APPENDIX B

Preferred infrastructure project description

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1. Preferred infrastructure features and operation

This section provides a description of the preferred infrastructure's features and how the preferred infrastructure would operate. The proposed approach to construction is described in section 2.

1.1 The preferred infrastructure

ARTC is proposing to construct and operate the Narrabri to North Star section of Inland Rail, which consists of upgraded rail track and associated facilities, generally within the existing rail corridor between Narrabri and the village of North Star. The Narrabri to North Star section would be undertaken in two phases:

- Phase 1 would consist of two sections of upgraded track and associated facilities, comprising:
  - about 93 kilometres between Narrabri and Alice Street, Moree
  - about 80 kilometres between Camurra North and North Star
- Phase 2 would consist of about 15 kilometres of upgraded track and associated facilities between Alice Street, Moree and Camurra North.

ARTC is currently seeking approval to undertake Phase 1, which is referred to as 'the preferred infrastructure' for the purposes of the Submissions and Preferred Infrastructure Report.

1.1.1 Location

The preferred infrastructure is generally located within the existing rail corridor between Narrabri and Moree and between Camurra North and the village of North Star. Some works would also be undertaken outside the rail corridor, including works at Bellata, Moree and Camurra.

The location of the preferred infrastructure is shown in Figure 1.1.

1.1.2 Key features

The key features of the preferred infrastructure, which are shown in Figure 1.2, are as follows:

- upgrading the track, track formation, culverts and underbridges, within the existing rail corridor, in two sections:
  - between Narrabri and Alice Street in Moree (a distance of about 93 kilometres)
  - between Camurra North and North Star (a distance of about 80 kilometres)
- realigning the track within the existing rail corridor at Gurley and Moree stations
- providing five new crossing loops within the existing rail corridor at Bobbiwaa, Waterloo Creek, Tycannah Creek, Coolleearllee, and Murgo
- removing the existing bridge and providing a new rail bridge over Croppa Creek
- realigning about 1.5 kilometres of the Newell Highway near Bellata, and providing a new road bridge over the existing rail corridor ('the Newell Highway overbridge')
- providing a new road bridge over the existing rail corridor at Jones Avenue in Moree ('the Jones Avenue overbridge').

The key features of the preferred infrastructure are described in sections 1.2 and 1.3.

Ancillary work would include works to level crossings, signalling and communications, signage, fencing, noise attenuation structures, rail maintenance access roads, and services and utilities. Ancillary works are described in section 1.4.

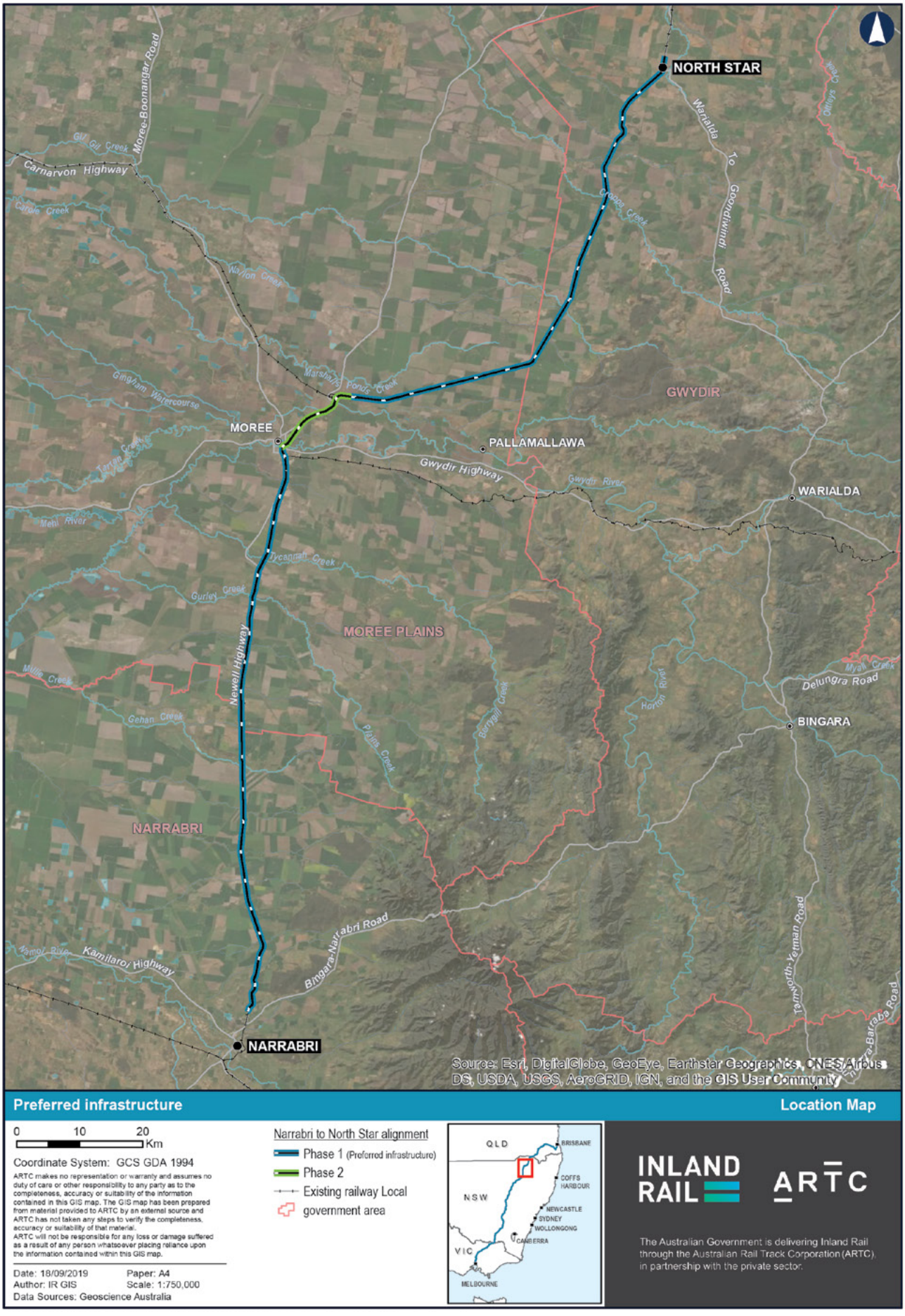


FIGURE 1.1: LOCATION OF PREFERRED INFRASTRUCTURE

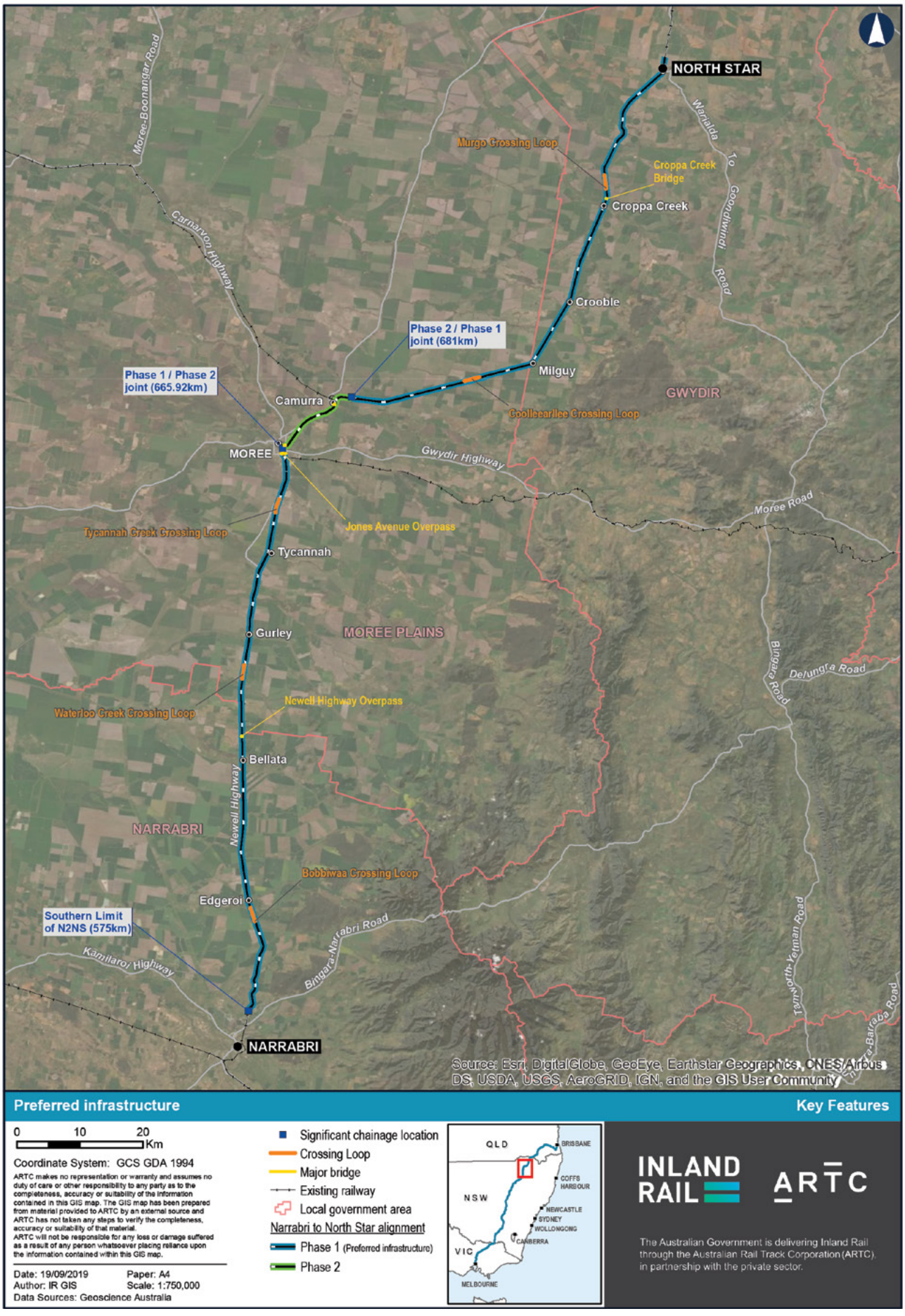


FIGURE 1.2: KEY FEATURES OF THE PREFERRED INFRASTRUCTURE

The land requirements for the preferred infrastructure would comprise the existing corridor with a typical width of 30 metres, with some variation to accommodate particular infrastructure and to cater for local topography. The corridor would be of sufficient width to accommodate the infrastructure currently proposed for construction, as well as future expansion, including any possible future requirement for 3600 metre long trains. It is noted that any future expansion, and the operation of 3600 metre long trains, does not form part of the preferred infrastructure for which approval is being sought.

The preferred infrastructure would consist of a single-track standard gauge railway, with crossing loops to accommodate double stacked freight trains up to 1800 metres long. Components of the construction include infrastructure to accommodate possible future augmentation and upgrades of the track. Clearing of the corridor would occur where necessary for the preferred infrastructure, including to allow for construction and to maintain the safe operation of the railway.

