grazing	Standard rural chain wire
95.0	102.9	Agriculture and grazing	Standard rural chain wire	Agriculture and grazing	Standard rural chain wire
102.9	120.2	Agriculture and grazing	Standard rural chain wire	Agriculture and grazing	Standard rural chain wire
120.2	120.2	Agriculture and grazing	Rabbit trap (similar to existing rabbit trap on Millmerran–Inglewood Road)	Agriculture and grazing	Rabbit trap. Reinstatement of DDMRB rabbit fence also required
120.2	121.0	Agriculture and grazing	Standard rural chain wire	Agriculture and grazing	Standard rural chain wire
121.0	123.7	Road corridor	Standard rural chain wire	Commodore Mine	Standard rural chain wire
123.7	126.2	Road corridor	Standard rural chain wire	Commodore Mine, agriculture and grazing	Standard rural chain wire
126.2	137.0	Agriculture and grazing	Standard rural chain wire	Agriculture and grazing	Standard rural chain wire
137.0	146.1	Agriculture (Condamine River Floodplain)	Guideposts only	Agriculture (Condamine River floodplain)	Guideposts only
146.3	147.0	Community (Pampas)	Standard chain link boundary fence	Community (Pampas)	Standard chain link boundary fence
147.0	149.8	Road corridor (Gore Highway)	Guideposts only	Agriculture (Condamine River floodplain)	Guideposts only
149.8	152.7	Road/rail corridor, GrainCorp facility, community (Brookstead)	Standard chain link boundary fence	Agriculture, some community residences	Standard chain link boundary fence
152.7	162.0	Agriculture	Standard rural chain wire	Agriculture	Standard rural chain wire
162.0	169.0	Agriculture and grazing	Standard rural chain wire	Agriculture and grazing	Standard rural chain wire
169.0	173.4	Agriculture and grazing	Standard rural chain wire	Road corridor (Gore Highway)	Standard rural chain wire
173.4	182.7	Agriculture and grazing	Standard rural chain wire	Agriculture and grazing	Standard rural chain wire
182.7	186.2	Agriculture and grazing	Standard rural chain wire	Road corridor (Gore Highway)	Standard rural chain wire
186.2	206.3	Agriculture and grazing	Standard rural chain wire	Agriculture and grazing	Standard rural chain wire

5.2.11 Fish passage

Fish passage is an essential requirement for the survival and productivity of many species of Queensland fish. Due to the construction of instream structures (such as dams and culverts) on waterways, the loss of access to habitat has caused the decline in distribution of native fish populations.

The *Fisheries Act 1994* (Qld) (Fisheries Act) and the Planning Act 2016 (Qld) (Planning Act) require that works within waterways that are considered the development of new waterway barriers, raising of existing waterway barriers or maintenance of existing structures, must be conducted in a manner to provide for adequate fish passage.

The Department of Agriculture and Fisheries (DAF), under the Fisheries Act, provides the 'Queensland Waterway Barriers for Waterway Barrier Works' spatial mapping layer, which defines the legislative fish passage requirements for the cross-drainage structures within Queensland. Waterways include freshwater and tidal waters (both permanent and ephemeral waterways) and includes drainage features. It also includes channels along which fish are expected to move if they connect isolated water bodies to defined waterways during times of flow. However, it does not include isolated waterbodies where no connectivity is available.

To construct or raise waterway barrier works within a waterway, a development application under the Planning Act, or compliance with the Accepted Development Requirements for operational works that is construction or raising waterway barrier works, is needed. To determine the legislative requirements for assessment and design criteria, the risk level of the waterway is determined from the State mapping. Further discussion on the approvals process for the Project under the Planning Act and Fisheries Act is provided in Chapter 3: Legislation and Project Approvals Process.

A review of the DAF GIS data layer 'Queensland Waterways for Waterway Barrier Works' has been undertaken for each waterway crossed by the Project. The Project alignment crosses a total of 88 waterways for waterway barrier works. Of the 88 waterways, several of the waterways are crossed by the Project alignment multiple times. These waterways are classified as follows:

- **Low risk of impact (category 1)**—The alignment intersects 43 waterways mapped as 'low'
- **Moderate risk of impact (category 2)**—The alignment intersects 28 waterways mapped as 'moderate'
- **High risk of impact (category 3)**—The alignment intersects 7 waterways mapped as 'high'
- **Major risk of impact (category 4)** – The alignment intersects 10 waterways mapped as 'major'.

5.2.12 Signalling and communications

A Direct Traffic Control signalling system is currently used on the existing South Western Line and Millmerran Branch Line. Train movements on these lines are controlled and communicated via QR's Control Centre in Brisbane.

The Project will be operated using Advanced Train Management System (ATMS), a communications-based safeworking signalling system currently being developed by ARTC. The ATMS will consist of signalling and communications equipment to ensure the safe movement of trains on the Inland Rail network. This system will consist of signals, indicators, signs, detection, monitoring and control equipment on track, beside the track and in enclosures in the rail corridor. The safeworking system will be monitored and controlled by one or more of ARTC's network control centres currently located in Adelaide, Junee and Newcastle.

The ATMS will replace the Direct Traffic Control signalling system operation on sections of replaced QR track. This will interrupt the current continuous Direct Traffic Control operation along QR's network. The interoperability of the ATMS with QR's network will be confirmed through consultation with QR and incorporated into the detail design for the Project.

Earthworks requirements for signalling infrastructure, including signalling hut and solar charging panels, have been included in the design of crossing loops and maintenance sidings. A single signalling hut can service multiple turnouts where the turnouts are no more than 150 m from the proposed hut site. Signal hut locations associated with turnouts at passing loops and maintenance sidings are shown in the general arrangement drawings included in Volume 3 of this draft EIS.

5.2.13 Infrastructure alternatives

The reference design has been developed to include infrastructure components that contribute to a Project that can be safely and efficiently constructed and operated, is compliant with the Basis of Design for Inland Rail (refer Section 5.2.1) and is optimised with consideration for the overarching principles of ecologically sustainable development.

Infrastructure alternatives, as they relate to the use of energy, water conservation and wastewater management during construction and operation of the Project, will continue to be assessed for viability through the detail design process and refinement of the construction approach.

Chapter 6: Sustainability provides a full discussion on the sustainability initiatives that have been identified and incorporated into development of the reference design, in addition to the opportunities that have been identified to be assessed and implemented, if appropriate, through future phases of the Project.

5.3 Pre-construction activities and early works

Pre-construction activities are required to enable the construction of permanent infrastructure components of the Project to commence. These activities are expected to include:

- Land acquisition
- Obtaining additional environmental and planning approvals
- Surveys and geotechnical investigations
- Establishment of access tracks
- Utility/service relocations, realignments or protection
- Relocation or protection of QR assets
- Modification and re-instatement of fauna pest exclusion fencing
- Selective clearing of land acquired by ARTC through an early acquisition process
- Establishment of site compounds and construction facilities, including vehicle workshops and washdown facilities as required
- Establishment of non-resident workforce accommodation
- Delivery of materials with long lead times.

The acquisition of land process has been discussed in Section 5.1.7 and in Chapter 3: Legislation and Project Approvals Process. Other pre-construction activities are summarised below.

5.3.1 Environmental and planning approvals

Following approval of the EIS under the *State Development and Public Works Organisation Act 1971* (SDPWO) (Qld), the Project is likely to require additional post-EIS approvals under State environmental and planning legislation. The majority of the approvals will be required prior to the commencement of construction or any ground-disturbing activities.

Ancillary works (e.g. non-resident workforce accommodation, borrow pits, concrete batch plants) integral to the construction of the Project, being development for the construction of government supported infrastructure (Schedule 6, Part 5, Section 26 of the Planning Regulation), are exempt from assessment against the Goondiwindi and Toowoomba Regional Council local government planning schemes.

Under Schedule 21, Part 1, Item 14 of the Planning Regulation 2017, clearing work is 'exempt clearing work' for which a development permit is not required. This exemption includes 'other rail infrastructure' under Schedule 6 of the *Transport Infrastructure Act 1994* (Qld) (TI Act) that is, 'freight centres or depots, maintenance depots, office buildings or housing, rolling stock or other vehicles that operate on a railway, workshops and any railway track, works or other thing that is part of these'.

For development assessable under the Planning Act, under Section 51(2) of the Planning Act, evidence of consent of the owner is required to support applications for material change of use, reconfiguring a lot, or works below the high-water mark. This includes:

- Land subject to a permit to occupy or license
- Land that is unallocated State land
- Land that is a road (other than a State-controlled road) or stock route
- Land subject to a lease, including a freeholding lease or a reserve or deed of grant in trust, where the land is administered on behalf of the State as the lessee or trustee of the land
- Land subject to a lease, including a freeholding lease, or a reserve or deed of grant in trust, where the lessee or trustee is not or does not represent the State.

Owners' consent will be required prior to the making of some planning applications, for example ERAs that are required during construction to occur on any of the above-mentioned land types. The Project may involve the following ERAs during construction, as defined in Schedule 2 of the *Environmental Protection Regulation 2019*:

- Chemical storage (ERA 8)—threshold to be determined following refinement of construction methodology
- Fuel burning (ERA 15)—using fuel-burning equipment that can burn at least 500 kg of fuel in an hour
- Extractive and screening activities (ERA 16)—threshold to be determined following refinement of construction methodology
- Cement manufacturing (ERA 41)—manufacturing 200 tonnes (t) or more of cement in a year
- Sewage treatment (ERA 63)—the Project includes requirement for three non-resident workforce accommodations, each with estimated capacity of 300 beds. Sewage treatment works for each camp would trigger the ERA 63 threshold of 'more than 100 but not more than 1,500 equivalent people'.

A summary of the potential post-EIS approvals is provided in Chapter 3: Legislation and Project Approvals Process. These are subject to change during the detail design process and refinement of the construction approach and will need to be subject to further review at that stage.

Unless determined otherwise by the Principal Contractor, all construction activities (including pre-construction and early works) will remain within the Project footprint. If works outside the Project footprint are required (e.g. for borrow pits) the Principal Contractor will be responsible for undertaking further investigations of the disturbance area, obtaining relevant owner's consent and obtaining necessary approvals prior to the commencement of works at that location.

5.3.2 Surveys and geotechnical investigations

The construction of all infrastructure requires the adherence to survey control plans and procedures to ensure spatial correctness and quality of construction. The Project will engage reputable and competent surveying teams who will, among other things, control and guide the following:

- All elements of survey and survey control
- Survey mark preservation and compliance with mark destruction legislation in Queensland
- Development and nomination of survey control points to feed into inspection and test plans for construction, including:
  - Topsoil stripping
  - Quantity measurement (usually before and after all materials are used)
  - Setting out of all alignment and structural elements

The Principal Contractor will comply with ARTC survey requirements for the delivery of the Project.

Pre-construction surveys and investigations, e.g. dilapidation of buildings and structures, road pavement condition assessments, survey and mapping of weeds within the Project footprint, will also be progressed.

5.3.3 Site preparation

Site preparation works will require all grass, woody vegetation, topsoil and other organic and inorganic material to be stripped within the Project footprint. All turf, topsoil and other organic and unsuitable material will be also be stripped from the site. Wherever possible and appropriate, such material will be stockpiled for reuse within the immediate Project footprint.

Clearing and grubbing activities will commence on multiple work fronts and will always be ahead of the primary earthworks operations, but not so far ahead that exposed soil is left open for extended periods of time.

Clearing and grubbing activities will be preceded by:

- Flora and fauna surveys
- Appropriate flora and fauna treatments/re-locations
- Identification of underground utilities
- Appropriate utility works (i.e. protection/re-location)
- Erection of temporary and permanent fencing
- Any requirements under the approved CHMPs
- Installation of erosion and sediment control measures, including sediment basins.

Protective measures will be adopted around watercourses to ensure that the existing profiles are preserved. If weed infestations are encountered, the cleared vegetation will be disposed of in an appropriate manner to minimise risk of spread of infestation.

Cleared vegetation ready for mulching will be stockpiled outside the earthworks footprint but inside the rail corridor ready for mulching. The mulched material will be stockpiled and managed to facilitate re-use, and to prevent combustion. Possible alternatives to mulching of vegetation matter will be considered and appropriately assessed as the construction approach is refined during the detail design process.

5.3.4 Access roads

Access roads will be required along the rail corridor to allow construction crews to access work fronts. Access roads to the Project alignment will be designed and constructed, or upgraded if existing tracks are to be used, with appropriate consideration to minimising disruption to landowners and public infrastructure.

Construction access is proposed to be provided adjacent to all working fronts along the rail corridor and will be sized to allow free flow and unhindered access for all construction and support traffic vehicles. During this phase, materials including rail, sleepers, ballast, concrete, culverts, fill material (general and structural) and construction water will be delivered and stockpiled/stored in designated construction laydown areas. In general, the access roads will also cater for the movement of:

- Construction equipment and vehicles
- Personnel transport for staff and labour to access work fronts
- Maintenance vehicles
- Material deliveries
- Servicing temporary construction facilities along the route.

Several access roads, outlined in Table 5.20, will be developed to facilitate access to laydowns and construction sites located along the length of the Project footprint. These access roads will be designed and constructed with consideration for:

- Vehicle numbers
- Vehicle lengths
- Vehicle weights
- Separation requirements
- One-way or two-way vehicle movements
- Overtaking requirements.

Access routes will, in the first instance, be located within the rail corridor and use the future RMAR footprint. This will be in preference to creating new tracks that will require restoration once the construction work has been completed.

When planning for the location of access roads and haul routes, an assessment will be made of above and underground services that may be affected by oversized loads or weights. This assessment will also consider the asset owners' maintenance access requirements. Where a route is noted in Table 5.20 as using future RMAR, then it is within the rail corridor and uses the footprint of the future RMAR.

TABLE 5.20 TEMPORARY ACCESS ROADS

Location	Chainage	Length (m)	Note
Kildonan Road	Ch 32.0 km (NS2B)	3,000	▸ Existing dirt track, upgrading or regrading may only be required
Eukabilla Road	Ch 37.0 km (NS2B)	1,300	▸ Access available off existing Eukabilla Road
Georges Road	Ch 1.0 km	1,800	▸ A 2 km extension of Georges Road will be required ▸ A dirt track already exists; upgrading or regrading may only be required
McDougall's Crossing Road	Ch 50.0 km	190	▸ Access via cut/fill point ▸ McDougall's Crossing Road may need regrading to accommodate frequent construction traffic ▸ Structure over Macintyre brook may not be suitable for construction traffic
Cremascos Road	Ch 52.8 km	1,300	▸ Access via Cremascos Road ▸ Structure over Macintyre Brook may not be suitable for construction traffic ▸ The access track will be utilising future RMAR
Cremascos Road	Ch 55.0 km	900	▸ Access via Cremascos Road ▸ Structure over Macintyre Brook may not be suitable for construction traffic ▸ The access track will be using future RMAR
Inglewood	Ch 65.0 km	470	▸ Access via Lovells crossing road ▸ Structure over Macintyre brook may not be suitable for construction traffic
Cremascos Road	Ch 67.8 km	970	▸ Access via Thornton Road ▸ The access track will be using future RMAR
Millmerran–Inglewood Road	Ch 73.0 km	55	▸ Access from the adjacent Millmerran–Inglewood Road
Millmerran–Inglewood Road	Ch 73.6 km	290	▸ Access from the adjacent Millmerran–Inglewood Road ▸ The access track will be partly using future RMAR
Millmerran–Inglewood Road	Ch 74.8 km	80	▸ Access from the adjacent Millmerran–Inglewood Road
Cattle Creek	Ch 88.4 km	150	▸ Access from the adjacent Millmerran–Inglewood Road
Millmerran–Inglewood Road	Ch 93.6 km	220	▸ Access off Millmerran–Inglewood Road
Millmerran–Inglewood Road	Ch 100.7 km	100	▸ Access from the adjacent Millmerran–Inglewood Road ▸ The access track will be using future RMAR
Nicol Creek	Ch 105.7 km	990	▸ Access from Patons–Koorooga Road ▸ The access track will be using future RMAR
Millmerran–Inglewood Road	Ch 115.7 km	25	▸ Access from the adjacent Millmerran–Inglewood Road
Kooroongarra Road	Ch 127.0 km	800	▸ Access from the adjacent Millmerran–Inglewood Road ▸ The access track will be using future RMAR
Gore Highway–Yandilla	Ch 137.0 km	2,300	▸ Access via Gore Highway
Halls McCallums Road–Yandilla	Ch 138.0 km	950	▸ Access via Hall McCallums Road. May require upgrading/grading and/or widening
Millmerran–Leyburn Road	Ch 140.1 km	1,500	▸ Access off the adjacent Millmerran–Leyburn Road ▸ The access track will be utilising future RMAR
Millmerran–Leyburn Road	Ch 140.2 km	1,040	▸ Access off the adjacent Millmerran–Leyburn Road

Location	Chainage	Length (m)	Note
Condamine River Bridge	Ch 144.2 km	1,400	▸ Access via the adjacent Gilgai Lane ▸ The access track will be utilising future RMAR
Aulfreys Road	Ch 147.3 km	100	▸ Access via Aulfreys Road
Construction Haul Road	Ch 194.0 km	7,800	▸ Construction haul road between Athol School Road and Toowoomba–Cecil Plains Road ▸ The access track will be using future RMAR
Westbrook Creek	Ch 197.0 km	850	▸ New access track to be developed off existing Toowoomba–Cecil Plains Road
Brimblecombe Road	Ch 197.5 km	1,000	▸ Alignment access between bridges ▸ Partly using existing private property access
Dry Creek–Brimblecombe Road	Ch 198.8 km	580	▸ New access track to be developed off existing Brimblecombe Road ▸ The access track will be using future RMAR
Brimblecombe Road and Warrego Highway	Ch 202.5 km	4,300	▸ Construction haul road between Brimblecombe Road and Warrego Highway ▸ The access track will be using future RMAR
Chamberlain Road	Ch 203.6 km	940	▸ Unsealed section of Chamberlain Road

5.3.5 Queensland Rail assets

A survey of all existing QR assets within the Project footprint will be required following the execution of an interface agreement between ARTC and QR, but prior to the commencement of construction. The purpose of this survey will be to locate all existing rail infrastructure components and determine their type, size, materials and condition. Such assets may include turnouts, signalling systems, culverts, sleepers, rail and ballast. This survey will inform Project decisions on the ability to reuse or the need to protect, remove or relocate existing QR assets.