1.1.3 Other rail lines

A short section of the former Inverell line is an existing operational rail line that joins the preferred infrastructure at Moree to service local businesses. The preferred infrastructure would include works to tie in to this rail line. This line would continue to operate following construction of the preferred infrastructure. Accordingly, only the relevant direct impacts on this existing line, described in section 2.5 of the EIS, form part of the preferred infrastructure. Any associated maintenance works and other minor works on this existing line, undertaken by ARTC in accordance with existing ARTC procedures and processes and under relevant NSW legislative requirements, does not form part of the preferred infrastructure.

The existing Mungindi Line also crosses the rail corridor just north of Moree. As the section of rail line near Camurra is not part of the preferred infrastructure, this existing line would not be impacted during Phase 1.

1.2 Description of key preferred infrastructure features within the existing rail corridor

This section describes those features of the preferred infrastructure that would be located within the existing rail corridor.

1.2.1 Track upgrading

The existing track would be upgraded within the existing rail corridor for a distance of about 93 kilometres, between Narrabri and Moree, and 80 kilometres between Camurra North and North Star. All of the existing track would be upgraded through track reconstruction.

Track reconstruction would involve replacing the existing track and formation. An indicative design for this form of treatment is provided in Figure 1.3.

1.2.2 Station works

At Gurley and Moree stations the rail line would be realigned within the existing rail corridor. The proposed works at Moree are shown in Figure 1.4.

At Gurley, the works would be required as part of the alterations to the siding and crossing loop that currently extend between the former station and the grain facilities. At Moree Station, the works would be required to conform with required platform clearances for Inland Rail trains.

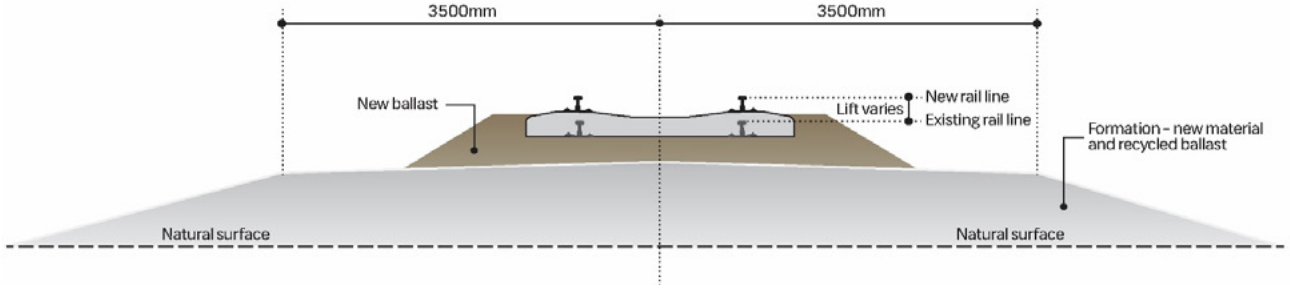


FIGURE 1.3: TRACK RECONSTRUCTION

At Moree Station, the works would be required to conform with required platform clearances for Inland Rail trains, and would involve moving the existing mainline track about 200 millimetres away from the existing station platform to allow Inland Rail trains to pass.

At Moree Station, the eastern side of the platform would be straightened and potentially resurfaced to allow passengers to safely join or alight from the Xplorer passenger service. Any alterations to the platform would comply with legislative requirements for accessibility of public transport, including the requirements of the *Disability Discrimination Act 1992* and the *Disability Standard for Accessible Public Transport 2002*. A security fence may also be constructed along the western platform to maintain passenger safety and to avoid conflict with Inland Rail train movements.

The detailed design of the works at Moree Station would consider the heritage significance of the station, and options to further minimise the potential impacts of the preferred infrastructure on the station would be confirmed during detailed design.

Other works near Moree Station involve upgrading the existing pedestrian level crossing at the northern end of the station. The existing crossing would be replaced with an automated gated zig-zag maze route. This arrangement would enhance pedestrian safety whilst maintaining the east–west connection between Morton Street and the Newell Highway. There would be no changes to existing pedestrian access to the station.

Rail services at Gurley and Edgeroi stations ceased in the late 1970s. The existing station infrastructure (platform and station hut) at these stations would be removed following the track realignment works.

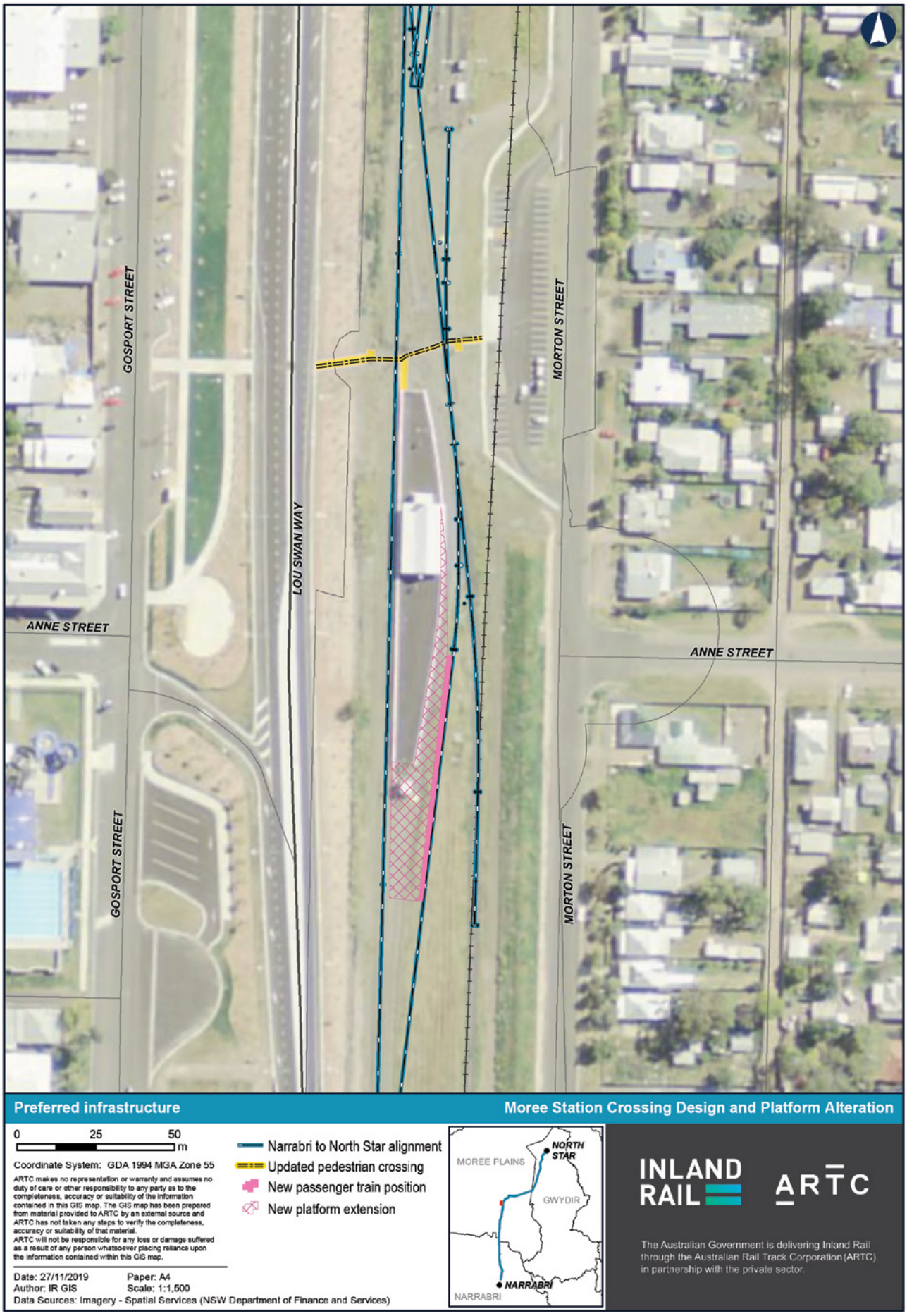


FIGURE 1.4: MOREE STATION TRACK REALIGNMENT WORKS

1.2.3 Cross drainage - culverts and underbridges

There are 177 culverts of varying types and sizes and eight underbridges along the preferred infrastructure site. Culverts are structures that allow water (in a watercourse or drain) to pass under the rail line. Like culverts, underbridges also allow water to pass under the rail line, however their span is longer and they are constructed differently. The majority of these structures (171 culverts and seven underbridges) need to be replaced as part of the preferred infrastructure to meet Inland Rail operational requirements. In addition, six of the culverts and one of the underbridges are proposed to be retained.

Fifty new culverts would also be built along the rail alignment. The location of the new culverts has been selected to maintain the existing flow paths and minimise the potential impacts to flood depths upstream and downstream of the culverts.

The design of new/replacement culverts and underbridges has been informed by a hydrologic and hydraulic assessment of the preferred infrastructure site, a geotechnical assessment, and a preliminary assessment of the existing structures. An assessment of flooding events has been undertaken for each structure and is provided in Appendix D of this report. The target design condition for the new structures is the one percent annual exceedance probability (AEP) flood event, where reasonably practicable.

The new structures have been designed to:

- take into account local constraints and flooding/ hydrological conditions
- permit an appropriate flow and minimise the potential for adverse flooding impacts, by:
  - locating culverts at low points along the preferred infrastructure site to prevent upstream water ponding
  - ensuring that the inside base of the culverts and underbridges match the natural surface level
  - retaining (at a minimum) the existing flow
  - minimising the potential for increases in the area of flood inundation
  - ensuring that sizes and capacities are as close to the existing situation as practicable, to minimise impacts on adjacent land and infrastructure.
- meet ARTC design standards
- ensure that the flooding situation is no worse than the existing situation.

Culverts would be constructed of concrete and would consist of various three and four sided designs ranging in widths from 0.45 metres to 2.4 metres and heights from 0.3 metres to 2.4 metres.

The majority of culverts would consist of one to four cells, however some culverts would have more than 40 cells.

The underbridges would consist of a bridge foundation based on bored or driven steel piles, precast abutment and pier headstocks and ballast walls and top.

1.2.4 Crossing loops

Five new crossing loops are proposed at Bobbiwaa, Waterloo Creek, Tycannah Creek, Coolleearllee, and Murgo. The loops would be constructed as new sections of track roughly parallel to the existing track. They would each be about 2200 metres long, to fit the design length of the train (1800 metres). The existing rail corridor is of sufficient width to accommodate the new crossing loops.

An indicative crossing loop design is shown in Figure 1.5. The loops are shown in Figure 1.6 to Figure 1.10.

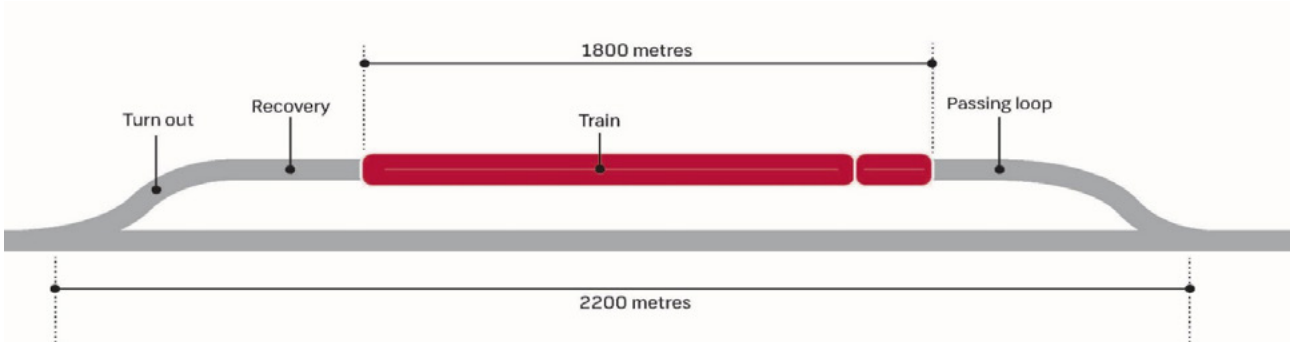


FIGURE 1.5: INDICATIVE CROSSING LOOP DESIGN

1.2.5 Turnouts

Turnouts allow the train to be guided from one track to another. The preferred infrastructure involves replacing some existing turnouts, and providing new turnouts, as described below.

New turnouts

Turnouts would be provided at the beginning and end of each crossing loop (10 in total).

Replacement turnouts

All turnouts would also be replaced at existing siding locations due to the changes in track height. All siding turnouts are maintained by ARTC under agreement with the siding owner. Although still within the preferred infrastructure site, some sections of these turnouts may be partially located outside the existing rail corridor.

1.2.6 Croppa Creek bridge

A new bridge is proposed to replace the existing bridge over Croppa Creek as the existing bridge does not meet Inland Rail requirements. The locations of the existing and replacement bridge are shown in Figure 1.11.

The existing bridge would be removed prior to construction to allow construction of the new bridge on the same alignment. The replacement bridge would consist of a three-span super T girder bridge structure based on driven steel tube piles. Abutments and piers would be cast in-situ.

Key features of the replacement bridge includes:

- 68 metres long
- three section/span bridge structure
- height of about 11 metres from the creek bed to the top of rail.

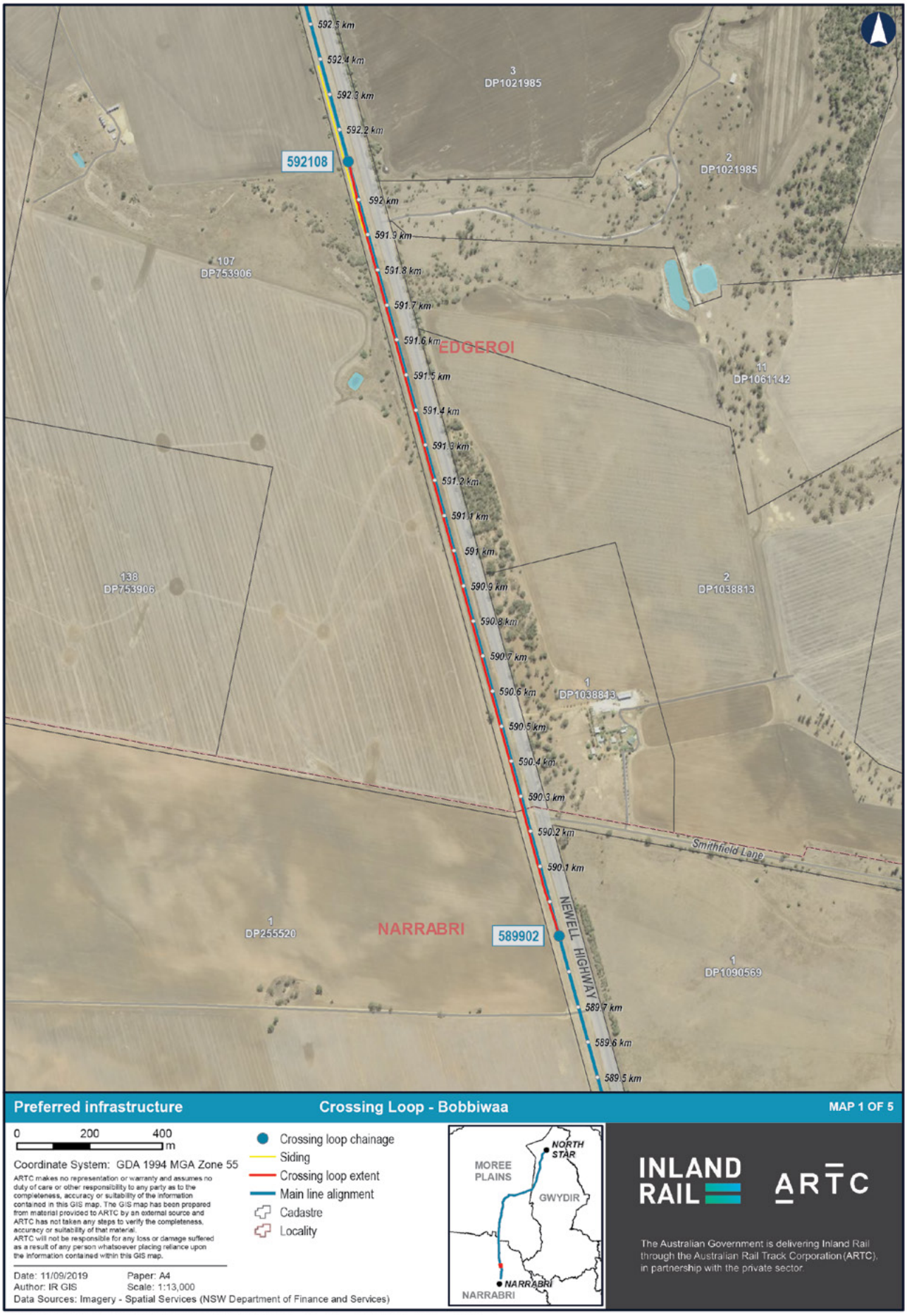


FIGURE 1.6: BOBBIWAA CROSSING LOOP

FIGURE 1.7: WATERLOO CREEK CROSSING LOOP

FIGURE 1.8: TYCANNAH CREEK CROSSING LOOP

FIGURE 1.9: COOLLEEARLLEE CROSSING LOOP

FIGURE 1.10: MURGO CROSSING LOOP

FIGURE 1.11: CROPPA RIVER BRIDGE

1.3 Description of key preferred infrastructure features outside the existing rail corridor

This section describes those features of the preferred infrastructure that would be located outside the existing rail corridor.

1.3.1 Newell Highway overbridge

A new road overbridge is proposed to enable the Newell Highway to pass above the rail corridor with sufficient clearance for double stacked Inland Rail trains to pass beneath. The overbridge would consist of about 1.5 kilometres of new two-lane road with a design speed of 120 kilometres per hour a posted speed limit of 110 kilometres per hour and a maximum grade of four percent, and would include a bridge structure and two tie-ins. The new bridge would be about 300 metres south of the existing bridge.

Key features of the overbridge are described below and are shown in Figure 1.12.

Bridge structure

The bridge structure would consist of:

- a 37 metre long single-span super T girder structure
- reinforced soil structure abutments, which would be supported on bored piles, sleeved though the reinforced soil structure walls and acting as separate structures
- a road pavement consisting of two lanes with a width of 3.5 metres each, a one metre width median strip in the centre and two shoulders with a width of 2.5 metres each and two verges of 1.2 metre width including guardrails
- spill through batters at the eastern and western abutments
- vertical protection screens of three metres height and barriers of 1.3 metre height on both sides of the bridge
- a bridge clearance height of at least 7.1 metres.

Tie-ins

New sections of road (known as 'tie-ins') would be constructed at the northern and southern ends of the overbridge to connect the bridge to the existing section of Newell Highway. The tie-ins would be about 650 metres long on the southern side, and about 880 metres long on the northern side, and would consist of two 3.5 metre lanes with 2.5 metre shoulders and 1.2 metre verges. Both tie-ins would include embankments.

1.3.2 Jones Avenue overbridge, Moree

The preferred infrastructure involves providing a road overbridge and road connections between Jones Avenue to the west of the rail corridor (between Warialda Street and Joyce Avenue), and Tycannah Street to the east of the road corridor (a distance of about 710 metres). The overbridge would enable road traffic and pedestrians to pass over Gosport Street, the Moree Bypass and the rail corridor. The overbridge would also enable temporary use by heavy vehicle in instances where there is a blockage at the level crossings.

Truck access to the industrial area south of Jones Avenue would be maintained. The overbridge would consist of about 620 metres of new road with a design speed of 50 kilometres per hour, and would include a bridge structure and two tie-ins.

Key features of the overbridge are described below and are shown in Figure 1.13. Visualisations of the proposed Jones Avenue overbridge are shown in Figure 1.14.