Where an existing asset requires protection, removal or relocation, these works may be conducted as a pre-construction activity if safe to do so for continued network operation, with prior approval from QR.

ARTC will work with QR to investigate the feasibility of the following options:

- Development of a technical specification for ballast reuse and blending with other materials for construction of the rail embankment
- Engagement with a metals recycling operator for the collection of disused rail for repurposing
- Engagement with landowners in relation to the reuse of sleepers, e.g. for landscaping or fencing.

5.3.6 Utility/service interfaces

Site preparation includes protection, realignment or relocation of utility services and infrastructure. There are no major utility structures along the Project footprint requiring complete removal (refer Section 5.2.9).

Further utility surveys will be undertaken during detail design, as required, to confirm the as-built locations and arrangements of potentially impacted utilities.

Where interfaces between the Project and utilities are confirmed, a variety of impact avoidance strategies are likely to be appropriate, as follows:

- Abandonment of redundant services
- Realignment of existing service where slack or arrangement allows
- Relocation with construction of new service, followed by transition from old service to new
- Protection of existing services, if no severance impact is anticipated.

Utility realignments and relocations will be undertaken by the utility provider and are not assessed as part of the Project. ARTC has commenced consultation with all owners of utility assets located within the Project footprint. The utility realignments and relocations will be subject to separate assessments, with all necessary approvals obtained prior to the relocation being undertaken.

The utilities required to support construction of the Project will be temporary in nature. When the final locations of site offices and batch plants are confirmed through detail design, the Principal Contractor will engage with utility providers with the objective of connecting to mains power, water, communications and sewerage. Where connection to existing infrastructure networks is not possible or practicable, temporary portable alternatives will be adopted, for example tanks (water), gen-sets (power), cellular network amplifiers (communications) and package sewage treatment plants.

5.3.7 Fauna pest exclusion fencing

As discussed in Section 5.2.10.2, the Project intersects the wild dog check fence at four locations and the DDMRB rabbit fence at one location. Where interfacing with or severance of biosecurity fence is required, it is anticipated that fence realignment and reconstruction will be undertaken as an early works package prior to the commencement of the construction of rail infrastructure. Replacement fencing will be in accordance with detail designs accepted by GRC or the DDMRB, as relevant.

5.3.8 Site offices

Eleven laydown areas have been nominated for the location of site offices. Not all locations are required to have site offices. However, the locations proposed in Table 5.21 have been selected as potential locations along the Project footprint with an area large enough to contain a site office.

TABLE 5.21 PROJECT SITE OFFICE LOCATIONS

ID (laydown area)[1]	Location	Chainage	Description
NS2B–LDN035.6	Eukabilla Road	Ch 35.6 km (NS2B)	Main site office
B2G–LDN025.9	Yelarbon–Kurumbul Road	Ch 25.9 km	Secondary site office
B2G–LDN054.2	Cremascos Road	Ch 54.2 km	Secondary site office
B2G–LDN074.0	Millmerran–Inglewood Road	Ch 74.4 km	Secondary site office
B2G–LDN081.0	Millmerran–Inglewood Road	Ch 81.0 km	Secondary site office
B2G–LDN116.5	Millmerran–Inglewood Road	Ch 116.5 km	Main site office
B2G–LDN161.0	Pittsworth–Tummaville Road	Ch 161.0 km	Main site office
B2G–LDN175.5	Linthorpe Road Bridge—Linthorpe Road	Ch 175.5 km	Secondary site office
B2G–LDN188.2	Athol School Road	Ch 188.2 km	Secondary site office
B2G–LDN192.3	Athol School Road and Toowoomba–Cecil Plains Road	Ch 192.3 km	Secondary site office
B2G–LDN206.3	Leesons Road	Ch 206.3 km	Secondary site office

Table note:
1. Refer to drawings in Volume 3 of the draft EIS.

5.3.9 Non-resident workforce accommodation

The accommodation requirements for workforce in the northern extent of the Project are expected to be sufficiently met by existing accommodation available in Toowoomba, and surrounding towns such as Southbrook and Pittsworth. Existing accommodation is less readily available south of Pittsworth. To compensate for this shortage in accommodation, the Project includes allowance for three non-resident workforce accommodations to accommodate the construction workforce. Each accommodation will be required to hold 300 staff during the peak, between weeks 50 and 70. The average occupancy of the accommodation outside of the peak period will be approximately 150 people per accommodation.

An initial assessment of workforce demand and safe commutable distances has identified a potential need for non-resident workforce accommodations in the vicinity of Yelarbon, Inglewood and Millmerran. Locations for accommodations in proximity to these townships have been identified with consideration for:

- The proximity of the accommodation to likely construction sites for fatigue-management purposes (maximum desirable commute of 30 minutes)
- Land tenure and ownership of the site
- Available land area

- Proximity to supporting infrastructure and services, such as water and electricity
- Likelihood of noise, vibration and air quality impacts originating from the accommodation
- Likelihood of disturbing significant vegetation communities, threatened species or heritage sites
- Road access
- Potential for planned future developments to impact on the non-resident workforce accommodation, or vice versa.

Based on these criteria, three properties have been identified as suitable for the establishment of non-resident workforce accommodations. The locations of these properties are summarised in Table 5.22 and discussed in Section 5.3.9.1 to Section 5.3.9.3. ARTC have consulted with the landowners of the three properties, each of whom are receptive to having a non-resident workforce accommodation being located on their property.

TABLE 5.22 LOCATIONS FOR NON-RESIDENT WORKFORCE ACCOMMODATIONS

Lot and plan	Address
Lot 30 MH721	Cunningham Highway, Yelarbon
Lot 5 MH75	Millmerran–Inglewood Road, Inglewood
Lot 135 DY1033	553 Turallin Road, Turallin

While possible locations for three non-resident workforce accommodations have been identified, not all locations may be required by the appointed Principal Contractor. The location, capacity and layout of the accommodations that are required will be confirmed and finalised by the Principal Contractor during the detail design phase of the Project. As discussed in Chapter 3: Legislation and Project Approvals non-resident workforce accommodations will be sought separately to the approvals sought through the EIS and will be obtained prior to accommodation establishment works commencing.

At a minimum, each non-resident workforce accommodation will be self-contained and will include accommodation units with kitchen, dining, ablution and laundry facilities. Supporting and additional infrastructure associated with each accommodation will include:

- Potable water storage—approximately 0.51 megalitre (ML) of water per five-day week of operation during peak occupancy, based on average usage of 340 litres (L) per person, per day (refer 5.1.1)
- Water and wastewater treatment and collection facilities, including temporary package sewage treatment (estimated capacity of 300 equivalent population)
- Power generation (if not connected to the local electricity grid) by diesel-powered generators, in combination with solar panels, where appropriate
- Solid waste-collection facilities
- Recreational facilities
- Paramedic and first aid facilities
- Offices
- Car parking and gatehouse/security.

An example layout of an existing non-resident workforce accommodation in Queensland is shown in Figure 5.40. Other layout options are available and may be adopted for non-resident workforce accommodations for this Project.

The layout of each non-resident workforce accommodation will vary depending on site constraints and accessibility to existing services. For example, water and sewage treatment plants may not be necessary where access to sewerage and potable water networks is available. Where water and sewage treatment plants are used, they will be complete package systems capable of the complete purification of domestic sewage to a degree allowing discharge to local watercourses, or for irrigation or other reuse.

Opportunities will be explored for rainwater harvesting systems to be established for each accommodation to reduce the requirement for external water supply (refer 5.1.1). A greywater recycling system will also be explored to reuse water for activities such as toilet flushing. All potable water supplies on the Project will comply with the *Australian Drinking Water Guidelines* (National Health and Medical Research Council and National Resource Management Ministerial Council (NHMRC & NRMMC), 2011).

FIGURE 5.40 EXAMPLE OF A NON-RESIDENT WORKFORCE ACCOMMODATION LAYOUT. DALBY, QUEENSLAND

5.3.9.1 Yelarbon non-resident workforce accommodation

The Yelarbon non-resident workforce accommodation would be located approximately 2.5 km northwest of Yelarbon with access into the accommodation off the Cunningham Highway, a State-controlled road. ARTC will consult with DTMR to agree on an appropriate turning solution into and out of the accommodation. An assessment of the approval requirements for the proposed turning solution will be completed as a component of the detail design process. The necessary approvals would be obtained prior to the commencement of accommodation establishment. The accommodation location is shown in Figure 5.41.

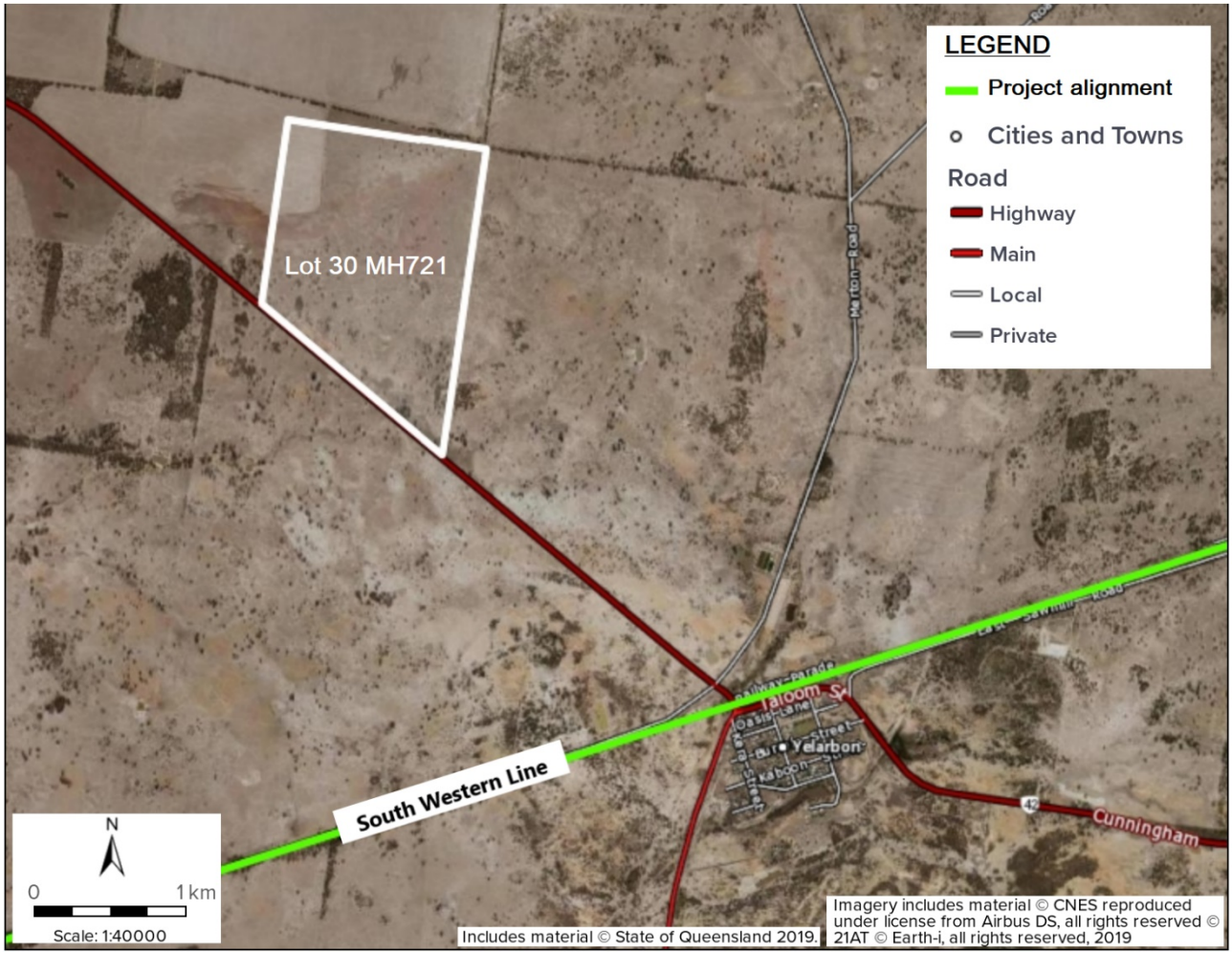

FIGURE 5.41 YELARBON NON-RESIDENT WORKFORCE ACCOMMODATION LOCATION

Clearing works to construct the non-resident workforce accommodation will require an approximate total footprint area of 110,000 m². Additional details of the proposed non-resident workforce accommodation are provided in Table 5.23.

TABLE 5.23 APPROXIMATE DETAILS FOR YELARBON NON-RESIDENT WORKFORCE ACCOMMODATION

Details	Quantities
Construction pad area	110,000 m²
Earthworks cut volume	Nil
Earthworks fill volume	58,000 m³
Perimeter length	1,500 m
Services—water reticulation	3,000 m
Services—electrical reticulation	3,000 m
Services—sewer reticulation	3,000 m
Services—communications reticulation	1,000 m
Carpark/hardstand area	28,000 m²
Landscaping	28,000 m²
Perimeter fencing	1,500 m

5.3.9.2 Inglewood non-resident workforce accommodation

The Inglewood non-resident workforce accommodation would be located approximately 12 km northeast of Inglewood with access into the accommodation from Millmerran–Inglewood Road, a State-controlled road. ARTC will consult with DTMR to agree on an appropriate turning solution into and out of the accommodation. An assessment of the approval requirements for the proposed turning solution will be completed as a component of the detail design process. The necessary approvals would be obtained prior to the commencement of accommodation establishment.

An overview of the accommodation location is presented in Figure 5.42.

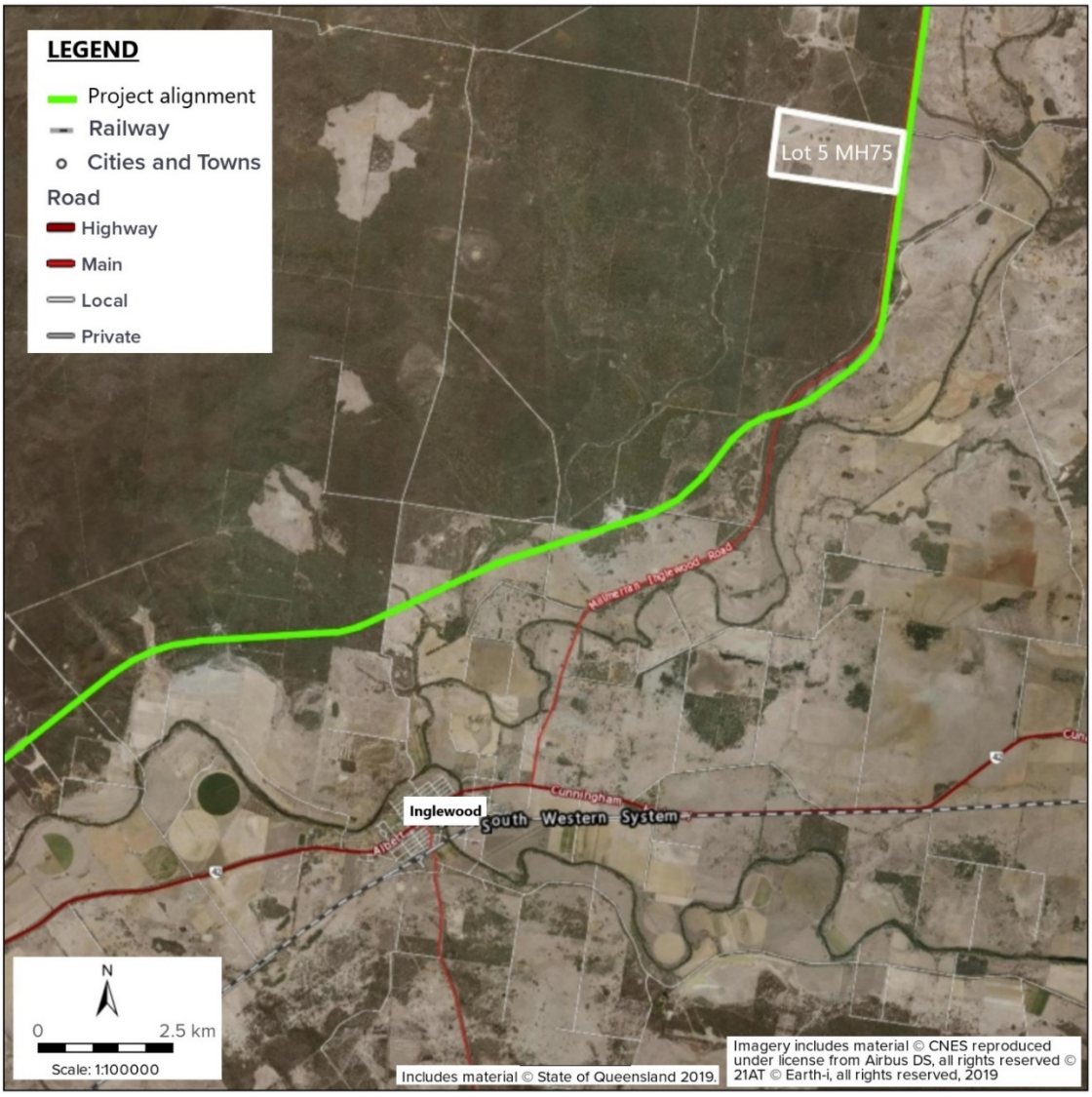

FIGURE 5.42 INGLEWOOD NON-RESIDENT WORKFORCE ACCOMMODATION LOCATION

Clearing works to construct the non-resident workforce accommodation will require an approximate total footprint area of 150,000 m². Additional details of the proposed non-resident workforce accommodation are provided in Table 5.24.

TABLE 5.24 APPROXIMATE DETAILS FOR INGLEWOOD NON-RESIDENT WORKFORCE ACCOMMODATION

Details	Approximate quantities
Construction pad area	150,000 m^2
Earthworks cut volume	35,000 m^3
Earthworks fill volume	35,000 m^3
Perimeter length	1,500 m
Services—water reticulation	3,000 m
Services—electrical reticulation	3,000 m
Services—sewer reticulation	3,000 m
Services—communications reticulation	1,000 m
Carpark/hardstand area	40,000 m^2
Landscaping	40,000 m^2
Perimeter fencing	1,500 m

5.3.9.3 Turallin non-resident workforce accommodation

The Turallin non-resident workforce accommodation would be located approximately 6.5 km northwest of the Millmerran township with access into the accommodation from Ellerslie Road. An overview of the proposed accommodation location is shown in Figure 5.43.

Clearing works to construct the non-resident workforce accommodation will require an approximate total footprint area of 200,000 m^2. Additional details of the proposed non-resident workforce accommodation are provided in Table 5.25.

TABLE 5.25 APPROXIMATE DETAILS FOR MILLMERRAN NON-RESIDENT WORKFORCE ACCOMMODATION

Details	Estimated quantities
Construction pad area	205,000 m^2
Earthworks cut volume	14,000 m^3
Earthworks fill volume	32,000 m^3
Perimeter length	2,0000 m
Services–water reticulation	3,500 m
Services–electrical reticulation	3,500 m
Services–sewer reticulation	3,500 m
Services–communications reticulation	2,200 m
Carpark/hardstand area	50,000 m^2
Landscaping	50,000 m^2
Perimeter fencing	1,800 m

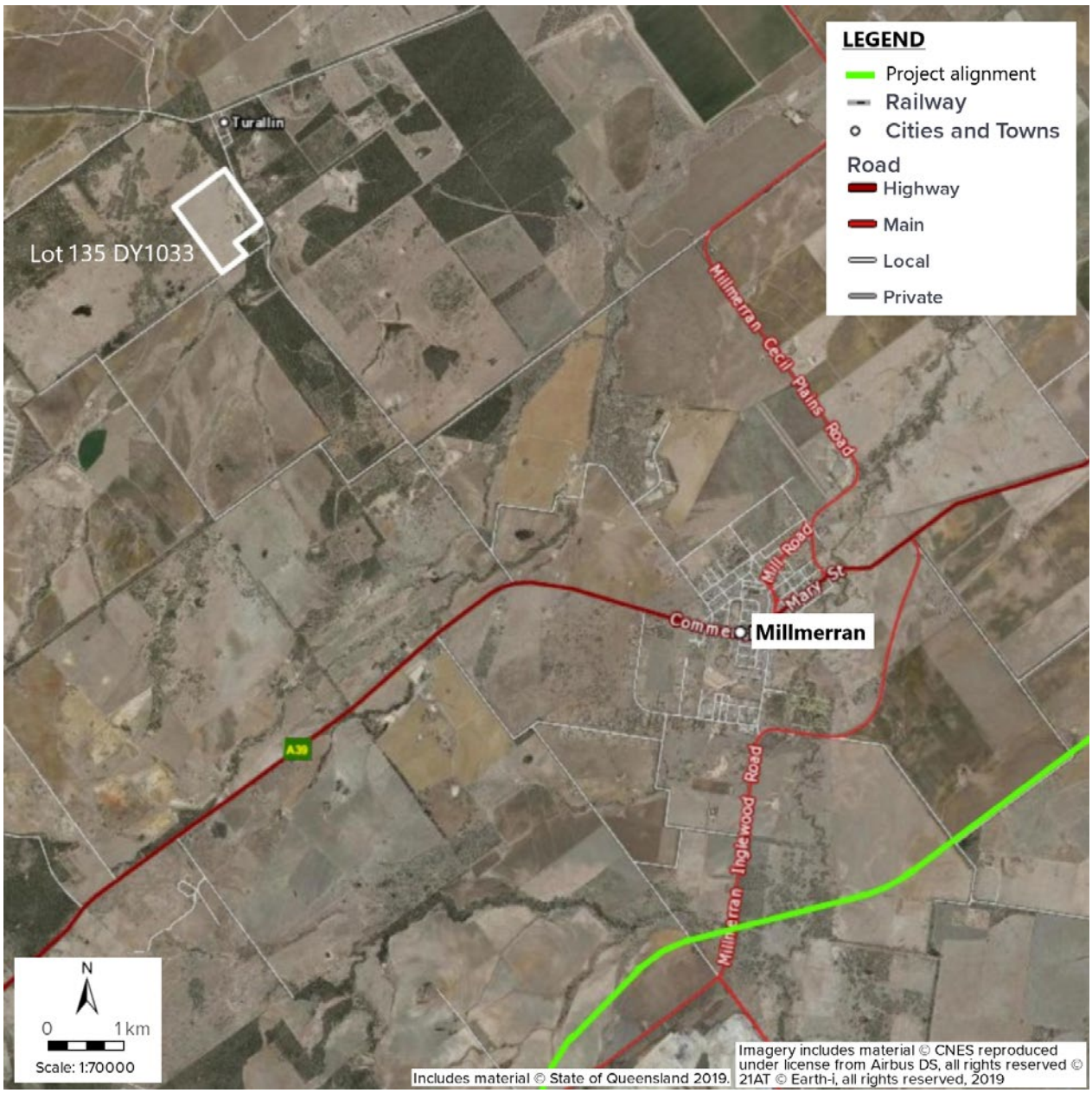

FIGURE 5.43 TURALLIN NON-RESIDENT WORKFORCE ACCOMMODATION LOCATION

5.4 Construction activities

5.4.1 Overview

The general construction activities for the Project will include:

- Site set out and pegging within the Project footprint
- Broadscale clearing within the Project footprint—using dozers, chainsaws, excavators, trucks and similar equipment
- Bulk earthworks within the permanent footprint—major cut-to-fill operations including the winning of suitable construction material from sections of cut along the railway alignment or from borrow pits external to the site
- Supply, delivery and installation of ballast and concrete sleepers
- Establishment and operation of a precast concrete facility and concrete batch plant
- Construction of drainage features—cut-off drains, table drains and culvert structures
- Installation of rail track and other items of rail infrastructure using rail-mounted equipment
- Construction and installation of railway bridges and culverts
- Installation of railway signalling and communications equipment
- Other activities to complete the works.

5.4.2 Indicative construction schedule

Construction of the Project will commence once the detail design is complete, all the necessary approvals have been obtained and land acquisition is sufficiently progressed. The indicative construction timetable for the Project is:

- Contract award to a Principal Contractor in mid-2021
- Commence construction activities, as defined in Section 5.4.1, in the fourth quarter of 2021 (tasks can commence prior to contract award)
- Target completion of construction by the beginning of 2026
- Six months testing and commissioning phase from early-to-mid 2026.

The broad milestone dates for construction are indicative only and are subject to change during the detail design and construction phases as a result of:

- Weather conditions
- Changes to construction methods and materials
- Unexpected finds, such as threatened biodiversity species or cultural heritage values
- Community interest in the Project or issues that need to be addressed.

Variations to the construction sequences in relation to program optimisation, constructability, resource availability and local conditions (weather and industry) will be investigated during the detail design phase of the Project. The schedule of environmental controls, including traffic management and noise controls, would be adjusted accordingly.

5.4.3 Workforce

The Project is part of a larger Inland Rail Program of works. It is anticipated that 16,000 jobs will be required program-wide at the peak of construction, with an average of 800 jobs per annum over the 10-year construction period. An average of 700 additional jobs per annum is anticipated over the initial 50 years of operation.

A preliminary estimate of the workforce required to undertake the construction tasks for the Project to the nominated program is shown in Figure 5.44. Workforce on site for the Project is estimated to peak at 950 full-time equivalents (FTE) between weeks 50 and 70 of construction. The average number of full-time equivalent workforce on site across the full construction period is over 400 people.

Workforce recruitment will be the responsibility of the Principal Contractor engaged by ARTC to construct the Project. Local resident and Indigenous workforce targets will be established by ARTC and passed on to the Principal Contractor through construction contract documentation.

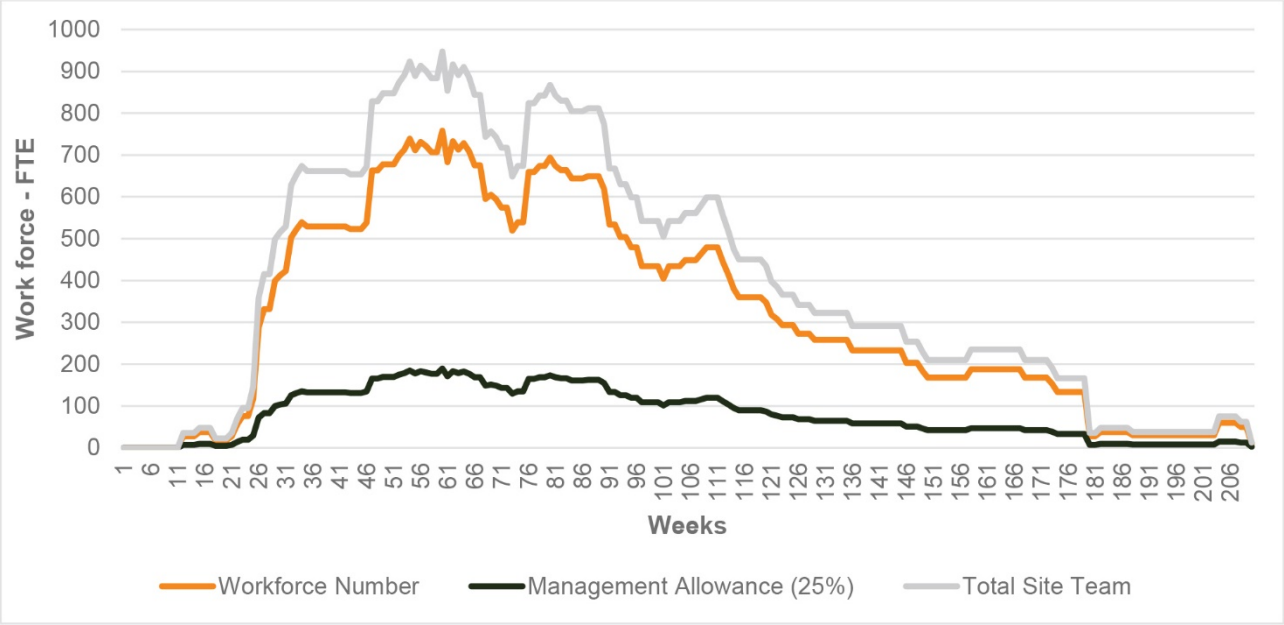

FIGURE 5.44 EXPECTED SITE WORKFORCE

5.4.4 Hours of work

The construction program will generally be based on the following worksite hours:

- General construction activities:
  - Monday to Friday—6.30 am to 6.00 pm
  - Saturday—6.30 am to 1.00 pm
  - No work planned on Sundays or public holiday
- Track possessions may occur on a 7 day/24-hour calendar basis, subject to agreement with QR.

Track possession of QR's assets will generally be allocated over weekend periods, with extended track possession occurring over holiday periods.

There may be circumstances where work outside the above standard hours, including night works, will be required, e.g. the delivery of materials. Work outside standard hours will only be undertaken where consultation with the local community has been undertaken.

5.4.5 Plant and equipment

The indicative plant and equipment required for different stages of the construction phase are provided in Table 5.26. This list will be refined and confirmed with the Principal Contractor prior to construction, and in line with consultation with relevant stakeholders.

TABLE 5.26 INDICATIVE PLANT AND EQUIPMENT FOR THE CONSTRUCTION PHASE

Activity	Week		Duration (weeks)	Plant type	Indicative number
	From	To			
Mobilisation and site setup					
Establishment of site compounds, site facilities, and non-resident workforce accommodations	12	17	6	Grader	2
				Dump truck—off road (25 t articulated)	4
				Excavator—40 t	2
				Water cart—35 kilolitre (kL)	2
Construction of the precast concrete facility and concrete batch plant	21	26	6	Grader	1
				Crane	1
				Dump truck—off road (25 t articulated)	2
				Excavator—40 t	1
				Water cart—35 kL	1
Install construction water infrastructure	15	20	6	Grader	1
				Dump trucks—off road (25 t articulated)	2
				Excavators—40 t	1
				Water cart—35 kL	1
Haul roads and access roads construction (2 crews)	12	19	8	Grader	2
				Excavator—40 t	1
				Sraper	2
				Dump truck—off road (25 t articulated)	2
				Water cart—35 kL	2
Haul road maintenance	20	187	168	Grader	2
				Scraper	1
				Truck—on road tandem	2
				Water cart—35 kL	2
Earthworks					
Clearing and grubbing/topsoil stripping	22	113	92	Bulldozer	20
				Excavator—40 t	10
				Truck—25 t articulated	10
				Scraper	5
				Water cart—35 kL	5
				Mulcher	4

Activity	Week		Duration (weeks)	Plant type	Indicative number
	From	To			
Cut-to-fill—scraper crew	25	119	95	Bulldozer D11—pushing	2
				Bulldozer D10—ripping	2
				Scraper—5 (for a 1.5–2 km cycle)	10
				Water cart—35 kL	4
Compaction crew—scraper matched	25	119	95	Bulldozer	3
				Padfoot roller—20 t	3
				Compactor	6
				Grader	6
				Water cart—35 kL	6
Cut-to-fill—excavator and truck crew (peaking at 4 crews total)	29	111	83	Excavator—85 t	6
				Excavator—50 t	1
				Truck—50 t To match excavator productivity, cycle time—average 6 trucks per 5 km haul	80+
				Water cart—35 kL	8
Compaction crew—excavator matched	30	121	92	Bulldozer	10
				Padfoot roller—20 t	10
				Compactor	10
				Grader	18
				Water cart—35 kL	18
Import structural fill	27	145	119	Tandem truck	40
				Loader	2
				Bulldozer	4
				Excavator—40 t	2
				Water cart—35 kL	4
Place structural fill	27	145	119	Bulldozer	3
				Padfoot roller—20 t	3
				Compactor	3
				Grader	4
				Water cart—35 kL	4
				Concrete pump	1
Blasting	29	111	83	Top hammer or down hole hammer	1
	As required through this period			Grade control rig	1
Structures (seven crews)					
Substructure/foundations construction	76	180	105	Excavator—40 t	7
				Piling rig	7
				Concrete truck	As required
Pier construction	80	185	168	Excavators—40 t	7
				Crane	7
				Concrete truck	As required
Superstructure construction	90	221	132	Crane	7
Drainage (17 crews)					
Install cross drainage	26	112	87	Backhoe—20 t	17
				Excavator—30 t	17
				Worktruck (Hiab)	17

Activity	Week		Duration (weeks)	Plant type	Indicative number
	From	To			
Install cross drainage (continued)				Small compactor	17
				Concrete truck	17
				Concrete pump	8
				Franna Crane	17
Rail civil works					
Capping material import	102	230	129	Tandem truck	10
				Bulldozer	1
				Excavator—40 t	1
				Water cart—35 kL	1
Capping material placement	102	154	129	Bulldozer	1
				Roller—15 t	1
				Compactor	1
				Grader	2
				Water cart—35 kL	2
Bottom ballast	209	238	30	Tandem truck	6
				Bulldozer or grader	1
				Front end loader	1
				Excavator—20 t	1
				Smooth drum roller—14 t	1
Sleeper installation	234	242	9	Truck—flat bed	2
				Front-end loader	3
				Excavator—20 t	3
Rail	239	245	7	Truck—flat bed	2
				Front-end loader	2
				Excavator—20 t	2
Top ballast	242	250	9	Truck	6
				Front-end loader	1
				Excavator—20 t	1
				Ballast train	1
				Water cart	1
Track tamping and regulating	246	276	31	Tamper	2
				Regulator	1
				Excavator—20 t	1
				Water cart—35 kL	1
Rail stressing	270	276	7	Truck—flat bed	2
Road civil works (one crew)					
Road works	59	228	170	Grader 12G	1
				Excavator—30 t	1
				Compactor—12 t	2
				Water cart—15 kL	2
				Tandem truck	5
				Bitumen seal sprayer/chip sealer	1

5.4.6 Sediment basins

Temporary site drainage and water-management controls will be installed in order to minimise the impacts of runoff and sedimentation from construction activities on adjacent receptors.

Temporary site drainage and water runoff management will be in line with the International Erosion Control Association's *Best Practice Erosion and Sediment Control* document (International Erosion Control Association, 2008) and will:

- Minimise runoff and sedimentation from Project activities to existing watercourses and drainage features
- Minimise disturbance to the water quality of existing watercourses and drainage features along the Project alignment.

The reference design includes 17 sediment basins, as identified in Table 5.27. All of the proposed sediment basins are passive, which allows surface runoff from a catchment to flow into the sediment basin without the need for pumping.

The locations of sediment basins are shown in working plans and longitudinal sections presented in Volume 3 of the draft EIS.

The placement and sizing of sediment basins for the Project has been established based on the landform and earthworks required to construct the reference design. Therefore, the placement and sizing of sediment basins will need to be reassessed and revised, as required, as part of the detail design process. Sufficient allowance has been included in the Project footprint for sediment basins to be relocated and/or resized, as required, to support the detail design.

TABLE 5.27 SEDIMENT BASINS FOR THE PROJECT

Sediment basin ID and chainage[1]	Catchment size (m^2)	Settling volume (m^3)	Total volume (m^3)
Sediment basin 1 (Ch.48.5 km)	35,175	409	613
Sediment basin 2 (Ch.73.7 km)	116,116	1,349	2,024
Sediment basin 3 (Ch.52.7 km)	88,708	1,031	1,546
Sediment basin 4 (Ch.55.5 km)	86,440	1,004	1,506
Sediment basin 5 (Ch.60.4 km)	85,664	995	1,493
Sediment basin 6 (Ch.61.5 km)	31,279	363	545
Sediment basin 7 (Ch.63.1 km)	27,150	315	473
Sediment basin 8 (Ch.73.6 km)	40,187	467	700
Sediment basin 9 (Ch.163.1 km)	20,571	239	359
Sediment basin 10 (Ch.170.6 km)	20,720	241	361
Sediment basin 11 (Ch.172.6 km)	82,424	958	1,436
Sediment basin 12 (Ch.179.9 km)	68,475	796	1,193
Sediment basin 13 (Ch.183.5 km)	41,256	479	719
Sediment basin 14 (Ch.191.8 km)	51,268	596	893
Sediment basin 15 (Ch.195.7 km)	67,138	780	1,170
Sediment basin 16 (Ch.204.4 km)	63,918	743	1,114
Sediment basin 17 (Ch.204.6 km)	7,425	86	129

Table note:

1. Refer to drawings in Volume 3 of the draft EIS.

5.4.7 Laydown, stockpile and storage areas

Several laydown areas have been identified along the length of the Project. These laydown areas are situated next to the rail corridor to facilitate direct access to/from the laydown to the rail corridor. The laydown areas will act as designated locations for all material storage. Some laydowns will also consist of fuel storage areas and site office compounds. Establishing temporary laydown areas will generally involve clearing, grubbing, topsoil stripping (refer Section 5.3.3), installing environmental controls, laying hardstand material, and constructing parking areas and access tracks.