FIGURE 1.12: NEWELL HIGHWAY OVERBRIDGE

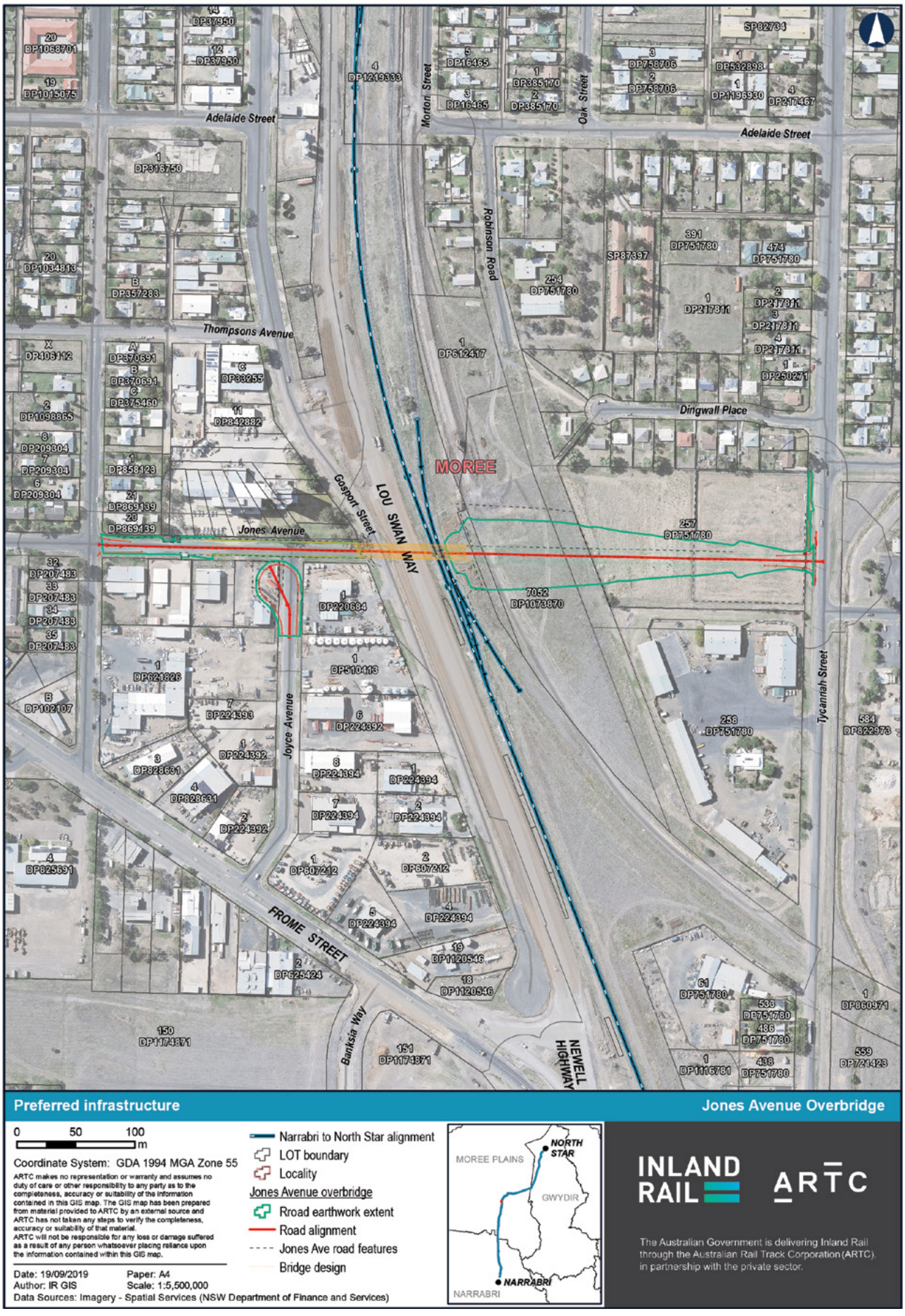


FIGURE 1.13: JONES AVENUE OVERBRIDGE

FIGURE 1.14: VISUALISATIONS OF THE PROPOSED JONES AVENUE OVERBRIDGE

Bridge structure

The bridge structure would consist of:

- a 89.5 metre long three-span super T girder bridge structure, supported on cast in-situ reinforced concrete piers/abutments, and founded using reinforced concrete bored piles
- a road pavement consisting of two lanes with a width of 3.5 metres each, a northern shoulder with a width of one metre, a southern shoulder with a width of 1.4 metres, and one 1.5 metre wide shared pedestrian/cycle path with kerb separation on the northern side of the bridge
- throw screens on both sides of the bridge that meet crime prevention through environmental design (CPTED) objectives and extend onto the abutments
- bridge clearance of at least 7.1 metres to the rail line, at least 5.5 metres to Gosport Street and at least 6.5 metres to Newell Highway.

Tie-ins

New sections of road would be constructed:

- at the western end of the overbridge, to connect the bridge to the existing section of Jones Avenue
- at the eastern end to create a road intersection with Tycannah Street.

On the western end the tie-in would be about 200 metres long and include a retaining wall. At the eastern end it would be about 250 metres long and include an approach embankment.

The tie-ins would be about 11.7 metres wide. They would consist of two lanes with a width of 3.5 metres each, and two shoulders with a width of one metre each. A 1.5 metre wide shared pedestrian/cycle path would be located on the northern side of the road.

Road modifications

The existing intersection between Jones Avenue and Joyce Avenue would be removed. The northern end of Joyce Avenue would be converted to a cul-de-sac, with access to Joyce Avenue via the existing intersection with Frome Street to the south..All property access would be maintained along Joyce Avenue and Jones Avenue.

Timing

Once Inland Rail is operating, the Jones Avenue overbridge would provide an additional light vehicle and pedestrian route to the Alice Street and Bullus Drive crossings between East Moree and Moree. The Jones Avenue Overbridge connection is required to be in place for 2025, the scheduled year of opening of the full Inland Rail service.

1.4 Ancillary works and infrastructure

1.4.1 Longitudinal track drainage

Longitudinal drainage in the form of cess and toe drains would be installed within the rail corridor adjacent to the track. Additionally, culverts crossing beneath the approach roads to level crossings would be installed to maintain the flow of drainage within the corridor.

Cess drains are surface drains located to the side of the tracks, used to remove water that percolates through the ballast and flows along the capping layer towards the outside of the track formation. Cess drains are used to protect the track formation by keeping it dry. The cess drains would be positioned towards the outer limit of the rail corridor, with the surrounding earthworks shaped to shed water towards its location.

Toe drains are surface drains located to the side of the tracks, used to manage surface water flow. Toe drains would be located along the base of embankments and low-flow open channels would be provided in areas of flat topography to provide preferential flow paths to direct water to cross drainage culverts in order to limit ponding.

Culverts would be provided beneath roads at levels crossings to provide local drainage connectivity and the continuity of cess drains. The road culverts would range in widths from 0.45 metres to 2.4 metres and would have heights from 0.3 metres to 1.2 metres. Localised open channels would be provided to manage surface water flows at level crossings and direct cess drainage to suitable cross culverts or public drainage discharge points.

1.4.2 Level crossings

A total of 72 level crossings are located along the preferred infrastructure site. Of these, 38 are located on public roads (a number of which are Crown roads providing access to a single property), and 34 crossings are located on private roads or maintenance access tracks.

Following exhibition of the EIS, ARTC prepared a Level Crossing Treatment Methodology to provide stakeholders with further detail regarding ARTC's decision-making process in relation to the sectionsof treatments for level crossings. The methodology is consistent with ARTC's *Road-Rail Crossing Investigation and Design Procedure*. It involved reviewing all formal public and private crossings along the preferred infrastructure site to determine the works required to meet relevant crossing standards, guidelines, and Inland Rail operational criteria.

The level crossing methodology and procedure consists of two stages:

- Stage 1 – identify options for level crossings and the preferred approach. Available options are:
  - level crossing consolidation, being closure or relocation
  - geometric adjustments to improve sight lines
  - alterations to the rail design to avoid level crossing conflicts with sidings and/or crossing loops
  - implementation of further design solutions for level crossings adjacent to existing sidings, which alter how train movements pass over the level crossing.
- Stage 2 – consult with relevant stakeholders (including landowners and road owners) to confirm the preferred treatment, and undertake the design process:
  - data collection and analysis regarding road types, vehicle movements and volume
- risk assessment and development of tentative treatments, using the Australian Level Crossing Assessment Model (ALCAM, and relevant NSW/ National road design requirements and guidelines
  - design solution development
  - stakeholder consultation and design review (where closure is not proposed)
  - detailed design finalisation.

ARTC has recently undertaken stage 2 of the level crossing strategy. The preferred infrastructure addresses each level crossing individually to respond to issues such as:

- vertical and horizontal geometry resulting from the revised track design and drainage requirements
- design vehicle movements and potential short stacking between the railway line and adjacent roads
- anticipated traffic growth, reflecting advice provided by councils.

The preferred option for level crossings across the preferred infrastructure site is listed in Table 1.1.

TABLE 1.1: SUMMARY OF PREFERRED OPTION FOR LEVEL CROSSINGS

ACTION	NUMBER OF CROSSINGS AFFECTED		
	PRIVATE	PUBLIC	TOTAL
Crossing consolidation (closure)	5	1	6
Closure of redundant crossing	3	0	3
Upgrade from existing passive protection (Give Way sign) to Stop sign	1	2	3
Upgrade existing passive protection (Give Way sign) to flashing lights and boom barriers	0	4	4
Retain existing passive protection (Give way sign)	0	0	0
Retain existing passive protection (Stop sign)	25	21	46
Upgrade from Stop sign to flashing lights and boom barriers	0	7	7
Retain existing active protection (railway crossing flashing signal and boom)	0	3	3
Total	34	38	72

Where an existing access to or within a property is proposed to be removed, altered or severed, additional works to reinstate access to the property would be undertaken. This may require works outside the rail corridor.

A small number of crossings have become redundant where property holdings no longer span the railway line.

Upgrading signalling and communications

Signalling and communications would be upgraded as part of the level crossing works, to enable any level crossings with active controls to tie into the rail network.

ARTC's Advanced Train Management System (ATMS) would be implemented to manage signalling and communications for the wider rail network. ATMS is a communication-based train management system, which communicates via both voice and data between Network Control Centres and locomotives operating on ARTC's rail network. Installation of the new signalling system would also require various upgrades to the electrical network.

1.4.3 New fencing and noise attenuation structures

Fencing would be required to provide a higher level of corridor security given the anticipated number of train movements, to prevent safety issues for people and animals.

Existing fencing along the rail corridor would be replaced as required. Where the corridor abuts a public road, fencing would be installed on the field side only. The fencing would consist of a standard stock fence (1.2 metres high). Fencing requirements are currently being confirmed as part of the detailed design process, in consultation with adjacent landholders, the relevant council and other infrastructure owners.

Noise attenuation structures would be constructed instead of fencing along some sections of the preferred infrastructure site. Preliminary locations for noise attenuation structures have been identified for the preferred infrastructure based on the results of noise modelling and the location of sensitive receivers relative to the rail line. Key locations include:

- Bellata, to a height of five metres above ground level
- Gurley, to a height of five metres above ground level
- Burlington Road, Moree, to a height of five metres above ground level
- Moree, between Alice Street and the Gwydir River, to a height of five metres above ground level
- Croppa Creek, with heights of between two to four metres above ground level
- North Star, to a height of five metres above ground level.

The location of the noise attenuation structures would be confirmed during detailed design. Generally they would be located towards the outer edge of the rail corridor to improve the effectiveness of the attenuation structures.

In Moree, it is anticipated that noise attenuation structures would be provided where required (expected to be north of Alice Street) instead of fencing. Elsewhere in Moree, the need for fencing is currently being confirmed in consultation with relevant stakeholders (including council, emergency services and community representatives). The aim is to establish practical solutions and reach a consensus with relevant parties on a suitable solution for addressing safety issues between Bulluss Drive and the Mehi River bridge.

1.4.4 Signage

Signage would be provided/replaced where required.

1.4.5 Rail maintenance access roads

Maintenance and inspection access is necessary for both the track and formation. A review of existing rail maintenance access tracks undertaken as part of the detailed design process found that these tracks did not serve the full length of the corridor, and in places they were shared with adjacent properties.

The preferred infrastructure provides for provision of a rail maintenance access road within the corridor, with three categories proposed:

- Type 1 – all-weather access road located at rail formation levels. This format would be provided for all crossing loops and maintenance sidings
- Type 2 – all-weather access road at natural surface level. This format would provide the link between Type 1 access roads and the local road network
- Type 3 – dry-weather only / 4WD / machine access along the corridor. This format would be provided for the majority of the corridor and may consist of site access roads established during the construction period.

The access road would be accessible by ARTC authorised maintenance vehicles only.

Crossings would be created at drainage lines and watercourses. Crossings would be designed in accordance with the *Guidelines for watercourse crossings on waterfront land* (Office of Water, 2012). Any other structures than a bed level crossing would be subject to additional assessment and approval.