Each bridge location along the Project alignment will have a dedicated laydown/work area. The area may also include crane pads for the lifting of bridge members. These areas are primarily to support bridge works; however, larger areas have been provided for locations requiring the storage of other materials that are not associated with the construction of bridges.

Each laydown has been positioned to avoid or minimise potential impacts to environmental and social receptors. The locations of the laydown areas have been chosen to avoid areas that are within the 1% AEP floodplains where possible. However, by virtue of the requirement of laydown areas for constructing bridges, some laydown areas must be within floodplains and near watercourses or drainage features. In such instances, the following precautions will be taken:

- The potential site will be surveyed prior to site establishment to understand the exact extent of potential flooding impact to facilities and storage areas
- The earthworks and temporary drainage will be designed to minimise flooding impacts
- Critical equipment would be placed on earthworks and plinths that raise it above the predicted 1% AEP water level.

Excess material resulting mainly from the excavation of track formation and longitudinal drainage will be stockpiled along the rail corridor. The stockpiles will be located as close as possible to the source of the excavated material and will be formed into permanent spoil mounds, spread out to minimise height.

A full list of laydown areas and their planned uses is provided in Table 5.28.

TABLE 5.28 LAYDOWN AREAS AND USES

				Laydown uses											
ID[1]	Location	Chainage (km)	Size (m^2)	Rail	Sleepers	Ballast	Bridge	Culverts	Aggregates	Fuel	Site office	Batch plant	Parking	Other	Comments
NS2B–LDN031.0	Kildonan Road	31.0	184,000				✓	✓					✓		Access available off existing (sealed) Kildonan Road
NS2B–LDN032.5	Kildonan Road	32.5	160,000				✓						✓		Access available off existing (sealed) Kildonan Road
NS2B–LDN033.2	Kildonan Road	33.2	7,000	✓				✓					✓	✓	Access available directly off existing (sealed) Kildonan Road
NS2B–LDN035.6	Eukabilla Road	35.6	87,000	✓	✓	✓		✓	✓	✓	✓		✓	✓	Access available directly off existing (sealed) Eukabilla Road Fuel (<10,000 L)
B2G–LDN000.9	Georges Road (extension)	0.9	126,000		✓	✓			✓				✓		General construction laydown
B2G–LDN006.3	Yelarbon–Kurumbul Road	6.3	10,000	✓	✓	✓		✓	✓	✓			✓	✓	General construction laydown: Fuel (<10,000 L) Road upgrade laydown
B2G–LDN016.0	Yelarbon–Kurumbul Road	16.0	26,000	✓	✓	✓		✓	✓				✓		General construction laydown
B2G–LDN020.3	Yelarbon–Kurumbul Road	20.3	8,000			✓							✓		General construction laydown
B2G–LDN025.9	Yelarbon (south)	25.9	21,000	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	Multi-use construction laydown Fuel storage (<10,000 L) Road upgrade laydown
B2G–LDN025.9	Yelarbon (north)	25.9	11,000	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	Multi-use construction laydown including satellite offices Bridge laydown for Cunningham Highway bridge Fuel (<10,000 L)
B2G–LDN030.0	Suttons Road	30.0	11,000	✓	✓	✓		✓	✓				✓		General construction laydown
B2G–LDN037.6	Springborg Road	37.6	12,000	✓	✓	✓		✓	✓				✓	✓	General construction laydown Road upgrade laydown

				Laydown uses											
ID[1]	Location	Chainage (km)	Size (m^2)	Rail	Sleepers	Ballast	Bridge	Culverts	Aggregates	Fuel	Site office	Batch plant	Parking	Other	Comments
B2G–FBW045.0	Whetstone Access Road (south)	45.0	125,000	✓									✓	✓	Flash-butt welding facility
B2G–LDN045.5	Whetstone Access Road (north)	45.5	18,000	✓	✓	✓		✓	✓				✓	✓	Multi-use construction laydown Road upgrade laydown
B2G–LDN050.1	McDougalls Crossing Road	50.1	32,000	✓	✓	✓		✓	✓				✓		Multi use construction laydown
B2G–LDN052.8	Cremascos Road	52.8	11,000				✓						✓		Bridge construction site Laydown for Macintyre Brook bail bridge #1
B2G–LDN054.2	Cremascos Road	54.2	54,000		✓	✓		✓	✓	✓	✓		✓	✓	Multi-use construction laydown including satellite offices Fuel storage (<10,000 L) Road upgrade laydown
B2G–LDN055.4	Cremascos Road	55.4	12,000				✓						✓		Bridge construction site Laydown for Macintyre Brook rail bridge #2
B2G–LDN060.4	Bybera Road	60.4	27,000		✓	✓		✓	✓				✓	✓	Multi-use construction laydown
B2G–LDN065.8	Lovells Crossing Road	65.8	25,000		✓	✓		✓	✓				✓	✓	Multi-use construction laydown Road upgrade laydown
B2G–LDN067.6	Thornton Road	67.6	10,000				✓	✓					✓		Bridge construction site Laydown for Pariagara Creek rail bridge
B2G–LDN069.0	Thornton Road	69.0	100,000	✓	✓	✓		✓	✓				✓	✓	Multi-use construction laydown Road upgrade laydown
B2G–LDN073.0	Millmerran–Inglewood Road	73.0	10,000				✓						✓		Laydown for Millmerran–Inglewood Road rail bridge #1
B2G–LDN074.0	Millmerran–Inglewood Road	74.0	147,000	✓	✓	✓		✓	✓	✓	✓		✓	✓	Multi-use construction laydown including satellite offices Fuel storage (<10,000 L)
B2G–LDN081.0	Millmerran–Inglewood Road	81.0	27,000	✓	✓	✓		✓	✓	✓	✓		✓	✓	Multi-use construction laydown Fuel storage (<10,000 L)

				Laydown uses											
ID[1]	Location	Chainage (km)	Size (m^2)	Rail	Sleepers	Ballast	Bridge	Culverts	Aggregates	Fuel	Site office	Batch plant	Parking	Other	Comments
B2G–LDN088.4	Cattle Creek	88.4	10,000				✓	✓					✓		Bridge construction site Laydown for Cattle Tree Creek rail bridge
B2G–LDN091.8	Millmerran–Inglewood Road	91.8	15,500	✓	✓	✓		✓	✓				✓		Multi-use construction laydown
B2G–LDN093.8	Millmerran–Inglewood Road	93.8	12,800				✓	✓					✓		Bridge construction site Laydown for Native Dog Creek rail bridge
B2G–LDN098.0	Millmerran–Inglewood Road	98.0	30,500				✓	✓					✓		Bridge construction site Laydown for Bringalily Creek #1 rail bridge
B2G–LDN100.6	Millmerran–Inglewood Road	100.6	3,500				✓	✓					✓		Bridge construction site Laydown for Bringalily Creek #3 rail bridge
B2G–LDN104.5	Nicol Creek	104.5	25,800	✓	✓	✓	✓	✓	✓				✓	✓	Multi-use construction laydown Bridge construction site Laydown for Nicol Creek rail bridge
B2G–LDN112.1	Kooroongarra–Bull Creek Road	112.1	26,000	✓	✓	✓		✓	✓				✓		Multi-use construction laydown
B2G–LDN115.6	Millmerran–Inglewood Road	115.6	14,000				✓						✓		Bridge construction site Laydown for Millmerran–Inglewood Road rail bridge
B2G–LDN116.5	Millmerran–Inglewood Road	116.5	109,000	✓	✓	✓		✓	✓	✓	✓		✓	✓	Construction laydown including main site offices for southern extent of the Project Fuel storage (<20,000 L)
B2G–LDN120.2	Blackwell Road	120.2	90,000	✓	✓	✓		✓	✓				✓	✓	Multi-use construction laydown Road upgrade laydown
B2G–LDN127.0	Millmerran–Inglewood Road	127.0	10,000				✓	✓					✓		Bridge construction site Laydown for Millmerran–Inglewood #3 road bridge
B2G–LDN127.8	Millmerran–Inglewood Road	127.8	10,000				✓						✓		Bridge construction site Laydown for Back Creek rail bridge
B2G–LDN129.8	Owens Scrub Road	129.8	10,300		✓	✓		✓	✓				✓	✓	General construction laydown Road upgrade laydown

				Laydown uses											
ID[1]	Location	Chainage (km)	Size (m^2)	Rail	Sleepers	Ballast	Bridge	Culverts	Aggregates	Fuel	Site office	Batch plant	Parking	Other	Comments
B2G–LDN133.5	Pfeffers Lindenmeyers Road	133.5	26,000		✓	✓		✓	✓				✓		General construction laydown
B2G–LDN137.0	Yandilla	137.0	145,000										✓	✓	Potential precast facility and concrete batch plant
B2G–LDN138.5	Grasstree Creek Bridge	138.5	44,600		✓	✓	✓	✓	✓				✓	✓	Bridge construction site Laydown for Grasstree Creek #1 and #2 rail bridge Road upgrade laydown
B2G–LDN140.2	Condamine River	140.2	76,000		✓	✓		✓					✓		Large area for storage of precast concrete
B2G–LDN141.3	Condamine River #1 rail bridge	141.3	12,000				✓	✓					✓		Bridge construction site Laydown for Condamine River #1 rail bridge
B2G–LDN143.0	Condamine River #2 rail bridge	143.0	12,000				✓						✓		Bridge construction site Laydown for Condamine River #2 rail bridge
B2G–LDN144.6	Condamine River #3 rail bridge	144.6	142,500		✓		✓	✓					✓		Large area for storage of precast concrete Bridge construction site Laydown for Condamine River #3 rail bridge
B2G–LDN147.1	Fysh Road	147.1	5,000		✓	✓		✓	✓				✓		General construction laydown
B2G–LDN149.0	Condamine River Bridge (North Branch)	149.0	45,400				✓	✓					✓		Laydown for Condamine River North Branch rail bridge
B2G–LDN150.5	Dieckmann Road	150.5	129,000										✓	✓	Potential precast facility and concrete batch plant
B2G–LDN150.9	Gore Highway	150.9	5,000		✓	✓			✓				✓		Material access/temporary laydown
B2G–LDN153.1	Gore Highway	153.1	90,600		✓		✓	✓	✓				✓	✓	Bridge construction site Laydown for Gore Highway bridge Road upgrade laydown
B2G–LDN161.0	Pittsworth–Tummaville Road	161.0	65,500	✓	✓	✓		✓	✓	✓	✓		✓	✓	Construction laydown including main site offices for northern section of the Project Fuel storage (<20,000 L) Laydown for Yarranlea Road rail bridge

				Laydown uses											
ID[1]	Location	Chainage (km)	Size (m^2)	Rail	Sleepers	Ballast	Bridge	Culverts	Aggregates	Fuel	Site office	Batch plant	Parking	Other	Comments
B2G–LDN163.3	Roche Road	163.3	5,300			✓	✓		✓				✓		Material access/temporary laydown Laydown for Roche Road rail bridge
B2G–LDN164.3	Murlaggan Road	164.3	24,600	✓	✓	✓		✓	✓				✓		Multi-use construction laydown
B2G–LDN165.6	Kahler Road	165.6	8,300			✓			✓				✓		Multi-use construction laydown
B2G–LDN169.6	Gore Highway	169.6	30,000	✓	✓	✓		✓	✓				✓	✓	Material access/temporary laydown at cut/fill location Road upgrade laydown
B2G–LDN171.0	Pittsworth	171.0	6,800				✓						✓		Bridge construction site Laydown for Oakey–Pittsworth Road rail bridge
B2G–LDN172.0	Gore Highway	172.0	15,400	✓		✓		✓	✓				✓	✓	Material access/temporary laydown at cut/fill location Road upgrade laydown
B2G–LDN172.6	Lochaber Road	172.6	27,000				✓						✓		Laydown for Lochaber Road rail bridge
B2G–LDN173.5	Gore Highway	173.5	17,000	✓		✓		✓	✓				✓	✓	Multi-use construction laydown
B2G–LDN175.5	Linthorpe Road Bridge	175.5	72,000	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	Multi-use construction laydown including satellite offices Fuel storage (<10,000 L) Road upgrade laydown
B2G–LDN179.0	Linthorpe Valley Road	179.0	22,000	✓	✓	✓		✓	✓				✓		Multi-use construction laydown
B2G–LDN183.0	Bushy Lane	183.0	19,000	✓	✓	✓		✓	✓				✓	✓	Material access/temporary laydown at cut/fill location Road upgrade laydown
B2G–LDN183.8	Southbrook–Rockview Road	183.8	15,000				✓						✓		Laydown for Biddeston–Southbrook Road rail bridge
B2G–LDN185.0	Gore Highway	185.0	32,000	✓		✓		✓	✓				✓		Material access/temporary laydown at cut/fill location

				Laydown uses											
ID[1]	Location	Chainage (km)	Size (m^2)	Rail	Sleepers	Ballast	Bridge	Culverts	Aggregates	Fuel	Site office	Batch plant	Parking	Other	Comments
B2G–LDN188.2	Athol School Road	188.2	81,000	✓	✓	✓		✓	✓	✓	✓		✓	✓	Multi-use construction laydown including satellite offices Fuel storage (<10,000 L) Road upgrade laydown
B2G–LDN192.3	Off Berghofer Road	192.3	30,400	✓	✓	✓		✓	✓	✓	✓		✓		Multi-use construction laydown Laydown for bridge alternative to fill Fuel storage (<10,000 L)
B2G–LDN196.2	Toowoomba–Cecil Plains Road	196.2	4,000		✓		✓	✓					✓		Bridge construction site Laydown for Toowoomba–Cecil Plains Road rail bridge
B2G–LDN197.0	Westbrook Creek	197.0	4,300				✓	✓					✓		Bridge construction site Laydown for Westbrook Creek rail bridge
B2G–LDN198.1	Dry Creek	198.1	4,000				✓	✓					✓		Bridge construction site Laydown for Dry Creek rail bridge
B2G–LDN198.7	Brimblecombe Road	198.7	2,500		✓		✓						✓		Bridge construction site Laydown for Brimblecombe Road rail bridge
B2G–LDN203.0	Warrego Highway	203.0	4,100		✓		✓	✓					✓		Bridge construction site Laydown for Warrego Highway rail bridge
B2G–LDN204.2	Chamberlain Road	204.2	38,000				✓						✓		Bridge construction site Laydown for Chamberlain Road rail bridge
B2G–LDN206.3	Leesons Road	206.3	30,000	✓	✓	✓		✓	✓	✓	✓		✓	✓	Multi-use construction laydown including satellite offices Fuel storage (<10,000 L) Road upgrade laydown
B2G-LDN206.9	Draper Road	206.9	80,500											✓	Allowance for construction interface with InterLinkSQ

Table note:
1. Refer to drawings in Volume 3 of the draft EIS

5.4.8 Concrete batching

Two locations have been identified for the temporary siting of a precast concrete facility and concrete batch plant for the Project (refer Table 5.29). While two locations have been nominated, only one plant is expected to be necessary to supplement the supply of concrete from established plants. The proposed locations are immediately north and south of the Condamine River floodplain outside the 1% AEP flood line.

TABLE 5.29 PRECAST CONCRETE FACILITY AND CONCRETE BATCH PLANT LOCATIONS

ID[1]	Location	Chainage	Description
B2G-LDN150.5	Gore Highway and Dieckmann Road	Ch 150.5 km	Precast concrete facility and concrete batch plant—north
B2G-LDN137.0	Gore Highway	Ch 137.0 km	Precast concrete facility and concrete batch plant—south

Table note:
1. Refer to drawings in Volume 3 of the draft EIS

The locations for the potential precast concrete facility and concrete batch plant for the Project are shown on Figure 5.45. Also shown are locations of established precast concrete suppliers and concrete batch plants in proximity to the Project that may be used in support of construction.

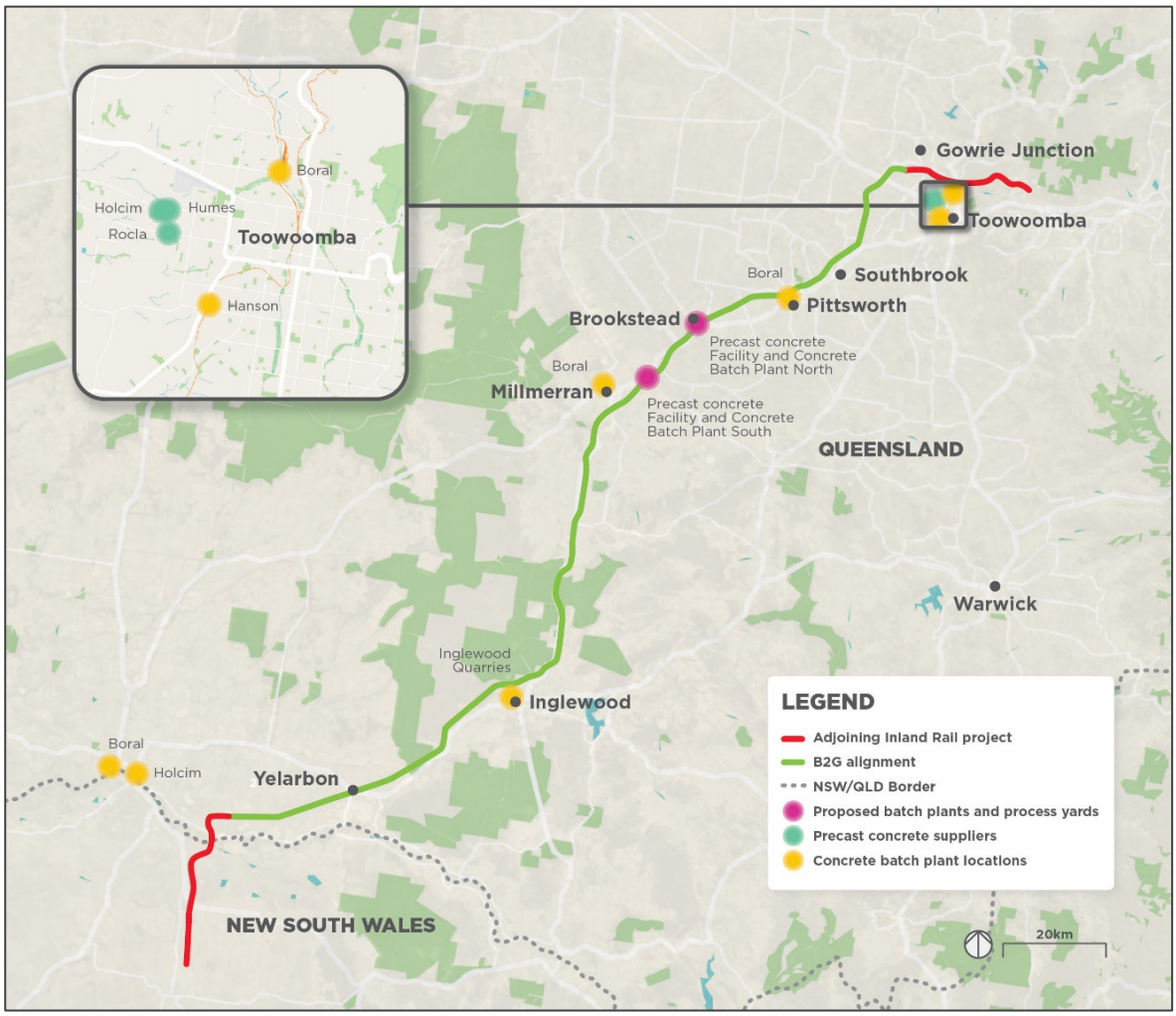

FIGURE 5.45 ESTABLISHED CONCRETE SUPPLIERS AND LOCATIONS FOR THE PROPOSED PRECAST CONCRETE FACILITY AND CONCRETE BATCH PLANT

5.4.9 Fuel

Diesel is to be stored during construction at 13 nominated laydown areas along the Project footprint as identified in Table 5.28. Diesel will be stored in self-bunded, relocatable fuel pods with a nominal capacity of about 10,000 L. The storage and handling of diesel will be in accordance with *AS 1940:2017 The storage and handling of flammable and combustible liquids* (Standards Australia, 2017a) and any further approval conditions.

During refilling of the fuel pods, they will be moved to or pre-positioned in an area with a drainage system capable of isolation from the surrounding area to contain spills.

Refuelling of mobile plant will be conducted using a mobile service truck with an appropriate spill-control kit on board.

5.4.10 Other hazardous materials

During construction, laydown areas will be used for the storage and distribution of hazardous materials required for construction purposes. Non-resident workforce accommodations may also have a hazardous materials storage requirement, to enable self-sufficient operation.

The dangerous goods and hazardous substances likely to be required for construction activities have been determined based on usage on similar rail projects. The types and indicative quantities of dangerous goods and hazardous substances identified in Table 5.30 are considered to represent the usage requirements for a project of this type. The chemicals required, and their quantities, may vary due to refinement of the construction approach during detail design, in addition to the on-site chemical requirements of the three non-resident workforce accommodations.

TABLE 5.30 INDICATIVE LIST OF DANGEROUS GOODS AND HAZARDOUS SUBSTANCES REQUIRED DURING CONSTRUCTION

Chemical type	Typical chemicals	Purpose/use	Dangerous good class	Packing group	Indicative rate of use	Expected storage method
Fuel oil	Diesel	Fuel for mobile equipment	9 (C1)[2]	III	40 kL/2 weeks	40 kL bulk storage (fuel depots)
Grease	Rocol Rail Curve Grease	Lubricate plant and equipment	C2[3]	N/A	Limited	Package storage
	Shell GADUS Gauge Face Curve Grease	Lubricate plant and equipment	C2[3]	N/A	Limited	Package storage
Blasting chemicals	Ammonium Nitrate[1]	Cuttings and borrow pit operations	5.1	III	Limited	Not stored
	Blasting Explosives	Cuttings and borrow pit operations	1	II	Limited	Not stored
Concreting	Concrete and Concrete Residue	Concreting for slab construction	N/A	N/A	As required by the local construction team	Truck deliveries
	Concrete Curing Compound	Concreting for slab construction	N/A	N/A	As required by the local construction team	Truck deliveries
Welding gases	Oxygen	Welding	2.2/5.1	N/A	Cylinders and/or manifold packs as required by the local construction team	Cylinder storage
	Acetylene	Welding	2.1	N/A	Cylinders and/or manifold packs as required by the local construction team	Cylinder storage

Chemical type	Typical chemicals	Purpose/use	Dangerous good class	Packing group	Indicative rate of use	Expected storage method
Pesticides	Australian Pesticides and Veterinary Medicines Authority Approved Pesticides	Pests and weeds control	6.1 or 9	I, II or III	As required	Not stored in the rail corridor

Table notes:
1. Product is a security sensitive explosive defined under Schedule 7 of the *Explosives Regulation 2017*.
2. Class C1—a combustible liquid that has a flashpoint of 150°C or less.
3. Class C2—a combustible liquid that has a flashpoint exceeding 150°C.

Generally, low volumes of hazardous chemicals would be stored at construction work fronts and laydown areas near points of use. The quantities stored will be equivalent to the demand for construction activities within that area of the rail corridor.

During construction, the following facilities are expected to be provided for storage and distribution of construction chemicals:

- Laydown areas will be located approximately every 5 km along the Project alignment, in addition to bridge and turnout locations onto the QR network. Small quantities of lubricants and oil (e.g. drum and intermediate bulk container package stores) will be stored at these locations.
- Diesel fuel depots will be located at approximately 20 km intervals along the Project alignment, which will provide for 40 kL bulk storage of diesel.

As discussed in Section 5.4.7, each laydown has been positioned to avoid or minimise potential impacts to environmental constraints and social receptors.

5.4.11 Utilities and services

Utilities and services such as water, sewerage, electricity and telecommunications will need to be supplied to each of the laydown areas and compounds for use in site offices and amenities. Where these utilities are already located close to construction sites, the Principal Contractor will engage with utility providers, with the objective of connecting to mains power, water, communications and sewerage. Where connection to existing infrastructure networks is not possible or practicable, temporary portable alternatives will be adopted, for example tanks (water), gen-sets and solar panels (power), cellular network amplifiers (communications) and package sewage treatment plants.

The maintenance of uninterrupted supply of service to existing residential and commercial users will be the priority when planning the provision of utilities and services to construction sites.

5.4.12 Bulk earthworks

Construction of the foundation of the railway line will require earthworks and engineered fill to provide a stable platform designed to accommodate freight rail movements, as specified in the Basis of Design (refer Section 5.2.1). The earthworks will mostly involve the excavation of cuttings and the construction of formation. Each of these tasks is summarised below.

5.4.12.1 Cuttings

Cuttings in the existing ground profile will be needed where the final design level is lower than the surrounding land. Excavation will progress depending on the in-situ material types. If the material is of sufficient quality, is rippable, and does not contain oversized rocks, then dozers and scrapers will move the material along the Project footprint to locations of embankment construction. If the material contains a high percentage of rock, it may be necessary to use excavators and trucks to move the material. This material may require some processing prior to use in embankment construction, dependent on meeting the adopted Inland Rail material specifications (Earthworks Specification ETC-08-03, available on the ARTC Extranet: extranet.artc.com.au/).

Non-rippable rock (rock that is not able to be broken down using smaller plant, e.g. excavators) will be broken via drill and blast or by hydraulic rock breakers. Broken rock will be loaded onto trucks by front-end loaders and excavators and transported along the Project footprint for placement at its intended point of reuse within the Project.

Significant volumes of non-rippable rock are anticipated within some of the cuttings along the rail corridor, particularly in the northern part of the Project alignment. The extent to which drilling and blasting will occur will be confirmed through further geotechnical investigation; however, based on reference design geotechnical information, it is anticipated that blasting may be required for the cuttings between:

- Ch 164.4 km and Ch 165.8 km
- Ch 174.4 km and Ch 175.5 km
- Ch 177.0 km and Ch 179.3 km
- Ch 188.8 km and Ch 190.4 km.

Where explosives are used during construction, the works will be undertaken by the appointed licensed blasting contractor in accordance with the *Explosive Act 1999* and *AS 2187:2006—Explosive—Storage, Transport and Use: Use of Explosives* (Standards Australia, 2006). The blasting contractor will need to maintain a Security Management System and prepare a Blast Management Plan for the task to ensure that potential impacts are properly assessed and managed.

The Blasting Contractor will be responsible for the security of the explosives for the entire duration of the task, including the segregation of incompatible products.

Further details on the potential impacts of blasting and the necessary controls are presented in Chapter 14: Noise and Vibration and Chapter 19: Hazard and Risk.

5.4.12.2 Formation

The formation consists of general fill embankment placed on top of subsoil. Structural fill and capping is then placed on top of the general fill embankment, as shown in Figure 5.4. The Basis of Design requires formation to be designed to accommodate 30 TAL at 80 km/h (refer Section 5.2.1).

This section provides a description of how each of these formation components is prepared and constructed.

Subsoil and embankment

Initially, the native subsoils underlying the Project alignment will be inspected and tested to determine if these materials comply with the adopted Inland Rail material specifications (Earthworks Specification ETC-08-03, available on the ARTC Extranet: (**extranet.artc.com.au/**). Where native subsoils do not comply with the material specifications, one or more of the following broad treatment strategies may be applied to achieve compliance:

- Compaction
- Lime treatment to reduce the dispersive nature of native material. This involves the spreading of lime and mixing it into the soil with a reclaimer/stabilizer, followed by compacting and rolling of the lime-treated material
- Excavation and removal of material for treatment, such as drying, before being reused within the rail corridor, subject to suitability
- Excavation and removal, with replacement of unsuitable materials with suitable fill, which is then compacted. In this instance, unsuitable materials may still have a reuse within the Project footprint.

Once the subsoil has been prepared, general fill embankment can be constructed. The embankment will be constructed in layers, with zones designated for:

- Placement of material directly via scrapers or trucks, or spread from stockpiles via bulldozers and graders
- Compaction of material with roller compactors, and plate compactors for confined working
- Rolling and grading to final level and finish.

Embankment fill material will be laid out in the maximum lift depths by a grader or dozers prior to compaction.

The moisture conditioning required for compaction will be determined by further geotechnical investigations. The compacting effort required for the fill material will be determined so that compaction equipment can be effectively matched to requirements. Access ramps onto the embankment will be located at regular intervals to facilitate concurrent activities of fill placement and compaction, and continued delivery of materials.

The reference design and Project footprint have been developed based on the following embankment slope and benching principles:

- A maximum slope of 1V:2H (0.5 gradient) for earth-fill embankments
- A maximum slope of 1V:3H (0.3 gradient) for embankment subject to flood, to reduce the potential for scour and increase the effectiveness of rock protection (refer below)
- Benching:
  - The first bench is to be applied at 7 m height, followed by 10 m height intervals thereafter to accommodate the future 30 TAL surcharge loading
  - Benches to have minimum 3.5 m width to facilitate maintenance, as per ARTC maintenance specifications.

Generally, embankment fill slopes are protected against erosion through the adoption of appropriate batter geometry and material specification, as discussed above. However, to further ensure long-term stability and minimise degradation over time, 1,000 mm thick rock armour protection will be applied to the outer surface of embankments that will be exposed to flood waters during a 1% AEP event.

Structural fill and capping

Structural fill and capping is required at the top of the formation to provide a solid foundation on which the railway ballast, sleepers and track can be placed.

Generally, a standard capping layer of 300 mm and a structural fill layer of 1,075 mm have been applied across the reference design. However, the structural fill layer has been reduced where the geotechnical assessment has indicated that in-situ subgrade strengths are high (in large cuttings, generally at the northern end of the Project).

An additional 300 mm layer of drainage material has been allowed below the capping layer where groundwater may be encountered in cuttings.

Materials used in the capping and structural fill layers are required to be compliant with the Inland Rail material specifications (Earthworks Specification ETC-08-03, available on the ARTC Extranet: **extranet.artc.com.au**).

In the first instance, structural fill will be sourced from cuts within the rail corridor. If there is a lack of suitable structural fill material from cuts, then this material may be sourced from borrow pits (refer Section 5.1.1).

Capping material is currently planned to be transported by existing road network from commercial quarries, as discussed in Section 5.1.1.

The following are the key strategies with regards to transport, handling, and placement for structural fill and capping material:

- Suitable material will be transported to the corridor and delivered directly to the Project alignment or stockpiled within the nominated laydown areas of the rail corridor
- The materials will be moisture conditioned and tipped directly onto the formation in suitable volumes to deliver the required thicknesses for compaction
- Spreading and compaction of the material will be undertaken using graders and compactors
- Final trimming and profiling will be undertaken to allow rail construction.

The general configuration of the rail formation is shown in Figure 5.4.

5.4.13 Mass haul

The bulk earthworks for rail and road components of the Project are summarised in Table 5.31.

TABLE 5.31 SUMMARY OF BULK EARTHWORKS FOR RAIL AND ROAD COMPONENTS

Earthworks	Volume
Cut	
Unusable cut (without treatment)	148,905 m^3
Useable cut (without treatment)	12,376,132 m^3
Total cut	12,525,037 m^3
Fill	
General (rail)	9,595,807m^3
Structural (rail)	2,070,678 m^3

Earthworks	Volume
Capping (rail)	584,214 m^3
Fill requirement (rail)	12,250,699 m^3
Fill requirement (road)	1,096,670 m^3
Total fill requirement	13,347,369 m^3
Balance	**822,332 m^3 material deficit**

The total fill requirement (i.e. rail, road and supporting infrastructure) based on the reference design for the Project is 13,347,369 m^3. If all unusable cut material is able to be treated for re-use, then the total material deficit for the Project will be 822,332 m^3. However, this deficit may be up to 971,237 m^3 depending on the feasibility and success of material treatment options. The fill deficit for the Project will be met through the importation of appropriate material type from operational licensed quarries or from borrow pits established for the Project (refer Section 5.1.1).

Different options have been identified for the reuse of localised excess cut material within the Project. Detailed mass haul assessment will be carried out in the detail design stage to assess the possibility of the following options:

- Use excess rock material for scour protection of embankments, bridges and culverts, if suitable
- Use excess material for temporary works construction, such as access roads, laydown areas etc.
- Construct RMAR at rail formation
- Extend the rail formation for future passing loops
- Use excess material for other developments near the Project
- Rehabilitate borrow pit sites.

Offsite disposal to landfill will only occur as a last resort, if the material is considered unsuitable for other uses, e.g. due to contamination reasons. The need for offsite disposal of spoil is not foreseen at this stage of Project planning.

It is anticipated that spoil will be transported from the point of generation to stockpiles, via access tracks and temporary haul roads established within the rail corridor. The transportation routes for the movement of cut-and-fill material, including spoil, have been assessed in Chapter 18: Traffic, Transport and Access. It is anticipated that the movement of all cut-and-fill material will be confined to Queensland.

5.4.14 Borrow pits and quarries

Nineteen possible material source locations have been identified by ARTC as potentially suitable for use during construction activities. These sites consist of 7 operational licensed quarries and 12 potential borrow pit sites. The viability and feasibility of accessing material from these locations will be confirmed during the detail design phase of the Project (post-EIS). These locations are shown in Figure 5.46.

The potential borrow pit locations have been identified based on the following factors:

- Proximity to rail alignment
- Proximity to road access and accessibility
- Minimal to no vegetation clearing, based on preliminary assessment
- Presence and size of existing borrow pit.

Standard earthmoving equipment such as bulldozers and trucks will be used to extract material from borrow pits. If required, mechanical screens will be used to screen and grade material. The material will then be transported to construction sites using the public road network and tipped directly onto the formation. Prior to commencing works within borrow pits, the necessary approvals and licences will be obtained by the Principal Contractor.

FIGURE 5.46 BORROW PIT AND QUARRY LOCATIONS

It is anticipated that sufficient useable material will be generated through cut (12,376,132 m^3) to meet the necessary general fill (9,595,807 m^3) and structural fill (2,070,678 m^3) requirements for the Project (refer Table 5.31); however, there may be localised instances where the haulage of material from the point of source to the location of need is prohibitive. In such instances, the Principal Contractor may elect to obtain general fill from borrow pits to supplement the general fill requirement for the Project.

In some instances, suitable ballast and capping material may be obtained through cut activities along the rail corridor. However, established quarries are expected to be the primary source for ballast and capping for the Project. The ballast and capping requirements for the Project are summarised in Table 5.32. These are the maximum tonnages of material that may be required from the nominated operational quarries.

TABLE 5.32 ESTIMATE OF QUARRY MATERIAL REQUIREMENT

Material type	Tonnes per metre of railway	Kilotonnes required
Bottom ballast	2	432.4
Top ballast	1	216.2
Capping	2	432.4

5.4.15 Bridge construction

Bridges are proposed at all major watercourse crossings to avoid disturbance to the existing drainage system and flow regime. Bridge structures will also be constructed to allow access for road, farm track or stock crossings. The reference design includes 34 bridges across the Project alignment. The bridge structures for the Project are summarised in Table 5.10.

All bridge structures will be formed from precast, pre-stressed concrete and in-situ concrete with galvanised steel ancillary elements. Bridge foundations will be piled, unless an alternative approach is required by local geological conditions. It is envisaged that all materials for concrete bridge structures will be delivered by public road network to the rail corridor.

The anticipated methodology and approach for bridge construction is outlined as follows:

- Establishment of bridge construction laydown areas
- Construction of working platform access for piling rigs and cranes. It is assumed that temporary works solutions will allow for the staged construction of working platforms across watercourses. Where this is not feasible, temporary steel working stages will need to be constructed for access to the bridge piers.
- For substructures, large diameter piles will be installed. The plant required for this task will include trucks, excavators and roller compactors for working platforms for driven piles and piling rigs, cranes and concrete delivery trucks.
- Pile caps and piers will be installed through successive lifts of reinforced concrete structures using re-usable forms, cranes, concrete pumps and trucks
- Headstocks and abutments will be constructed using re-usable forms and reinforced concrete
- For bridge superstructure and deck construction, the proposed structures are all anticipated to be less than 20 m high. Deck structures are expected to be constructed via lifting precast beams into place with a conventional crawler crane. A form traveller may be used for segmental bridge construction.

5.4.16 Road works

Road–rail interfaces for the Project are identified in Table 5.13. Construction works on these interfaces will be required to comply with the asset owners' approved safety requirements and temporary works procedures. In most instances, this will be achieved through adherence to the Manual of Uniform Traffic Control Devices (DTMR, 2018c).

For works on, over or adjacent to State-controlled roads, the proposed construction methodology and traffic management arrangements will have to be approved by DTMR prior to works commencing.