1.5 Land requirements

The existing rail corridor is owned by the NSW Government (Transport for NSW). The majority of the preferred infrastructure would be undertaken within the existing rail corridor or on land for which ARTC has existing access agreements.

1.5.1 Permanent land requirements

The indicative land requirements for the preferred infrastructure are shown in Appendix H. The areas shown are estimated land requirements. The final acquisition areas would be confirmed during detail design in consultation with landowners.

It is estimated that the land requirements for the preferred infrastructure would affect:

- Private properties – 16 lots across 14 properties would be partially affected.
- Government-owned land – 15 lots would be partially affected, owned by the Country Rail Infrastructure Authority, State Rail Authority, Transport for NSW and the State of NSW.

The reasons that the land is required are detailed in Appendix H.

All acquisitions would be undertaken in accordance with the requirements of the *Land Acquisition (Just Terms) Compensation Act 1991. For partial acquisitions, property adjustment plans would be developed in consultation with the property landowner.*

1.5.2 Temporary land requirements

Temporary occupation of land adjacent to the rail corridor would also be required to facilitate construction. Leasing requirements for affected land would be finalised following the completion of detailed design.

Individual property agreements would be developed in consultation with landowners/lessees who would be directly impacted during construction. These would define ARTC's commitments as to how construction would be managed where it affects individual properties.

1.6 Operation of the preferred infrastructure

1.6.1 Train operations

The preferred infrastructure would form part of the rail network managed and maintained by ARTC. Train services would be provided by a variety of operators. The existing operation of the Mungindi line would continue prior to and following construction of the preferred infrastructure. Inland Rail as a whole would be operational once all 13 sections are complete, which is estimated to be in 2025.

Inland Rail would involve operation of a single rail track with crossing loops, to accommodate double stacked freight trains up to 1.8 kilometres long and 6.5 metres high. Train speeds would vary according to axle loads, and range from 80 to 115 kilometres per hour, except through Moree where the maximum train speed would be 65 kilometres per hour due to track geometry.

It is estimated that the operation of Inland Rail would involve an annual average of about 10 trains per day travelling north of Moree (between North Star and Moree) and 12 trains per day travelling south of Moree (between Moree and Narrabri) in 2025. This would increase to about 19 trains per day north of Moree (between North Star and Moree) and 21 trains per day south of Moree (between Moree and Narrabri) in 2040. This rail traffic would be in addition to the existing rail traffic using the Narrabri to North Star line.

The Inland Rail trains would be a mix of grain, bulk freight, and other general transport trains. Total annual freight tonnages would be about 11.8 million tonnes in 2025, increasing to about 19 million tonnes in 2040 (from the existing two million tonnes of grain per year).

The Xplorer passenger train would continue to stop at Moree and Bellata stations. Train stop locations for Inland Rail trains would be confirmed during detailed design.

1.6.2 Maintenance activities

Standard ARTC maintenance activities would be undertaken during operations. Typically, these activities include minor maintenance works, such as bridge and culvert inspections, rail grinding and track tamping, through to major maintenance, such as reconditioning of track and topping up of ballast as required.

2. Construction of the preferred infrastructure

This chapter provides an outline of the indicative construction activities likely to be used to construct the preferred infrastructure. It includes a summary of the proposed timing, an indicative construction methodology, likely resources, and proposed access arrangements. This information is preliminary and is based on the current stage of the design. The construction methodology would be refined as the design of the preferred infrastructure progresses, and once the construction contractor is engaged.

2.1 Overview of construction scope and approach

Construction would commence once all necessary approvals are obtained, the detailed design is complete and contractor engagement finalised. It is anticipated that construction would take about 44 months, commencing in late 2020 and concluding in mid-2024.

Early works relating to the relocation or protection of utilities and services would be undertaken prior to construction. Where these works are not finished before the start of construction, the remaining activities would be completed as part of the preferred infrastructure, in accordance with the conditions of approval.

The construction methodology, sequencing and durations have been refined based on consultation with Transport for NSW, freight operators, and owners of grain sidings. A possession strategy has been developed that takes into consideration the grain harvest season and peak grain freight movement period of November to April. This possession strategy and the associated approach to rail traffic management during construction is provided in Table 2.1.

Construction along the existing rail corridor would be dependent on the possession strategy and is intended to be completed in three stages, as follows:

- Stage 1 – Penneys Road to Narrabri.
- Stage 2 – Camurra to North Star.
- Stage 3 – Penneys Road to Moree South.

These stages are subject to review and may be further refined in consultation with the relevant stakeholders.

Construction of the Newell Highway overbridge, and the Jones Avenue overbridge would be undertaken in parallel with the above stages, as would potentially some of the works on underbridges where components can be constructed outside of the rail danger zone or in available possession windows.

Further information on the proposed staging and working hours is provided in section 2.3.

2.2 Indicative construction methodology

For each stage, construction would typically involve:

- site establishment (described in section 2.2.1)
- main construction works (described in sections 2.2.2 to 2.2.7)
- testing and commissioning (described in section 2.2.10)
- finishing works (described in section 2.2.11).

The construction methodology would be further developed and confirmed during detailed design.

2.2.1 Site establishment

Site establishment would generally involve:

- consult landowners/occupants where required
- install site environment management and traffic controls in accordance with the CEMP
- establish site compounds and facilities
- clear vegetation
- erect temporary fencing
- establish site access roads where required
- utility relocations as required
- deliver and stockpile materials including rail, sleepers, ballast, culverts and structural fill.

2.2.2 Track works

Track upgrading

A general methodology for track upgrading via track reconstruction is provided below:

- remove fastenings, rail and sleepers and stockpile to one side of the rail corridor
- excavate the existing ballast and earth formation
- stockpile material suitable for reuse
- place new fill material and recycled ballast into the excavated area, undertake any necessary geotechnical treatments, compact and shape
- place new ballast on top of the earth formation and compact
- place concrete sleepers and rail tracks on prepared ballast bed and weld up rails
- place new ballast on top of the sleepers
- tamp and profile the ballast around the sleepers and line to the design's vertical and horizontal alignment
- install signal equipment and associated equipment
- testing and commissioning.

Track realignment works

Track realignment works at Gurley, and Moree stations would involve:

- excavate and remove existing track and formation
- construct new track as described above
- weld and adjust track to interface back into existing track alignment.

Platform works at Moree station would involve straightening and resurfacing using cast in-situ concrete.

Culverts/underbridges

Where required, culverts and underbridges would be removed and replaced as described below. Culvert and underbridge replacement would be undertaken online (the structure would be replaced in the same location). Culverts would be pre-cast of- sit, and installed along thedpreferred infrastructure site as the track upgrading works progress.

Culvert replacement

- remove existing culvert structure (either concrete or steel pipes)
- excavate to the required depth
- place and compact bedding material
- place pre-fabricated culvert structures on the new formation area and fasten together
- place ballast, sleepers and rail on top of the culverts and tamp and profile the ballast under and around the sleepers and weld up tracks.

Underbridge replacement

- remove existing superstructure (including girders) and substructure components (abutments and piers) and store at nominated locations within the rail corridor
- undertake piling offset from existing track and structures
- install substructure components including bored/ precast concrete/ steel piles
- install any new substructure precast concrete components on the new substructure/ piles
- place new girders on the substructures and install bridge decks
- place ballast, sleepers and rail on top of the new bridge and tamp and profile the ballast under and around the sleepers and weld up tracks
- install guard rails as required
- install required scour protection including rock aprons and undertake any necessary backfill.

Where possible, the initial piling would commence during possession windows prior to the main possession periods, prior to the demolition of the existing structures.

Crossing loops

The general methodology for constructing crossing loops is as follows:

- excavate beside the existing track for the length of the crossing loop
- place and compact formation material
- place ballast, sleepers and rail tracks on top of the new formation
- install signal equipment and associated equipment
- testing and commissioning.

Turnouts

The general methodology for constructing turnouts is as follows:

- cut existing track, remove and dispose of existing turnout (at existing sidings only)
- undertake formation improvement works as required
- install ballast, sleepers and rails
- install control mechanisms (points motor, power supply etc)
- testing and commissioning.

Drainage

The general methodology for drainage construction is as follows:

- prepare survey control points for planned excavation of cess drains
- excavate earth material from the side of the existing track formation, and trim and compact base and sides of the drain
- form spoil mounds (if required, see section 2.2.9).

Rail maintenance access road

The general methodology for construction of the rail access maintenance road is as follows:

- undertake earthworks to shape the road to the required design level and to facilitate connections to external roads
- install subgrade material and compact and shape
- install capping material and compact.

2.2.3 Level crossings

The general methodology for level crossings is as follows:

- Upgrading controls:
  - remove existing controls, excavate to a suitable depth as required, place new formation material and ballast, replace track and surface panel as required
  - install new controls
  - provide standard road signs and road markings.
- Consolidating level crossings:
  - complete road works and appropriate road signage to redirect traffic
  - remove level crossing signs and road markings
  - upgrade tracks as described in section 2.2.2.

The pedestrian level crossing at Moree Station would be upgraded as follows:

- remove existing pedestrian crossing
- construct pedestrian footpath and pedestrian maze
- install relevant track circuitry for active crossing control
- line marking and installation of signage.

2.2.4 New bridges

Construction of the new bridge over Croppa Creek would involve the following:

- install substructure components including bored/ precast concrete/ steel piles alongside the existing bridge
- install any new substructure precast concrete components on the new substructure/ piles
- remove existing bridge superstructure and demolish the existing visible substructure (piers only) as far as required
- place new girders (concrete) on the new concrete substructures
- construct new earth formation to connect between the existing track alignment and the new bridge alignment
- place ballast, sleepers and rail on top of the new bridge and tamp and profile the ballast under and around the sleepers and weld up tracks
- install guard rails as required.

Demolition of the existing bridge over the Croppa Creek would involve the following:

- establish a crane pad for an appropriately sized crane (probably at least one on each side of the river bank)
- demolish the steel superstructure (lifting sections onto trucks to be reused elsewhere on ARTC network or disposed of at nearby recycling facility)
- demolish the visible existing brick or concrete piers
- dispose of waste material offsite.

2.2.5 Newell Highway overbridge construction

Construction of the Newell Highway overbridge would generally involve the following:

Bridge works

- construct cast-in-place piles at abutments and piers
- construct spill through abutments, column extensions and pier headstocks
- install pre-stressed concrete girders and construct reinforced concrete deck
- construct reinforced concrete approach slabs
- install expansion joints and steel traffic barrier railing
- install vertical protection screens
- install waterproof membrane and asphalt.

Embankment and pavement works

- place bulk general fill to construct approach embankments
- if identified as necessary during detailed design, install a culvert suitable for the travelling stock route
- construct new pavement, including placing and compacting select fill, sub base and asphalt wearing surface
- tie into the existing Newell Highway.

Finishing and landscaping

- rehabilitate disturbed areas and landscape in accordance with the rehabilitation strategy
- line marking and sign posting
- final site clean-up
- switch traffic
- demolish the existing bridge.

2.2.6 Jones Avenue overbridge construction

Construction of the Jones Avenue overbridge would generally involve the following:

Bridge works

- construct cast-in-place piles at abutments and piers
- construct spill through abutment on eastern side and reinforced soil wall abutment on western side
- construct column extensions and pier headstocks
- install girders and construct reinforced concrete deck
- install pedestrian footpath
- construct reinforced concrete approach slabs
- install throw screens
- install expansion joints and steel traffic barrier railing
- install waterproof membrane and asphalt.

Embankment and pavement works

- place bulk general fill to construct approach embankments
- construct new pavement, including placing and compacting select fill, sub base and asphalt wearing surface
- tie into existing Jones Avenue.

Finishing and landscaping

- rehabilitate disturbed areas and landscape in accordance with the rehabilitation plan
- line marking and sign posting
- demolish buildings in Joyce avenue affected by the new cul-de-sac (refer to section 2.2.7)
- modify existing Joyce Avenue intersection with Jones Avenue
- relocate property accesses for affected properties
- final site clean-up.

2.2.7 Building removal works

A number of buildings may need to be removed due to the proposed truncation of Joyce Avenue to build the Jones Avenue overbridge (refer to section 1.3.2). The need for removal of these buildings would be confirmed during detailed design. Additionally, as described in section 1.2.2 the station building/huts at Gurley and Edgeroi stations would also be removed as part of the preferred infrastructure.

Removal works would be carried out by licensed contractors. Typically, building removal would involve:

- establishment of hoarding, scaffolding and protection barriers around the perimeter of the site of the building to be removed
- all services into the buildings would be decommissioned, made safe and redundant
- soft stripping of internal building materials
- demolition of the building using an excavator, bobcat, cranes or other conventional methods following a top-down approach
- temporary propping and/or waterproofing provided for structural integrity of adjacent structures.

A hazardous materials analysis would be carried out prior to stripping and demolition of the main structure. Hazardous materials would be removed and disposed of in accordance with relevant legislation, codes of practice, and Australian Standards.

Materials such as bricks, tiles, timber, plastics and metals would be sorted where practicable and sent to a waste facility with recycling capabilities.

2.2.8 Signalling and communications

Installation of new signalling systems would involve:

- upgrades to the overhead electrical network to supply power to infrastructure
- the provision of new underground cable signal runs.

The general methodology for these works is described below.

- Upgrades to the overhead electrical network would involve:
  - excavate for the installation of power pole footings
  - install new poles, transmission wires and stability/stay wires, if required
- The provision of new underground cable signal runs would involve:
  - excavate trenches or tunnel bore
  - install bedding material
  - install conduits and wires
  - backfill, where necessary
- install new signalling, communications and electrical equipment
- commission and test.

Additionally, signal huts would be necessary at some locations and would involve:

- the establishment of footings or slabs
- construction of new huts or installation of pre-fabricated huts as applicable
- connection of huts to systems and installation of control equipment
- commissioning and testing.

2.2.9 Earthworks

Earthworks would be required:

- where upgrades to the formation are required
- to widen existing embankments and cuttings to meet design requirements
- to construct the new crossing loops
- to construct the Newell Highway and Jones Avenue overbridges and Croppa Creek bridge
- to construct culverts and underbridges
- to construct upgraded surface drainage and the road maintenance access road.

Minor earthworks would also be required to construct the ancillary infrastructure, including level crossings, and undertake the ancillary works associated with thedpreferred infrastructure.

2.2.10 Excess material/spoil

Excess material (spoil) resulting from excavation would be stockpiled within the rail corridor. The spoil stockpiles would be located as close as possible to the source of the excavated material.

Spoil would be used as follows:

1. Reconstruction of the track formation to the design's vertical alignment (the preferred option)
2. Spread within the rail corridor
3. Formation of spoil mounds for any excess spoil remaining after options 1 and 2 are implemented.

Spoil would be principally managed by integrating material into construction of the formation and, where this not possible, into the edge of the formation. Spoil from the creation of cess drains would be included into the formation. Current estimates of earthworks and spoil volumes indicate that there would be a very limited amount of excess spoil remaining after the track formation is reconstructed.

The location and design of any spoil mounds required would be confirmed during detailed design. Any mounds required would be placed in disturbed areas within the rail corridor, located at the outer edges of the corridor, and spread out to minimise height.

If mounds are required, they would be located and designed to ensure they are compatible with longitudinal drainage requirements, and that they do not result in adverse impacts to hydrology or flooding.

2.2.11 Testing and commissioning

Testing and commissioning (checking) of the rail line and communication/signalling systems would be undertaken to ensure that all systems and infrastructure are designed, installed, and operating according to ARTC's operational requirements.

2.2.12 Finishing works/reinstatement

All construction sites, compounds and access routes would be returned to the same or better condition than prior to construction commencing. Site reinstatement and rehabilitation would be undertaken progressively during the works and would include the following activities:

- demobilise site compounds and facilities
- remove all materials, waste and redundant structures from the works sites
- forming, and stabilising of spoil mounds
- decommission all temporary work site signs
- remove temporary fencing
- establish permanent fencing
- decommission site access roads that are no longer required
- restoration of disturbed areas as required, including revegetation where required.

Site rehabilitation would be undertaken in accordance with the rehabilitation plan, which would form a sub-plan of the CEMP (described in chapter 27). Additionally, where private land is temporarily acquired for the provision of compounds the standard of rehabilitation would be agreed with the affected landholder as part of the site leasing arrangements.

2.3 Timing, staging and working hours

2.3.1 Timing and staging

An indicative construction program is shown in Figure 2.1. Construction along the existing rail corridor (in the preferred infrastructure site) would be undertaken in three stages. The stages are shown in . For each stage, rail traffic would be managed as described in Table 2.1.

For works along the existing rail corridor, it is anticipated that it would take about 24 days to construct a 10 kilometre long section of track. This excludes location-specific works, such as culverts and underbridges and the relocation of services and utilities.

Construction of the key features outside the existing rail corridor would be undertaken as follows:

- Newell Highway overbridge construction would be undertaken in parallel with stage 1 and would take about 11 months to complete.
- Jones Avenue overbridge – construction would be undertaken in parallel with stage , and would take about 11 months to complete.

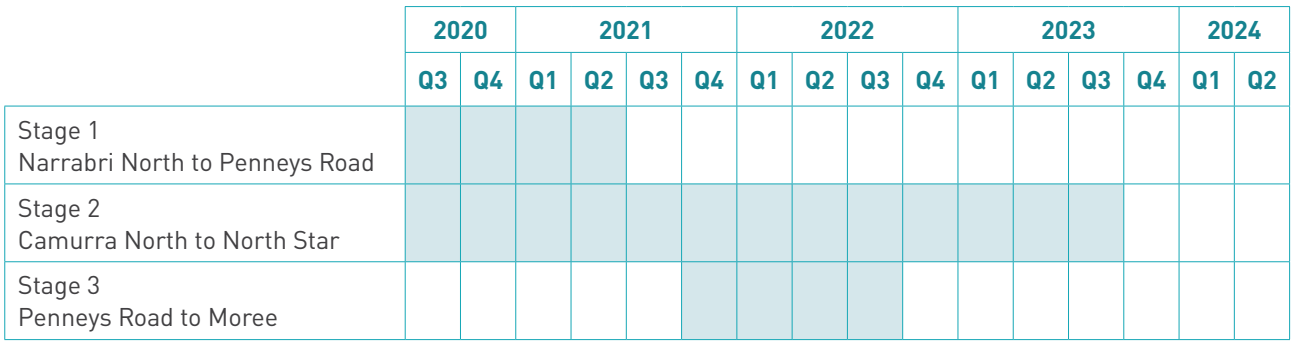


FIGURE 2.1: INDICATIVE CONSTRUCTION PROGRAM

TABLE 2.1: RAIL TRAFFIC MANAGEMENT DURING CONSTRUCTION

STAGE	LOCATION	DISTANCE (KM)	RAIL TRAFFIC	POSSESSION DESCRIPTIONS
1 – Penneys Road to Narrabri	Located between Narrabri and including the Bellata grain siding at the southern end of the preferred infrastructure site	50	Full closure possession of this section between September 2020 and April 2021. Temporary possessions may occur outside this period.	No freight/grain traffic north of Narrabri due to construction. During this construction stage, road haulage or grain storage solutions may replace rail traffic. Following completion of this stage, freight and grain rail traffic between Narrabri and Moree would reopen. Passenger rail services would terminate at Narrabri and would be replaced by bus services.
2 – Camurra to North Star	Located at the northern end of the preferred infrastructure site and stopping about 15 km north of the Moree	80	Full closure possession of this section between September 2020 and September 2023 (the full duration of construction of Stage 2).	No freight/grain traffic north of Camurra due to construction. During this stage, freight/grain traffic can move between Narrabri and Moree upon completion of Stage 1. Access would be available to the Mungindi CRN line. Passenger rail would remain suspended and terminate in Narrabri. Continuation of bus services between Narrabri and Moree.
3 – Penneys Road to Moree South	Located between Bellata and Moree South including the Inverell spur line in the middle of the preferred infrastructure site (described in section 2.2 of the EIS)	41	Full closure possession of this section between December 2021 and September 2022. Possible temporary possessions in this section outside this period. No possession between Narrabri and Penneys Road. No possession north of Moree, but isolated due to construction zone.	Freight/grain traffic can move between Narrabri and Penneys Road. No freight/grain traffic north of Penneys Road, due to construction. Areas north of Moree isolated. Passenger rail would remain suspended and terminate in Narrabri. Continuation of bus services between Narrabri and Moree.