Construction phase controls for works within road reserves are specified in Chapter 18: Traffic, Transport and Access and Appendix T: Traffic Impact Assessment.

5.4.17 Rail corridor works

The Project uses 71.2 km of existing rail corridor for the Queensland Rail South Western Line and Millmerran Branch Line.

The staging of the works and their associated impacts will be the subject of an interface agreement between ARTC and QR. It is currently assumed that proponents can occupy sections of existing corridor to avoid the need for constrained, short-term possession works. In accordance with Section 255 of the TI Act works cannot commence within the existing rail corridor without QR's written approval. If the construction of Project components within the existing rail corridor is completed during a temporary possession of the rail corridor, then works will be completed in accordance with the conditions of the temporary possession and/or wayleave agreement granted to ARTC by QR.

Details of the existing railway interfaces that are present along the Project alignment are summarised in Section 5.2.2.

5.4.18 Permanent drainage controls

5.4.18.1 Culverts

Culverts will be delivered to the nominated construction laydowns and then further distributed to the required installation locations via trucks, using the established construction haulage routes. Culvert installation will generally involve the following activities:

- Excavating to the required depth
- Placing and compacting the culvert bedding material
- Placing the precast culvert structures on the bedding material and fastening them together
- Proceeding with track works over the top of the culvert
- Restoring and revegetating disturbed areas.

Once installed, either side of culverts will be backfilled with support material for the culvert. Scour protection measures may also be installed (refer Section 5.2.6.1).

Construction of drainage structures will require up to 17 full-time installation crews throughout the construction period. This construction effort will be a mix of installation before and after the bulk earthworks, so as not to delay the overall earthmoving program.

5.4.18.2 Longitudinal drainage

As discussed in Section 5.2.6.2, embankment and catch drains will be constructed along the rail corridor where design requires their incorporation into embankments and cuts. It will be necessary to capture overland flow and transfer it to the nearest cross-drainage structures. As such, the sizing of the longitudinal drainage will be dependent on the hydrology and it is important that these drains are capable of efficiently moving overland flow to dedicated drainage lines to reduce the likelihood of water ingress into the formation.

The construction of longitudinal drainage will generally involve the following:

- Preparing survey control points for planned excavations
- Excavating material from the drain location
- Trimming and compacting the base and sides of the drain
- Lining the drain to prevent erosion (if required).

5.4.19 Track works

5.4.19.1 General

The proposed method of track construction will be tailored to maintain maximum flexibility, so as not to be confined to the use of dedicated plant or equipment. The focus will be to prioritise the use of readily available plant and equipment that is easy to maintain and has low establishment and operating costs.

However, given the long linear nature of the Project, there will be significant advantages in using a track-laying machine for track construction works. This will increase productivity and reduce the cost per track metre installed. This approach will require rail to be flash-butt welded into longer lengths in advance at designated laydown areas. This approach is discussed in Section 5.4.19.7.

5.4.19.2 Bottom ballast

Bottom ballast may be installed by one of the following approaches:

- Directly deposited onto the formation via truck and trailer or stockpiled and locally moved via 18 t dumper trucks
- Installed along with the top ballast via a works train. This means skeleton track will be constructed directly on the formation.

5.4.19.3 Sleepers

Sleepers may be installed by one of the following approaches:

- By excavator, which will place the sleepers using an 'Octopus' sleeper grab, which can pick up to six sleepers at a time and spread them to the correct spacing
- Delivered to the construction depot to be loaded onto a material train for direct discharge onto the formation by the track-laying machine.

5.4.19.4 Rail

Rails may be installed by one of the following approaches:

- Installed in 27.5 m lengths and flash-butt welded (FBW) in situ or FBW trackside and lifted into the sleeper housing in long welded rail (LWR) sections
- Delivered in short lengths (<30 m) to the FBW facility situated within the construction laydown. This will allow the short rail to be welded into LWR and then loaded onto the material train in strings of approximately 400 m. The rail (LWR) can then be positioned into the Project alignment along with the sleepers through the track laying machine.

The methods of rail welding are discussed further in Section 5.4.19.7.

5.4.19.5 Top ballast

The most efficient method of unloading top ballast will be via train using ballast hopper wagons, which would run on rails fastened to sleepers that are laid on the bottom ballast. Suitable areas to facilitate the loading of ballast onto a train with ballast hopper wagons can be designated in laydown areas that adjoin the rail alignment.

After establishing a ballast-handling facility, ballast can be delivered along the Project alignment by train. This train would not only distribute top ballast but could also distribute bottom ballast if installing skeleton track straight onto the formation is the desired method of track construction.

The key drivers of this method are the productivity of the key rail-bound equipment and matching this to the earthworks delivery program. Productivity depends on the number of ballast wagons used and the cycle time of the ballast train against the various ballast loading locations, as well as the productivity of the following rail surfacing fleet.

5.4.19.6 Tamping

Plain line tamping will be undertaken by a high output tamper fitted with guidance software, to implement the correct target track geometry. Turnout tampers will be used for the tamping of turnouts and will also be equipped with guidance software.

Depending on the required track construction tolerances and quality of constructed track, tamping operations could take anywhere from three to six passes. Correctly installed bottom ballast levels, adequately compacted bottom ballast and high-quality track installation dramatically reduces tamping operations and follow-up tamp requirements.

5.4.19.7 Welding and stressing

It is anticipated that the majority of rail welding will be undertaken by the flash-butt welding (FBW) method. Stressing welds and welds located close to turnouts may be undertaken by approved Alumino Thermic Welding processes.

The process of FBW involves the welding of short (27.5 m) rail into LWR, approximately 400 m in length. This welding either occurs:

- Within the rail corridor, adjacent to where the rail will be positioned, after which it is lifted (via thimble) into place in the sleeper housing
- In a designated FBW facility—the LWR can then be transported down the rail corridor using material train or rail roller and positioned into the sleeper housing via track-laying machine.

For this purpose, one designated FBW facility has been allowed for in the Project footprint (B2G–FBW045.0), located at Ch 45.0 km on Whetstone Access Road South (refer Table 5.28). If a second FBW facility is desirable to service the northern extent of the Project, opportunities to share the FBW facility established for the adjoining Gowrie to Helidon project will be explored.

It is assumed that rail will be delivered to one of two laydowns—B2G–FBW045.0 at Ch 45.0 km or B2G–LDN206.9 at Ch 206.9 km, via the closest rail network (QR network). Depending on where the welding is to occur, the rail will then either be transported along the rail corridor via truck to the work front where it is required, or it will be manoeuvred into a FBW facility.

The feasibility of delivering rail in full lengths via the QR network will be confirmed through consultation with QR during the detail design phase.

5.4.19.8 Turnouts

All turnouts connecting to existing operational infrastructure will be pre-built and panelled in if the rail corridor possession window approved by QR does not provide enough time to construct in situ. The pre-building and panelling-in method will also ensure that turnout componentry is complete and allows for some welding to happen prior to the rail corridor possession.

All crossing loop turnouts and maintenance sidings can be constructed in-situ to reduce lifting of switch and crossing panels. All turnout construction will be undertaken early enough in the construction schedule to ensure that any issues caused by incorrect or missing components can be rectified prior to the commissioning of the turnout.

5.4.20 Construction water

5.4.20.1 Water requirement

Significant volumes of water will be required for various activities associated with construction of the Project, including for earthworks, concrete production, track works and the operation of non-resident accommodation camps. The following sections provide a discussion on the anticipated water demand for each of these purposes.

The estimated construction water usage over time for the Project is presented in Figure 5.47 and the estimated water demand along the length of the Project alignment is presented in Figure 5.48.

Earthworks

The greatest water demand for the Project will be for earthworks, which predominately includes conditioning of fill material, haul road and laydown pad maintenance, and dust suppression.

The rates of water application for earthworks activities have been adopted based on the rates used during earthworks for a recent transport infrastructure project in the region and are as follows:

- Material conditioning is expected to require approximately 100 L/m^3 of fill, however this is variable, dependent on material properties
- General dust suppression across the site will be a constant activity. An allowance of 50 L/m3 of fill has been made. This allowance also covers the water required to re-establish vegetation on disturbed surfaces following the completion of works.
- Haul road and laydown area maintenance will also require water. An allowance of 40 L/m^3 of fill has been made.

Based on these rates of application and the volume of fill required for the reference design (13,347,369 m^3, refer Section 5.4.12), a total of 2,536 ML of water that is not quality dependent is estimated to be required for earthworks during construction. Water volumes for each earthworks activity are presented in Table 5.33.

Fill and water volumes for the Project will be confirmed during the detail design process.

TABLE 5.33 CONSTRUCTION WATER REQUIREMENTS FOR EARTHWORKS ACTIVITIES

Earthworks activity	Assumed application rate (L/m^3)	Total volume (ML)
Rail (Fill = 12.251 Mm^3)		
Material conditioning	100	1,225
Dust suppression and revegetation[1]	50	613
Haul road and laydown area maintenance	40	490
Roads (Fill = 1.097 Mm^3)		
Material conditioning	100	110
Dust suppression and revegetation[1]	50	55
Haul road and laydown area maintenance	40	44
Total		**2,536**

Table notes:
1. This allowance covers the water required to re-establish vegetation on disturbed surfaces following the completion of works.

Concrete batching

The Project is expected to rely on a combination of existing commercial concrete batching plants and a temporary plant for the batching and precast of concrete, established to service the Project.

Concrete batching has specific water-quality requirements in order to achieve structural integrity and asset life objectives. The water requirements for use in the supply of concrete are specified in *AS 1379–2007: Specification and supply of concrete* (Standards Australia, 2007). Established plants are connected into the mains water supply, so the quality and uninterrupted supply of water is not an issue for existing commercial facilities; therefore, the water requirement for concrete supplied by existing concrete/precast concrete suppliers does not contribute to the Project's direct water requirement.

Locations for two temporary plants, with combined concrete batching and precast function, have been nominated in the Toowoomba LGA to service the Project, one at Ch 137.0 km (Yandilla) and another at Ch 150.5 km (Dieckmann Road) (refer Table 5.28). The demand for an onsite temporary batching and precast plant is driven by the large number and scale of concrete structural elements that are included in the design solution for the crossing of the Condamine River floodplain. While two locations have been nominated, only one plant is expected to be necessary to supplement the supply of concrete from established commercial operators.

If a temporary batching and precast plant is established, a dedicated water supply sourced from mains water will be required. A temporary concrete batching and precast plant would be established with onsite water storage tanks, which would be filled by water trucks drawing water from mains connections in local towns, being Brookstead or Millmerran, if capacity is available. Alternatively, water would be sourced from further afield.

A water requirement of 200 L/m^3 has been estimated for the onsite batching of concrete (wet and precast). Using this rate, the water requirement for onsite concrete batching activities is estimated to be 15 ML, as summarised in Table 5.34.

TABLE 5.34 ESTIMATED WATER USAGE FOR ONSITE CONCRETE PRODUCTION

Concrete product	Volume required for the reference design (m^3) [1]	Water requirement (L/m^3)	Total estimated water usage (ML)
Precast	24,000	200	4.8
Wet (bulk)	51,000 [2]	200	10.2
		Total:	**15.0**

Table notes:

1. Excludes concrete (in-situ and precast) for culverts, which will all be supplied by existing commercial suppliers.
2. For in-situ concrete required between Ch 138 km and Ch 165 km. In-situ concrete required outside of this chainage range will be supplied by existing commercial concrete batching plants.

The availability of mains water for use in a temporary batching facility would be discussed with TRC as the construction approach is refined during the process. In the planning of water access, maintaining the uninterrupted supply of potable water to existing residential and commercial users will be the priority.

Track works

The predominant requirement for construction water during track works is for dust suppression relating to ballasting works, in particular ballast-dropping and ballast-regulating works during track-tamping activities.

Based on previous rail project experiences, a conservative allowance of 6 L per track metre has been assumed for dust suppression during ballast dropping and 4 L per track metre for dust suppression during tamping and regulating activities.

For 216.2 km of rail alignment, track works is estimated to require a total of 2.16 ML of water that is not quality dependent. A breakdown of this total volume is presented in Table 5.35.

TABLE 5.35 CONSTRUCTION WATER REQUIREMENTS FOR TRACK WORK ACTIVITIES

Track works activity	Assumed application rate (L/m)	Total project volume (ML)
Dust suppression during ballast dropping	6	1.30
Dust suppression during tamping and regulating	4	0.86
Total		**2.16**

Non-resident workforce accommodations

The total daily water usage on non-resident workforce accommodations is a factor of a camp's occupancy numbers and includes water used for the following purposes:

- Toilets
- Showers
- Laundry
- Food preparation
- Cleaning.

The average daily water use per person recorded by TRC in February 2020 was 120 L per person per day (L/p/d), with a maximum of 322 L/p/d (Millmerran) and a minimum of 44 L/p/d (Haden) (TRC, 2020). Based on this data, a conservative daily volume of 340 L/p/d has been adopted to estimate the water usage for non-resident workforce accommodation facilities. For three non-resident workforce accommodation facilities operating at full capacity (300 beds) over a 58-month period, a total conservative water usage of 540 ML is estimated. A breakdown of this total volume is presented in Table 5.36.

TABLE 5.36 ESTIMATED WATER USAGE FOR NON-RESIDENT WORKFORCE ACCOMMODATIONS

Rate of water usage (L/p/d)	Occupants per accommodation	Daily water usage (kL/day/accommodation)	Days of accommodation operation[1]	Total water usage per accommodation (ML)	Number of accommodations	Total water usage (ML)
340	300	102	1,765	180.03	3	540.09

Table notes:

1. Based on 58 months of workforce accommodation operation.

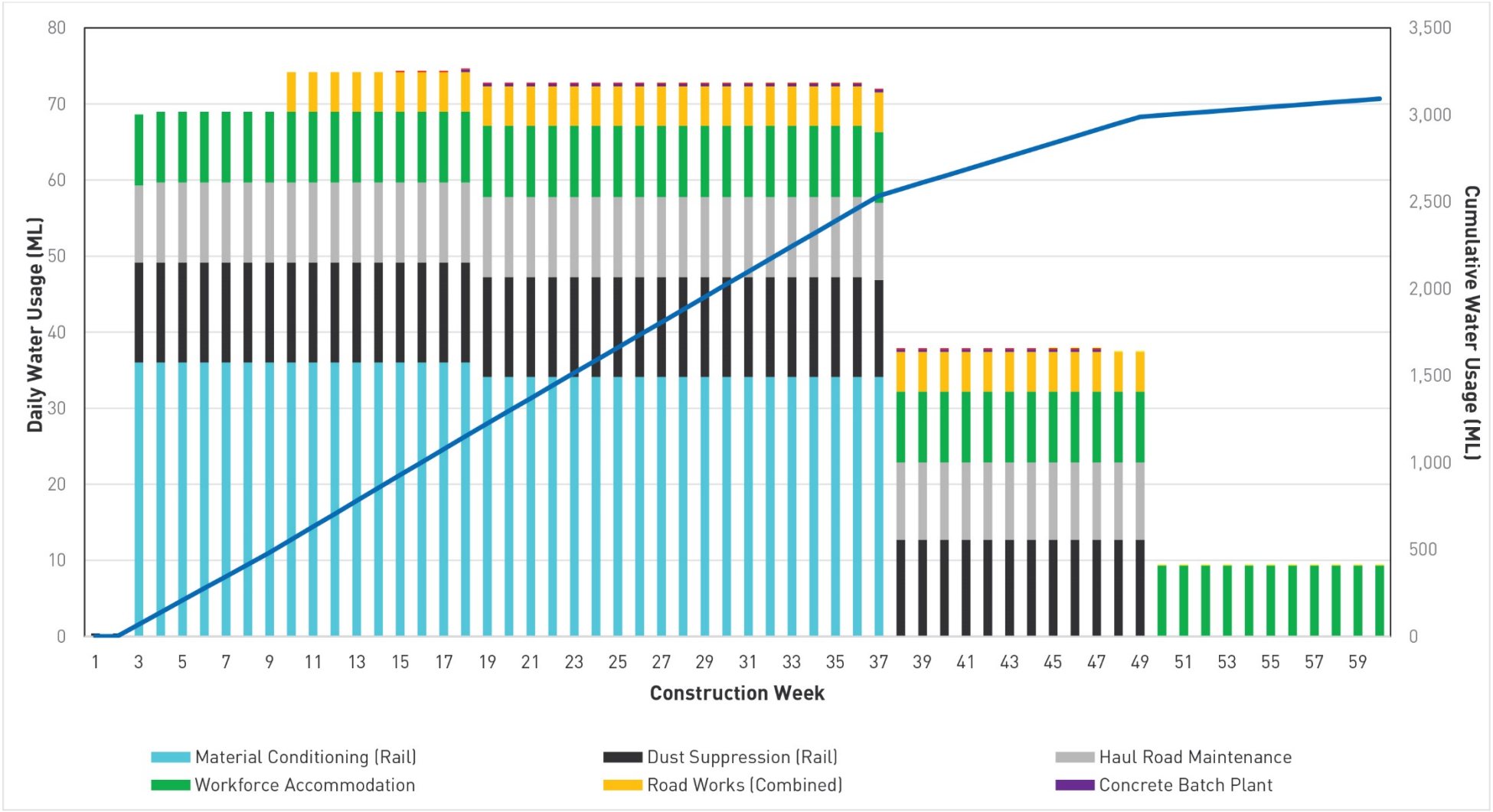

FIGURE 5.47 ESTIMATED CONSTRUCTION WATER USAGE OVER TIME

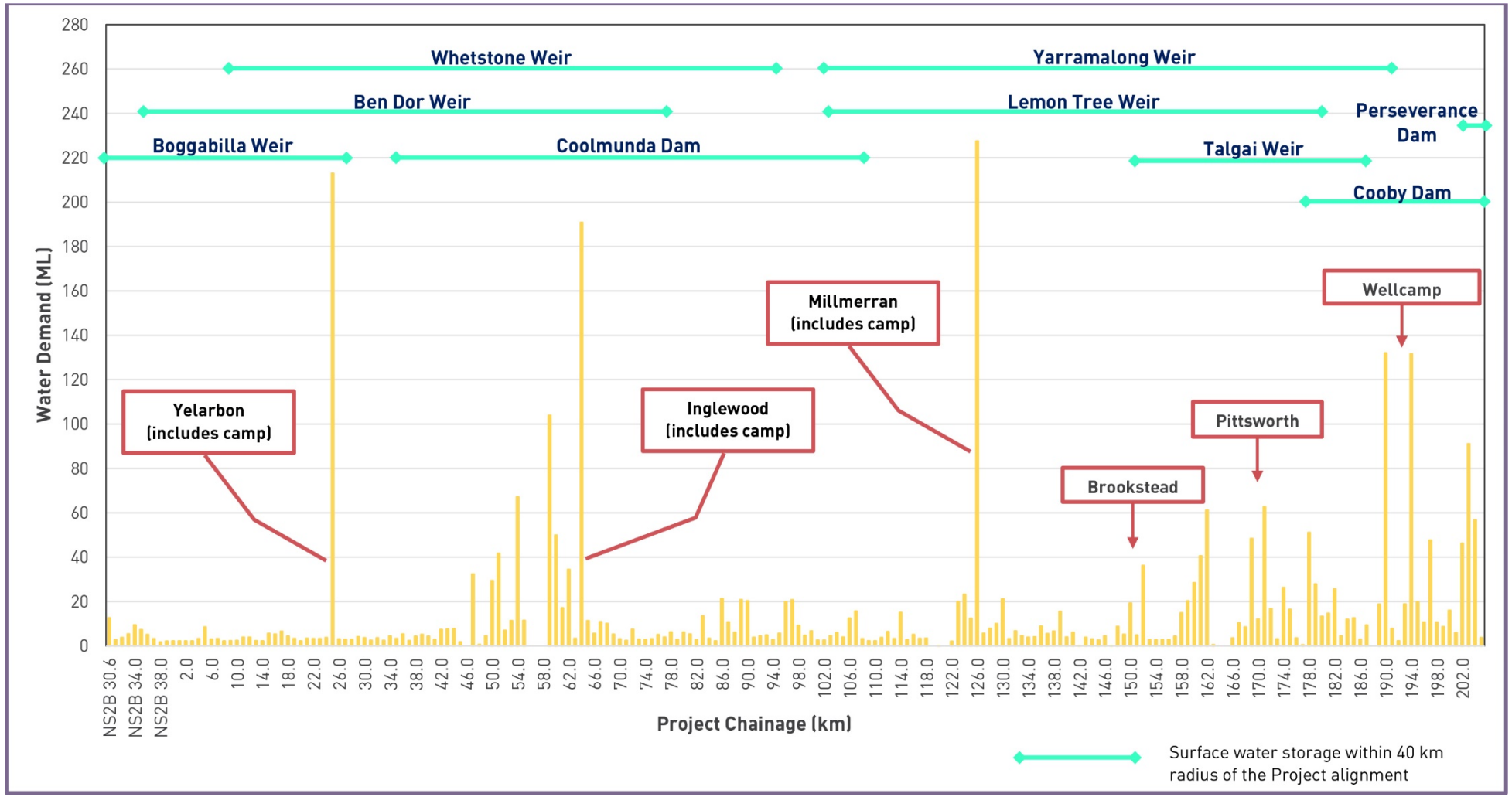

FIGURE 5.48 ESTIMATED WATER DEMAND ALONG THE PROJECT ALIGNMENT

5.4.20.2 Water sourcing

ARTC recognises water sourcing and availability is critical to supporting the construction program for the Project. Sources of construction water will be finalised as the construction approach is refined during the detail design phase of the Project (post-EIS). Through this process, detailed water demand planning will be undertaken, including detailed contingency options, in the event that protracted dry seasonal conditions prevail and water supply options become unavailable.

The ultimate water sourcing strategy for the Project will be documented in a Construction Water Plan and be dependent on:

- Climatic conditions in the lead up to construction
- Confirmation of private water sources made available to the Project by landowners under private agreement and in consultation with DNRME
- Confirmation of access agreements with local governments for sourcing of mains water
- Consultation with the State regarding access to water via markets, water licenses and water permits.

Options for the sourcing of construction water, subject to availability, are anticipated to be as follows:

- Commercial, licensed water supplies where capacity exists
- Public surface water storages, i.e. dams and weirs
- Permanently (perennial) flowing watercourses
- Privately held water storages, i.e. dams or ring tanks, under private agreement
- Existing registered and licensed bores
- Treated water, e.g. from wastewater treatment plants
- New bores established to service the Project under appropriate water licence or entitlement (least preferred option).

An assessment of the suitability of each source will need to be made for each construction activity requiring water, based on the following considerations:

- Legal access
- Volumetric requirement for the activity
- Water quality requirement for the activity, e.g. accommodations will need potable water
- Source location relative to the location of need.

A summary of the considerations for accessing water from each potential surface water source is presented in the following sections.

Surface water storages

Dams and weirs are constructed barriers that hold back water to provide a reservoir for water supply. Various dams and weirs are located in the vicinity of the Project and are listed in Table 5.37. These dams have, subject to climatic conditions, the ability to supply the required volume of construction water for the Project. However, the transportation cost of sourcing all construction water from these locations is prohibitive. Therefore, other sources will need to be accessed to meet the full construction water demand for the Project.

TABLE 5.37 WATER STORAGES IN PROXIMITY TO THE PROJECT

Storage	Operator	Water supply scheme	Location	Full supply volume	Current capacity/ flow rate
Boggabilla Weir	Dumaresq–Barwon Border Rivers Commission	Border Rivers	9 km upstream of Goondiwindi on the Macintyre River and 12 km via road from the Project alignment	5,850 ML when reservoir water level at 216 m AHD[1]	Reservoir water level: 216.0 m AHD[2]
Ben Dor Weir	Sunwater	Macintyre Brook	11 km upstream of Yelarbon on the Macintyre Brook and 5 km via road from the Project alignment	700 ML	Volume: 572 ML (81.8%)[3]
Whetstone Weir	Sunwater	Macintyre Brook	17 km downstream of Inglewood and 2 km via road from the Project alignment	506 ML	Volume: 512 ML (>100%)[3]
Lemon Tree Weir	Sunwater	Upper Condamine	12 km downstream of Yandilla on the Condamine River and 14 km via road from the Project alignment	305 ML	Volume: 42 ML (13.7%)[3]
Yarramalong Weir	Sunwater	Upper Condamine	5 km downstream of Tummaville on the Condamine River and 7 km via road from the Project alignment	390 ML	Data not available
Talgai Weir	Sunwater	Upper Condamine	13 km upstream of Ellangowan and 60 km via road from the Project alignment	638 ML	Volume: 168 ML (26.3 %)[3]
Coolmunda Dam	Sunwater	Macintyre Brook	14 km east of Inglewood, 18 km via road to the Project alignment	69,060 ML	Volume: 19,889 ML (28.8%)[3]
Cooby Dam	TRC	Nil	14 km northeast of Kingsthorpe and 27 km via road from the Project alignment	19,703 ML	Volume: 3,763 ML (19.1 %)[4]
Perseverance Dam	TRC	Cressbrook Creek	35 km northeast of Kingsthorpe and 48 km via road from the Project alignment	26,893 ML	6,714 ML (25.0 %)[4]

Table notes:
AHD = Australian Height Datum
1. Resource Operations Licence (*Water Act 2000*), DNRME [**mdba.gov.au/sites/default/files/pubs/qld-border-rivers-water-supply-scheme-resource-operations-licence-2019.PDF**] [Accessed 30 October 2020]
2. NSW Dam and River Levels, WaterNSW [**realtimedata.waternsw.com.au/**] [Accessed 30 October 2020]
3. Water Storage Levels, Sunwater [**storagelevels.sunwater.com.au/win/reports/win_storages.htm**] [Accessed 30 October 2020]
4. Dam levels, rainfall and water use statistics, TRC [**tr.qld.gov.au/environment-water-waste/water-supply-dams/dams-bores/8066-water-supply-and-dam-level-statistics**] [Accessed 30 October 2020]

Figure 5.48 shows the Project chainage ranges that could reasonably be serviced by water obtained from each of the storages listed in Table 5.37, if capacity allows.

Alternative surface water storages, identified in or otherwise, may be accessed for the sourcing of construction water subject to obtaining the appropriate water allocation or licence under the Water Act 2000 (Qld).

Current dam levels are reflective of the prolonged drought conditions in Queensland. The availability of water from these sources will continue to be dependent on climatic conditions prior to and during construction.

Consultation with the Dumaresq–Barwon Border Rivers Commission, Sunwater, GRC and TRC during the process will be required to establish the availability of water from dams and weirs in proximity to the Project.

Watercourses

The following perennial watercourses are in proximity to the Project:

- Oakey Creek
- Hodgson Creek
- Condamine River North Branch
- Condamine River
- Canning Creek
- Macintyre Brook
- Brigalow Creek
- Macintyre River.

Extraction of water from a watercourse typically requires:

- A water allocation, water licence or water permit. Applications for resource entitlements are assessed against relevant criteria in the Water Act and relevant water resource plan and resource operations plan.
- A development permit for use of water that is assessable development under the Planning Act.

The DNRME maintains *Exemption requirements for construction authorities for the take of water without a water entitlement (WSS/2013/666)* (DNRME, 2019). These exemption requirements may only be used by a constructing authority defined under Schedule 2 of the *Acquisition of Land Act 1967* (AL Act) (Qld) and includes State government departments and local governments. At present these guidelines do not directly apply to ARTC. However, ARTC's eligibility to operate under the exemption requirements will be reassessed prior to the commencement of construction.

If ARTC and its contractors remain ineligible to operate under the exemption requirements, or are unable to comply with the requirements, then a Temporary Water Permit would be required before taking any water for construction purposes.

Groundwater

Commercial and private land uses in the region have a strong reliance on access to groundwater for domestic and agricultural purposes. This reliance on groundwater as a resource is even stronger during periods of drought, as is currently being experienced. Consultation feedback from DNRME indicates that the alluvium and Main Range Volcanics aquifer units in the area are close to full allocation through existing water entitlements.

The use of groundwater to supplement the construction water demand for the Project is not preferable due to:

- The existing pressure placed on groundwater as a resource in the region
- The licensing and approval requirements to establish new groundwater bores
- The flow rates required to meet construction water demands are unlikely to be appropriately met through reliance on groundwater
- Challenges regarding the management of groundwater quality.

The use of existing sustainable groundwater allocated entitlements to supplement the construction demand for the Project may be considered if private owners of registered bores have capacity under their water entitlement that they wish to sell to ARTC or the Principal Contractor under private agreement.

Other water source opportunities

Other opportunities for potential sources of water for the Project are as follows:

- Recycled water: A 97 km pipeline currently transfers water from the Wetalla Water Treatment Plant in Toowoomba to the Millmerran Power Station. This potential water source could be further investigated through consultation with the operators of the Millmerran Power Station, Intergen, during the detail design process (post-EIS) to determine if there is unused capacity that may be suitable for construction water.
- Commodore Mine: Water is supplied to the Commodore Mine. Wastewater is also generated through the mine's operations. These potential water sources could be further investigated through consultation with the operators of the mine, Intergen, during the detail design process (post-EIS) to determine if there is unused capacity that may be suitable for construction water.
- Privately owned water storages: Smaller dams located on private properties along the Project alignment may be suitable as a source of construction water. Accessing such water would require private agreement between ARTC and the relevant landowner.

5.4.20.3 Water quality

The quality characteristics of water used by the Project during construction will be dependent on its intended use. The water quality requirements for the various activities associated with construction of the Project are summarised in Table 5.38.

TABLE 5.38 WATER QUALITY REQUIREMENTS FOR CONSTRUCTION ACTIVITIES

Activity	Water quality requirement
Earthworks	No specific quality criteria
Concrete batching	Specified in *AS 1379-2007: Specification and supply of concrete* (Standards Australia, 2007)
Track works	No specific quality criteria
Non-resident workforce accommodation	Potable water will need to achieve the quality requirements specified in the *Australian Drinking Water Guidelines* (NHMRC & NRMMC, 2011)
Vegetation establishment, landscaping and rehabilitation	Water should be consistent with the quality requirements specified for irrigation and general water use in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC & ARMCANZ), 2018)

5.4.21 Sewage treatment

Portable toilet facilities will be located along the rail corridor during construction, for use by workers. An appropriately licensed contractor will be engaged for the removal and transport of the sewage to an approved treatment site.

Wastewater treatment and collection facilities will be included as part of each non-resident workforce accommodation. Depending on the finalised treatment and disposal strategy for each camp, sewage could be drained to a sewage holding tank should there be no conventional sewage catchments nearby. The sewage holding tanks would provide means of temporarily storing sewage for subsequent removal and transport to an approved treatment site. The construction, operation and maintenance of the sewage holding tank would be managed in a manner that mitigates contamination of ground or surface waters or prevents it from being a source of nuisance odours.

Alternatively, package sewage treatment plants with a capacity of 300 equivalent population (EP) may be required to service each non-resident workforce accommodation. The necessary development permits required to install and operate package sewage treatment plants for each non-resident workforce accommodation will be applied for separately to approvals sought through this EIS.

Odour impacts are possible even from small-scale sewage treatment plants, such as those that may be required for non-resident workforce accommodation or site compounds. The Environment Protection Authority Victoria guideline *Recommended separation distances for industrial residual air emissions* (Environment Protection Authority Victoria, 2013) provides guidance on suitable separations distances between wastewater treatment facilities and neighbouring sensitive receptors. These guidelines are commonly referred to in the planning of sewage treatment facilities in the absence of a Queensland-specific equivalent. Table 5.39 presents the calculation methods and derived separation distances for a 300 EP sewage treatment plant.

TABLE 5.39 SEPARATION DISTANCES FOR SEWAGE

Type of installation	Environment Protection Authority Victoria separation distance equation	Separation distance for 300 EP sewage treatment plant (m)
Mechanical/biological wastewater plants	$10\ n^{1/3}$	67
Aerobic pondage systems	$5\ n^{1/2}$	87
Facultative ponds	$10\ n^{1/2}$	173

Table note:
n = equivalent population.

Mechanical or biological wastewater treatment systems are likely to be used and therefore a minimum separation distance of 67 m should be maintained from neighbouring sensitive receptors to minimise odour impacts for neighbouring sensitive receptors. Refer to Chapter 11: Air Quality for further discussion on potential odour impacts.

5.4.22 Construction traffic

5.4.22.1 Laydown area delivery points

Most construction materials are expected to be delivered to key laydown area delivery points along the rail corridor (refer Table 5.28). These delivery points will be designated locations. From these locations, construction material will be distributed to the surrounding construction laydown areas and work fronts. This re-distribution of material will be via the construction access road network within the rail corridor in the first instance. The public road network will only be used if required.

Some key laydown area delivery points may be established as a pre-construction and early works activity (refer Section 5.3.8). Where this is achieved, it may be possible for material deliveries to commence during the pre-construction and early works phase.

5.4.22.2 Quarry routes

Operational quarries that have been identified for use by the Project are shown in Figure 5.46. Haul routes to and from quarries, using the public road network, have been identified based on the location of the quarries and routes most likely to be used for the transportation of material to access points in the rail corridor.

Haulage routes for the Project are identified in Chapter 18: Traffic, Transport and Access and Appendix T: Traffic Impact Assessment.

5.4.22.3 Ready mix and precast concrete traffic routes

Concrete haulage routes have been identified based on the location of existing concrete suppliers, as shown in Figure 5.45. Roads most likely to be used for the transportation of precast concrete to rail corridor access points will be identified in consultation with the National Heavy Vehicle Regulator (NHVR) journey planner (NHVR, n.d.), which provides guidance in identifying suitable roads for heavy vehicles.

For the transportation of some of the larger precast concrete girders, it is expected that police escort will be required.

Haulage routes for the Project are identified in Chapter 18: Traffic, Transport and Access and Appendix T: Traffic Impact Assessment.

5.4.22.4 Consolidated sleeper routes

Concrete sleepers are expected to be sourced from a manufacturer in Grafton in NSW. It is expected that sleepers will be distributed via the road network to various laydown area delivery points for the Project. Sleepers may originate from alternative locations. However, a production facility for the sleeper configurations required for the Inland Rail network, and this Project, is operational in Grafton.

Road transportation routes will be formulated using the NHVR journey planner, which provides guidance in identifying suitable roads for heavy vehicles. The sleeper routes will then be consolidated, where feasible, to minimise the number of roads used.

Two overarching sleeper routes have been identified for the Project so far:

- North of Millmerran, deliveries will be via the Pacific, Warrego and Gore highways
- South of Millmerran, deliveries will be via the Summerland Way and Bruxner Highway.

Haulage routes for the Project are identified in Chapter 18: Traffic, Transport and Access and Appendix T: Traffic Impact Assessment.

5.4.22.5 Rail routes

It is currently assumed that rail will be supplied by a single source and will be distributed via the existing QR rail network (Western Line, Millmerran Branch and the South Western Line) to designated laydown areas along the Project alignment (refer Section 5.4.19.4 and Section 5.4.19.7). Where further transportation is required to distribute rail to designated areas along the Project alignment, road networks will be used to achieve this.

Road transportation routes will be formulated using the NHVR journey planner. Police escort is expected to be required when transporting rail via the road network.

5.4.22.6 Parking facilities

Temporary parking facilities for construction workers will be located within:

- Designated construction laydown areas (refer Table 5.28)
- The rail corridor, where activities are occurring on work fronts
- The limits of non-resident workforce accommodations.

The provision of parking in each location will be sufficient to accommodate the number of vehicles associated with the maximum number of workers expected to use each area during peak occupancy.

5.4.23 Waste disposal

Construction of the Project is expected to result in the generation of a variety of solid wastes, as summarised in Table 5.40. The waste stream classifications that have been adopted are consistent with those established under the EP Regulation and used by the State Government for policy and planning purposes.