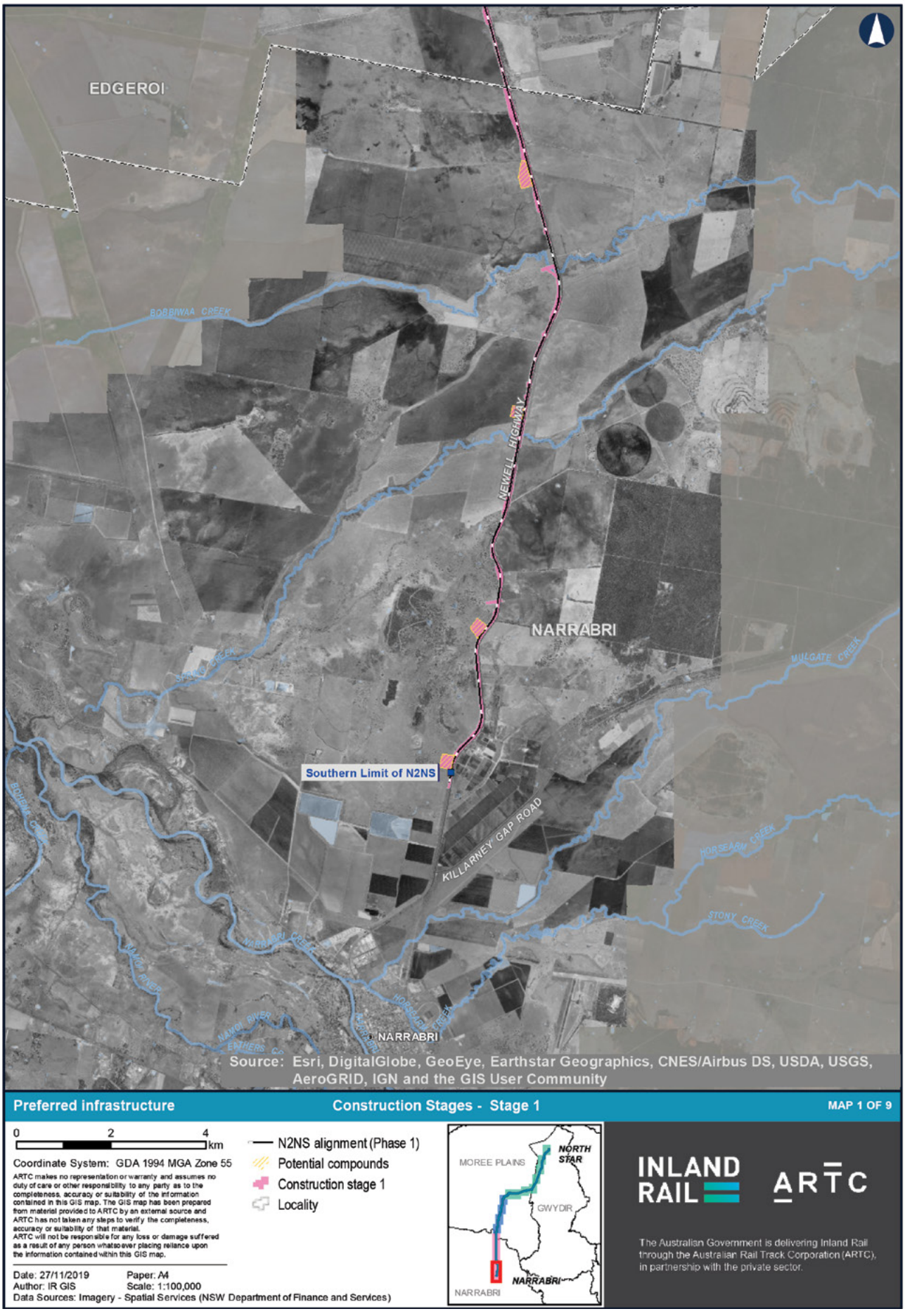
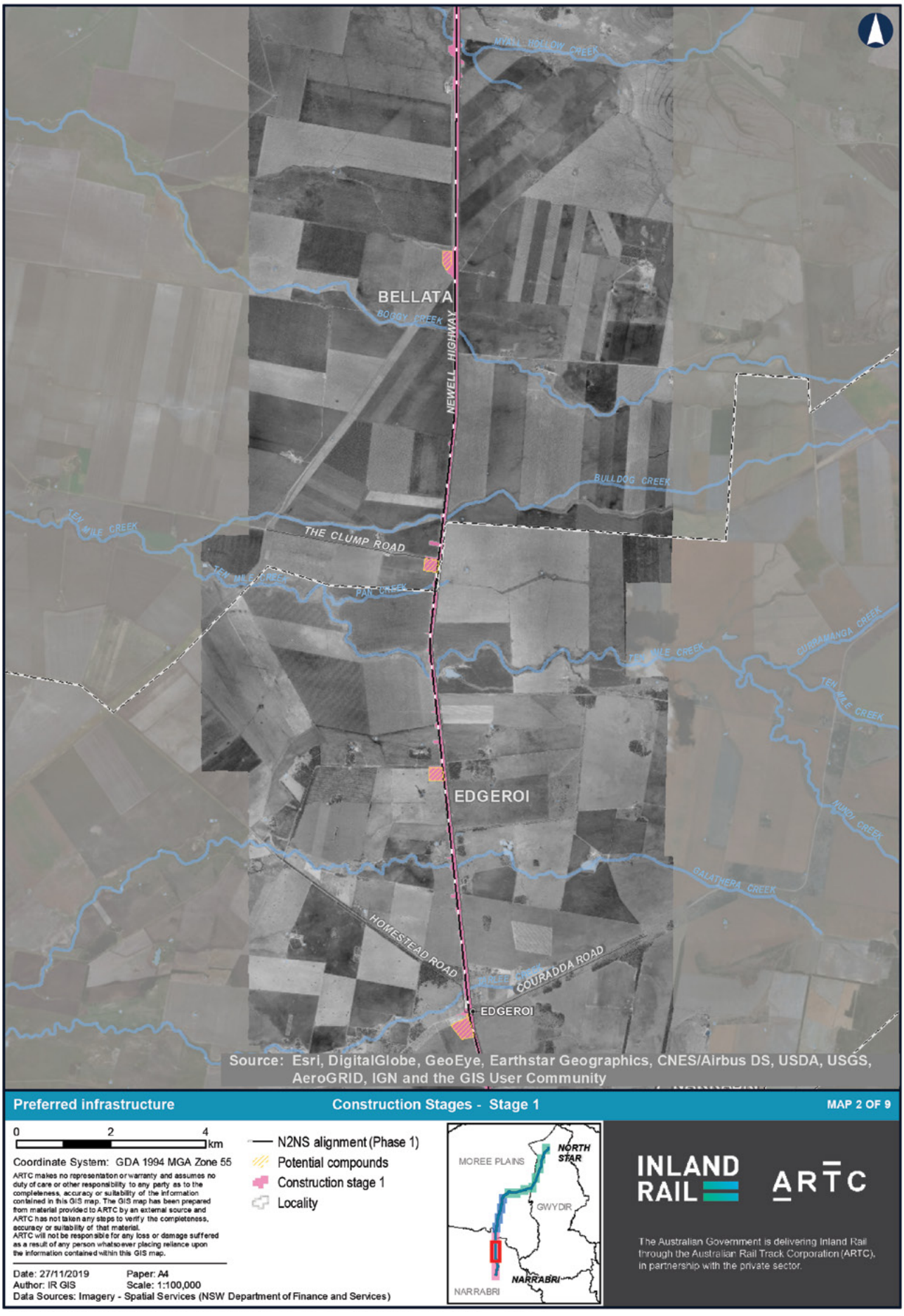


FIGURE 2.2: CONSTRUCTION WORK STAGES AND COMPOUNDS


MYALL HOLLOW CREEK
BELLATA
BOGGY CREEK
NEWELL HIGHWAY
BULLDOG CREEK
TEN MILE CREEK
THE CLUMP ROAD
PAN CREEK
GUBBAMANGA CREEK
EDGEROI
MUNDI CREEK
GALATHERA CREEK
HOMESTEAD ROAD
COURADDA ROAD
EDGEROI
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN and the GIS User Community
Preferred infrastructure
Construction Stages - Stage 1
MAP 2 OF 9
0 2 4 km
Coordinate System: GDA 1994 MGA Zone 55
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N2NS alignment (Phase 1)
Potential compounds
Construction stage 1
Locality
Date: 27/11/2019
Author: IR GIS
Paper: A4
Scale: 1:100,000
Data Sources: Imagery - Spatial Services (NSW Department of Finance and Services)
MOREE PLAINS
NORTH STAR
GWYDIR
NARRABRI
NARRABRI
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GURLEY
GURLEY
LITTLE BUMBLE CREEK
NEWELL HIGHWAY
WATERLOO CREEK
TOOKEY CREEK
BELLATA
MILLIE ROAD
BELLATA
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN and the GIS User Community
Preferred infrastructure
Construction Stages - Stage 1 & 2
MAP 3 OF 9
0 2 4 km
Coordinate System: GDA 1994 MGA Zone 55
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Author: IR GIS Scale: 1:100,000
Data Sources: Imagery - Spatial Services (NSW Department of Finance and Services)
N2NS alignment (Phase 1)
Potential compounds
Construction stage 1
Construction stage 2
Locality
MOREE PLAINS
NORTH STAR
GWYDIR
NARRABRI
NARRABRI
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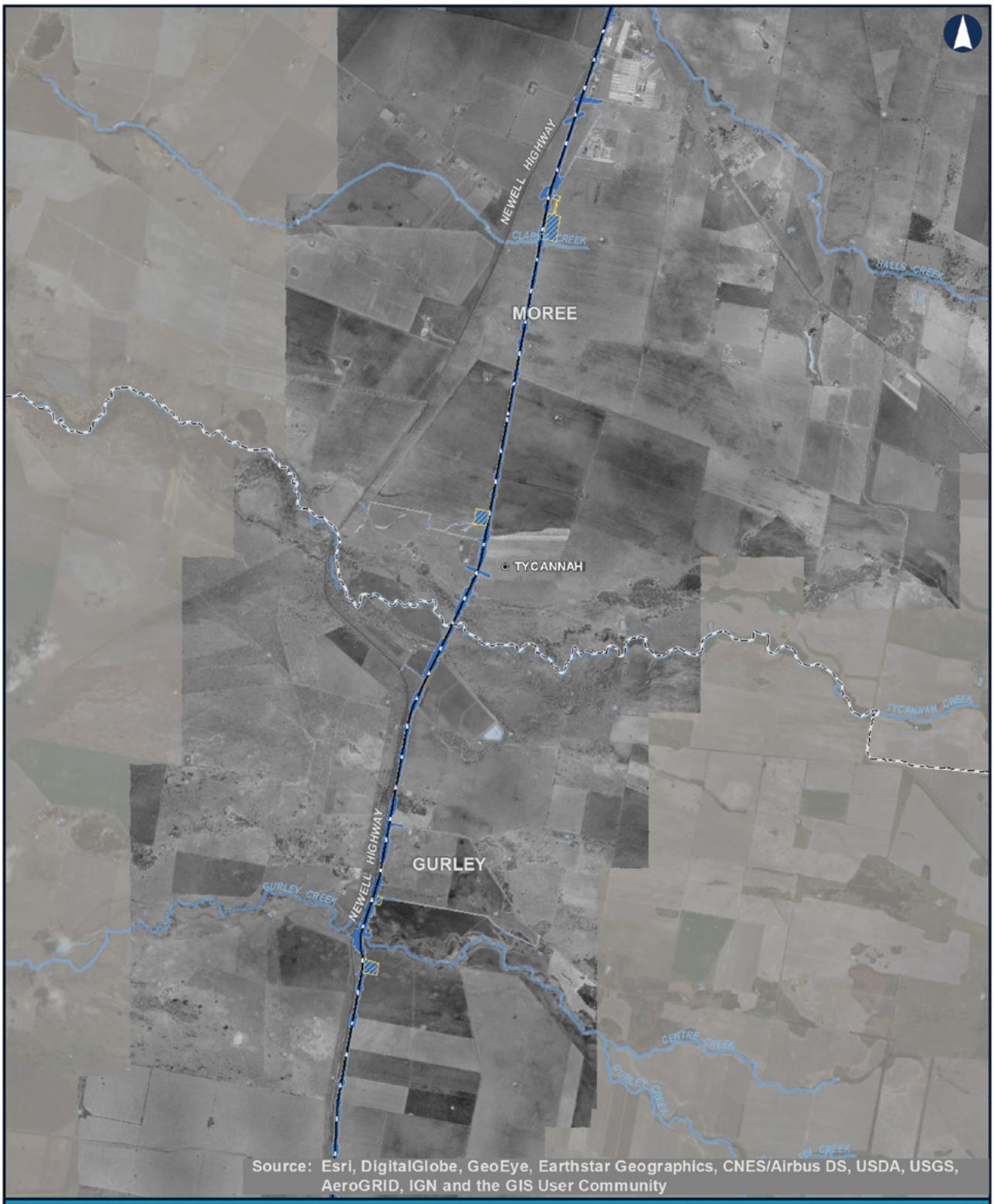
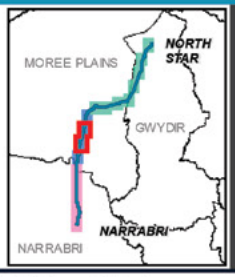