TABLE 5.40 WASTE STREAMS, DEFINITION AND POTENTIAL PROJECT SOURCES

Waste stream	Definition	Potential Project source
Commercial and industrial (C&I) waste	Waste that is produced by business and commerce and includes waste from schools, restaurants, offices, retail and wholesale businesses, and manufacturing industries. In the case of green waste, it includes material delivered by commercial operations.	▸ Non-resident workforce accommodations ▸ Site offices
Construction and demolition (C&D) waste	Non-putrescible waste arising from the construction or demolition activities. C&D waste includes materials such as brick, timber, concrete and steel.	▸ Demolition/removal of existing structures ▸ Work fronts ▸ Demobilisation of construction facilities, e.g. site offices
General waste	Wastes not defined as regulated waste under legislation. General wastes comprise putrescible wastes (easily decomposed, treated by composting) and non-putrescible wastes (not easily decomposed, may be recyclable).	▸ Kitchen and general waste from non-resident workforce accommodations ▸ Site offices ▸ Work fronts ▸ Laydown areas
Green waste	Includes grass clippings, tree, bush and shrub trimmings, branches and other similar material resulting from landscaping or maintenance activities.	▸ Clear and grubbing activities ▸ Site preparation works
Recyclable waste	Waste types that can be reconditioned, reprocessed or reused. What constitutes recyclable waste may change between LGAs, as it depends what the local government has declared to be recyclable waste for the area.	▸ Non-resident workforce accommodations ▸ Site offices ▸ Work fronts ▸ Laydown areas

Waste stream	Definition	Potential Project source
Regulated waste	Wastes that are commercial or industrial waste and is of a type or contains a constituent of a type mentioned in Schedule 9 Part 1 Column 1 of the EP Regulation. Regulated wastes require specific controls or actions as defined by legislation. Listed hazardous, regulated, controlled or trackable wastes typically have unique handling and disposal requirements in order to manage specific hazards associated with them. Regulated waste includes asbestos, pesticides, a range of chemicals and other industrial wastes (i.e. grease trap waste).	▸ Used containers and residues of hazardous chemicals and dangerous goods ▸ Kitchen waste from non-resident workforce accommodations (e.g. food processing waste, grease trap waste, etc.) ▸ Vehicle, plant and equipment maintenance (e.g. tyres, lead acid batteries, etc.) ▸ Demolition/removal of existing structures (e.g. asbestos, lead-based paint, etc.)

Quantities of wastes have been estimated based on the scale of the Project, with an appreciation for the construction activities that are typically required to establish a freight railway. These details are presented in Table 5.41 and will be subject to further refinement during the process.

TABLE 5.41 ESTIMATED CONSTRUCTION WASTE QUANTITIES

Waste/resource description	Waste type	Estimated quantity produced over construction duration	Residual as proportion of existing annual waste generation in the region	Potential reuse
Vegetation	Green waste	14,641,267 m^2	Not applicable—to be reused within the Project	Yes
Topsoil	C&D waste (topsoil for on-site reuse)	100 mm depth: 274,587 m^2 200 mm depth: 5,265,173 m^2 300 mm depth: 55,510 m^2	Not applicable—to be reused within the Project	Yes All topsoil is expected to be reused on the Project
Steel (existing rail)	C&D waste	5,822 t	5%	Yes Where practical, opportunities for reuse will be explored
Timber sleepers	Regulated waste (regarded as contaminated)	361,700 count	Data on regional proportion of regulated waste is not available	Yes Opportunities for reuse will be considered consistent with the intent of *End of Waste (EOW) Code: Chemically Treated Solid Timber (ENEW07503218)*
Ballast	Regulated waste (regarded as contaminated)	400,100 m^3	Data on regional proportion of regulated waste is not available	Yes Opportunities for reuse will be considered consistent with the intent of *Draft EOW Code: Recycled Aggregates (ENEW07604819)*
Occupying workforce accommodation	General waste	115 t	<0.1%	No

Waste/resource description	Waste type	Estimated quantity produced over construction duration	Residual as proportion of existing annual waste generation in the region	Potential reuse
Occupying site offices	General waste	26 t	<0.1%	No
Concrete culverts	C&D waste	Assume 2% of 20,721 m^3	0.5%	Yes Opportunities for reuse will be considered consistent with the intent of *EOW Code: Returned Concrete (ENEW07278517)*
Concrete (in situ)	C&D waste	Assume 2% of 91,076 m^3	2.5%	Yes Opportunities for reuse will be considered consistent with the intent of *EOW Code: Solid Concrete Washout (ENEW07602819)*
Concrete (pre-cast)	C&D waste	Assume 2% of 24,125 m^3	0.5%	Yes Opportunities for reuse will be considered consistent with the intent of *EOW Code: Returned Concrete (ENEW07278517)*
Oils, lubricants and greases	Regulated waste	Cannot be determined at present. Waste quantity is dependent on confirmed construction method and the numbers and types of plant and vehicular fleet.	Unknown	No
Packaging	General waste	Cannot be determined at present. Waste quantity is dependent on confirmed construction method, material requirements and packaging of received goods.	Unknown	Yes Opportunities for reuse will be considered consistent with the intent of the Used Packaging Materials NEPM

Further details on the potential sources, impacts, mitigation measures and management strategies (including efficiency of resource use) pertaining to Project wastes are discussed in Chapter 20: Waste Management.

Chapter 6: Sustainability provides an assessment of the Project against sustainability objectives and identifies opportunities to improve sustainable outcomes.

Waste collection, recycling and disposal services and facilities are provided for domestic uses by local governments. Commercial and industrial land uses primarily rely on private waste transportation contractors for the collection and off-site transportation of wastes.

Details of the existing waste management facilities in proximity to the Project that have potential to accept waste from commercial operations are listed in Table 5.42. The proximity of existing waste management facilities to the Project has been considered based on a commonly adopted haul route distance of 50 km for bulk waste and 15 km for municipal waste collected in domestic collection vehicles.

GRC are in the process of preparing a waste strategy in response to the reinstatement of the Queensland State Landfill Levy in July 2019. Through this strategy, Council expect to retain two designated landfill sites, located in Goondiwindi and Inglewood. Both of these sites will have weighbridges. Under the strategy, a transfer station would also be established in Yelarbon. Only existing waste management facilities have been listed in Table 5.42. The available and permissible annual capacity of the waste management facilities listed will be confirmed in consultation with the relevant operators once the construction approach and schedule are confirmed.

It is anticipated that the Project will require commercial arrangement with private waste transportation contractors for the off-site transportation of waste materials to appropriately licensed management facilities.

TABLE 5.42 WASTE MANAGEMENT FACILITIES IN THE REGION

Facility	Type	Operator	Contact details	Waste accepted
Toowoomba Waste Management Centre	Landfill and transfer station	TRC	155–175 Hermitage Road, Cranley QLD (07) 13 18 72	▸ C&I waste ▸ C&D waste ▸ Green waste ▸ General (putrescible and non-putrescible) ▸ Regulated waste
Millmerran Waste Facility	Landfill and transfer station	TRC	Owens Scrub Road, Millmerran QLD (07) 13 18 72	▸ C&I waste ▸ C&D waste ▸ Green waste ▸ General (putrescible and non-putrescible) ▸ Regulated waste (no solid regulated waste)
Goondiwindi Transfer Facility and Landfill	Landfill and transfer station	GRC (Proterra Group)	Rubbish Tip Road, Goondiwindi QLD (07) 4671 7400	▸ C&I waste ▸ C&D waste ▸ Green waste ▸ General (putrescible and non-putrescible) ▸ Regulated waste
Inglewood Landfill	Landfill	GRC (Proterra Group)	Inglewood–Texas Road, Inglewood QLD (07) 4671 7440	▸ C&I waste ▸ C&D waste ▸ Waste oils ▸ Green waste ▸ General (putrescible and non-putrescible) ▸ Scrap metal ▸ Regulated waste
Yelarbon Landfill	Landfill	GRC (Proterra Group)	East of Sawmill Road, Yelarbon QLD (07) 4671 7440	▸ C&I waste ▸ C&D waste ▸ Green waste ▸ General (putrescible and non-putrescible) ▸ Scrap metal
E&E Waste	Waste servicing/ Collection	E&E	81 Hungerford Street, Goondiwindi QLD (07) 4671 2403	▸ C&I waste ▸ C&D waste ▸ Green waste ▸ General (putrescible and non-putrescible) ▸ Regulated waste
Enwaste Toowoomba	Waste servicing/ Collection	Enwaste	18 Spalding Street, Toowoomba City QLD (07) 4638 2245	▸ C&I waste ▸ Regulated waste (only liquid regulated waste)

Facility	Type	Operator	Contact details	Waste accepted
Beutel and Oughtred Sons	Recycling services	Beutel Oughtred and Sons	38–72 Griffiths Street, Toowoomba QLD (07) 4638 4438	▸ C&I waste ▸ C&D waste ▸ Green waste
J&J Richards and Sons	Transfer station	J&J Richards and Sons	51 Wilkinson Street, Harlaxton QLD (07) 4634 1062	▸ C&I waste ▸ C&D waste ▸ Green waste ▸ General (putrescible and non-putrescible) ▸ Regulated waste

5.4.24 Signalling installation

The design and installation of the ATMS safeworking signalling system will be completed in parallel with the design and construction of the track and civil structures of the Project. The construction, procurement and testing program will be integrated into the track and civil programs to ensure both activities are carried out so commissioning activities can be undertaken at the same time.

5.5 Commissioning

All construction works will be subject to approved Testing and Commissioning Plans, as required, and appropriate Inspection and Test Plans.

Testing and commissioning (checking) of the rail line and communication/signalling systems will be undertaken to ensure that all systems and infrastructure are designed, installed, and operating according to ARTC's and QR's operational requirements. Testing and commissioning of the Project is scheduled to occur over a six-month period, commencing in the beginning of 2026.

For the connections to the existing QR and ARTC networks, the Testing and Commissioning Plan will address the existing QR and ARTC signalling system and will need to be approved by both parties.

Commissioning of the track works will require completed inspection and test plans, clearance reports, weld certification, rail stressing records, as-built documentation and track geometry reports.

5.6 Clean-up, landscaping and rehabilitation

Site restoration will be undertaken in accordance with the following:

- Inland Rail Environment and Sustainability Policy (refer Appendix E: Corporate Environment and Safety Policies)
- Inland Rail Landscape and Rehabilitation Strategy (available from inlandrail.artc.com.au)
- Border to Gowrie Rehabilitation and Landscaping Sub-plan.

The Inland Rail Landscape and Rehabilitation Strategy documents ARTC's approach to meeting these obligations and establishes governing landscape objectives and principles. The strategy also outlines landscape and rehabilitation treatment solutions for the various phases of the Inland Rail Program. This includes the rail corridor and ancillary infrastructure, as well as temporary works areas such as construction access, site compounds, non-resident workforce accommodations, borrow pits and other enabling works.

Opportunities for beneficial re-use of construction facilities, such as laydown areas and non-resident workforce accommodations, will be investigated through consultation with local governments and relevant stakeholders.

Where a beneficial re-use cannot be identified, the construction facilities will be progressively decommissioned so that reinstatement and revegetation activities can commence as soon as possible. A Project-specific Rehabilitation and Landscaping Management Sub-plan will be developed prior to the completion of construction for the management of land that is not required for the operation phase. The Rehabilitation and Landscaping Management Sub-plan will be developed based on the Inland Rail Landscape and Rehabilitation Strategy and property-specific reinstatement commitments (refer to Chapter 22: Outline Environmental Management Plan).

5.7 Operation

Operation phase activities will include the use of the railway for freight purposes, operation and maintenance of safety systems, signalling, and general track and infrastructure maintenance.

5.7.1 Hours of operation

The hours of operation are anticipated to be on a 24 hour/7-day calendar.

5.7.2 Workforce

It is anticipated that the ongoing operation and maintenance of the Project will require a workforce of approximately 10-to-15 FTE. The operational workforce will be based at provisioning centres outside the immediate vicinity of the Project.

5.7.3 Train operations

Train control will be managed via ARTC's existing control centres. Train services will be provided by a variety of operators. Trains will be a mix of grain, bulk freight and other general transport. Inland Rail as a whole will be operational once all 13 sections are complete, which is estimated to be in 2026.

The Project will involve operation of a single-rail track with crossing loops, initially, to accommodate double-stacked freight trains 1,800 m long and 6.5 m high. Train speeds will vary according to axle loads and track geometry, and range from 80 to 115 km/hr.

It is estimated that once operational, the Project will involve an annual average of about 14 train services per day in 2026. This is likely to increase to an average of 20 trains per day in 2040, and up to 25 per day during peak operational periods. Annual freight tonnages will increase in parallel, from approximately 14.2 million tonnes per year in 2026 to 21.8 million tonnes per year in 2040.

5.7.4 Operational maintenance

Standard ARTC maintenance activities will be undertaken during operations in accordance with task-specific ARTC work method statements (available on the ARTC Extranet: **extranet.artc.com.au/**). Typically, these activities include:

- Minor maintenance works, such as:
  - Bridge inspections
  - Culvert cleanout
  - Sleeper replacement
  - Rail welding
  - Rail grinding
  - Ballast profile management
  - Track tamping
  - Clearing/slashing vegetation within the rail corridor. The rail corridor will be maintained free of woody vegetation.
- Major periodic maintenance, such as:
  - Ballast cleaning
  - Formation work
  - Reconditioning of track
  - Adjustment
  - Turnout replacement
  - Correction of track level and line
  - Maintenance of structures including waterproofing, jointing etc.

These activities will occur on a scheduled basis, in addition to being in response to unplanned requirements (e.g. maintenance following adverse weather events).

5.7.5 Rollingstock maintenance and provisioning

No provisioning or rollingstock maintenance facilities are proposed to be provided within the proposed Border to Gowrie section of Inland Rail.

5.7.6 Fuel

No permanent refuelling facilities are proposed within the Project.

5.7.7 Other hazardous materials

Dangerous goods and hazardous chemicals that may be required during operation and maintenance of the Project are listed in Table 5.43 and have been determined based on usage on similar rail projects.

Operational usage of chemicals is expected to be on an 'as required' basis and will typically involve limited quantities during specific maintenance activities (e.g. application of pesticides in accordance with ARTC rail corridor maintenance protocols). There will be no permanent storage of dangerous goods or hazardous substances within the rail corridor. All substances will be transported to site by maintenance crews, as required.

TABLE 5.43 INDICATIVE LIST OF DANGEROUS GOODS AND HAZARDOUS SUBSTANCES

Chemical type	Typical chemicals	Purpose/use	Dangerous good class	Packing group
Fuel oil	Diesel	Fuel for mobile equipment	9 (C1)[1]	III
Grease	RS Claretech Biodegradable Grease	Lubricate plant and equipment	C2[2]	N/A
	Caltex 904 Grease	Lubricate plant and equipment	C2[2]	N/A
Pesticides	Australian Pesticides and Veterinary Medicines Authority Approved Pesticides	Pests and weeds control	6.1 or 9	I, II or III

Table notes:
1. Class C1—a combustible liquid that has a flashpoint of 150°C or less.
2. Class C2—a combustible liquid that has a flashpoint exceeding 150°C.

5.7.8 Electricity

Electricity supply will be needed for points, signalling and other infrastructure. It is anticipated that the supply of these services will be delivered by relevant providers under the terms of their respective approvals and/or assessment exemptions.

5.7.9 Telecommunications

The Project involves new telecommunications and signalling infrastructure including ATMS. ATMS will provide significantly upgraded capabilities to the rail industry of Australia. It is designed to support ARTC's objectives of improving rail network capacity, operational flexibility, train service availability, transit times, rail safety and system reliability.

5.7.10 Operational water supply and management

The Project's operational water requirements are anticipated to be minor, relative to the construction phase requirements. Water may be required to support localised maintenance activities, such as high-pressure cleaning of culverts. The volumes required will be dependent on the specific activities and frequency of undertaking, and therefore cannot be quantified at this stage of the Project.

Vegetation planted as part of the landscaping design for the Project will be self-sustaining and will not require watering once established.

An assessment of the suitability of each source will need to be made for each maintenance activity requiring water, based on the following considerations:

- Legal access
- Volumetric requirement for the activity
- Water quality requirement for the activity
- Source location relative to the location of need.

5.7.11 Operational stormwater management

Stormwater will be managed through the drainage structures incorporated into the Project design, as discussed in Section 5.2.6.

5.7.12 Road transport

The existing road network will be used by maintenance crews to travel to the rail corridor. Once in the rail corridor, the RMAR incorporated into the design of the Project will be used in preference to the existing road network for project maintenance activities. The RMAR is discussed in Section 5.2.8.

5.7.13 Waste management

The volumes of waste generated during operation of the Project are expected to be insignificant in comparison to the construction phase. The wastes anticipated to be generated during the operational phase of the Project are shown in Table 5.44.

Quantities of waste would depend on operational frequencies of maintenance regimes. These details cannot be determined at this stage of the Project. As such, quantities of operation phase waste cannot be accurately established at this time.

TABLE 5.44 OPERATIONAL AND MAINTENANCE WASTE QUANTITIES

Activity	Waste description	Waste type
Vegetation management	Green waste	General waste (non-putrescible)
Re-profiling of landforms, e.g. embankments	Potentially contaminated solid waste	Variable: General waste (non-putrescible) or regulated
General upkeep	Debris, litter/rubbish	General waste (non-putrescible)
Rail track replacement/upgrade	Scrap metal	General waste (non-putrescible)
	Potentially contaminated solid waste	Variable: General waste (non-putrescible) or regulated
Infrastructure maintenance	Waste paints and solvents	Regulated waste
General maintenance of rail corridor	Empty chemical containers	Regulated waste
Maintenance of erosion and control devices and culverts	Silt and sediment	General waste (non-putrescible)
	Vegetation debris	General waste (non-putrescible)

Wastes generated during the operation of the Project would be removed offsite for disposal at an appropriately licensed facility, in accordance with the requirements of the EP Act.

5.7.14 Landscaping and rehabilitation

Ongoing monitoring is to ensure that the Project landscaping continues to be successful. Additional maintenance or intervention works may be required if monitoring demonstrates that landscape and rehabilitation completion criteria established in the Rehabilitation and Landscaping Sub-plan (refer Section 5.6) are not being achieved.

Inspections of reinstated, landscaped or revegetated areas will occur for a period specified in the Principal Contractor's CEMP and contract requirements for the Project. Reporting will include information on reinstatement, landscaping and revegetation or as otherwise specified by the Project contract.

The ongoing maintenance of the rail corridor will include management of weeds, pests and vegetation (e.g. for bushfire and safe access), fauna furniture and fencing, and other infrastructure. These works will be managed in accordance with operational environmental management documentation consistent with the Inland Rail Environment and Sustainability Policy and the Inland Rail Landscape and Rehabilitation Strategy (refer Section 5.6).

5.8 Decommissioning

The Project is expected to be operational for in excess of 100 years. The design life of structures is 100 years to support this operational objective. The decommissioning of the Project cannot be foreseen at this point in time and is therefore not considered further as a Project phase in this draft EIS.

If the Project, or elements of it, were subject to plans for decommissioning, it is envisaged that the works would be undertaken in accordance with a Decommissioning Environmental Management Plan, or similar, which would be developed in consultation with relevant stakeholders and regulatory authorities.