Preferred infrastructure | **Construction Stages - Stage 2** | **MAP 4 OF 9**

0 2 4 km

Coordinate System: GDA 1994 MGA Zone 55

- N2NS alignment (Phase 1)
- Potential compounds
- Construction stage 2
- Locality



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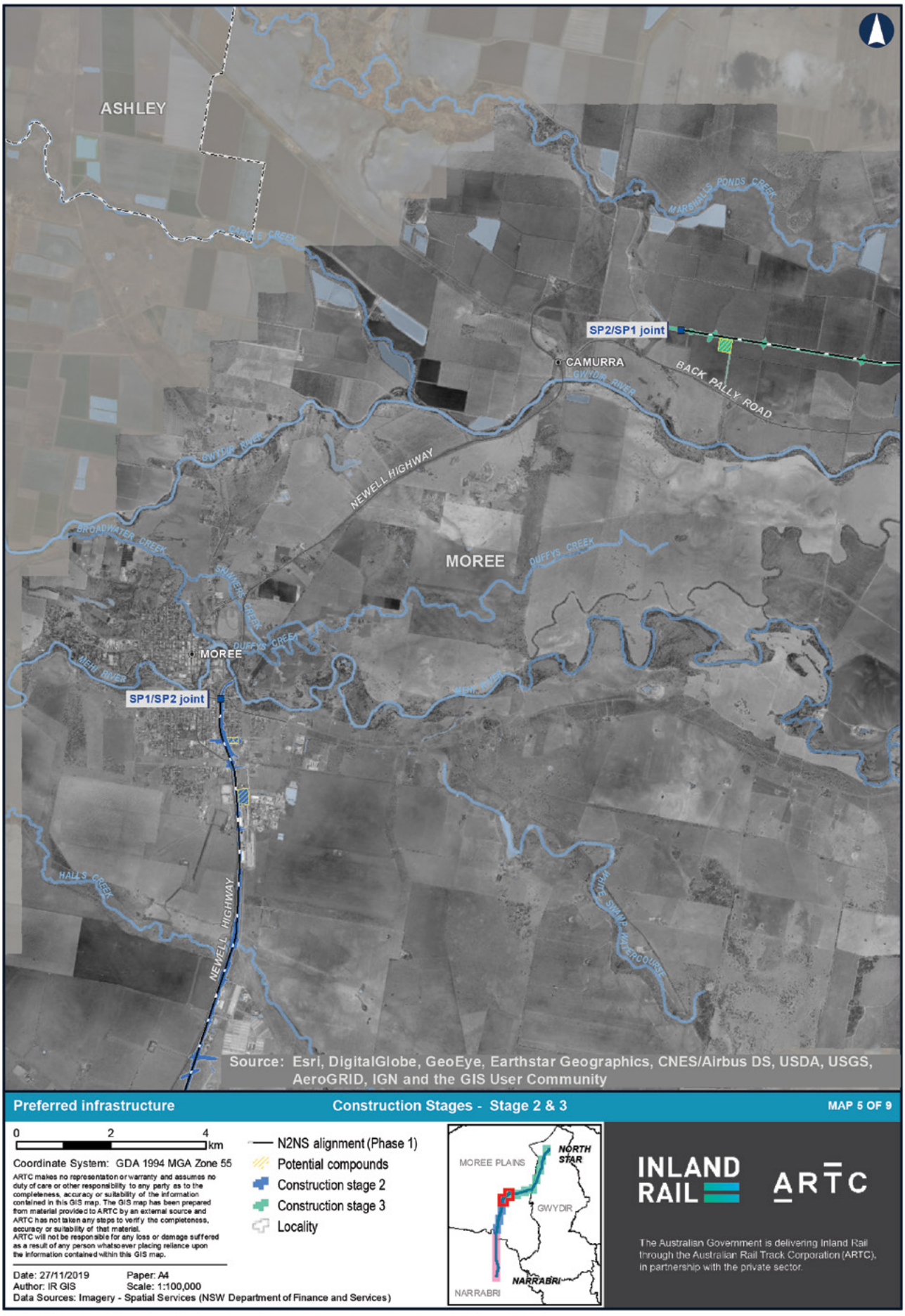
ASHLEY
CABBLE CREEK
MARSHALLS PONDS CREEK
SP2/SP1 joint
CAMURRA
GWYDIR RIVER
BACK PALLY ROAD
NEWELL HIGHWAY
BROADWATER CREEK
SHAMROCK CREEK
MOREE
DUFFYS CREEK
MEHI RIVER
SP1/SP2 joint
HALLS CREEK
NEWELL HIGHWAY
WHITE SWAMP WATERCOURSE
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN and the GIS User Community
Preferred infrastructure
Construction Stages - Stage 2 & 3
MAP 5 OF 9
0 2 4 km
Coordinate System: GDA 1994 MGA Zone 55
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N2NS alignment (Phase 1)
Potential compounds
Construction stage 2
Construction stage 3
Locality
MOREE PLAINS
NORTH STAR
GWYDIR
NARRABRI
NARRABRI
Date: 27/11/2019
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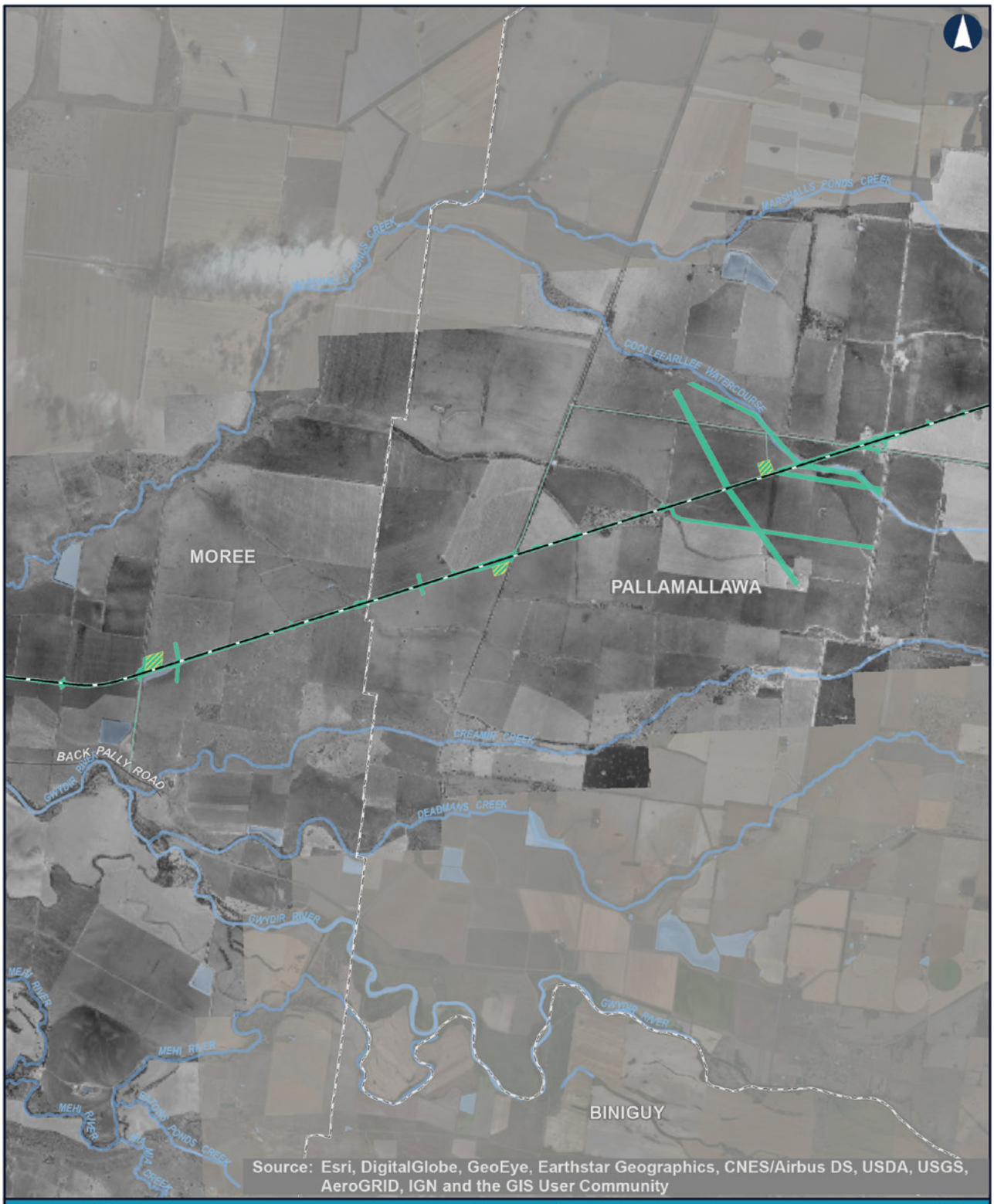
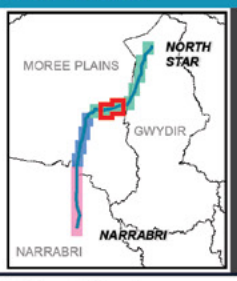


Preferred infrastructure | **Construction Stages - Stage 3** | **MAP 6 OF 9**

0 2 4 km

Coordinate System: GDA 1994 MGA Zone 56

- N2NS alignment (Phase 1)
- Potential compounds
- Construction stage 3
- Locality



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BOONAL CREEK
MOREE
CROPPA CREEK
GIL GIL CREEK
MIDDLE CREEK
CROOBLE
GOONAL CREEK
OREGON ROAD
BUNNA BUNNA CREEK
CROOBLE
GIL GIL CREEK
MARSHALLS PONDS CREEK
PALLAMALLAWA
COUNTY BOUNDARY ROAD
ROCKY HOLE CREEK
GIL GIL CREEK
COUNTY BOUNDARY ROAD
MILGUY
PULLAMA CREEK
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN and the GIS User Community
Preferred infrastructure
Construction Stages - Stage 3
MAP 7 OF 9
0 2 4 km
Coordinate System: GDA 1994 MGA Zone 56
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N2NS alignment (Phase 1)
Potential compounds
Construction stage 3
Locality
MOREE PLAINS
NORTH STAR
GWYDIR
NARRABRI
NARRABRI
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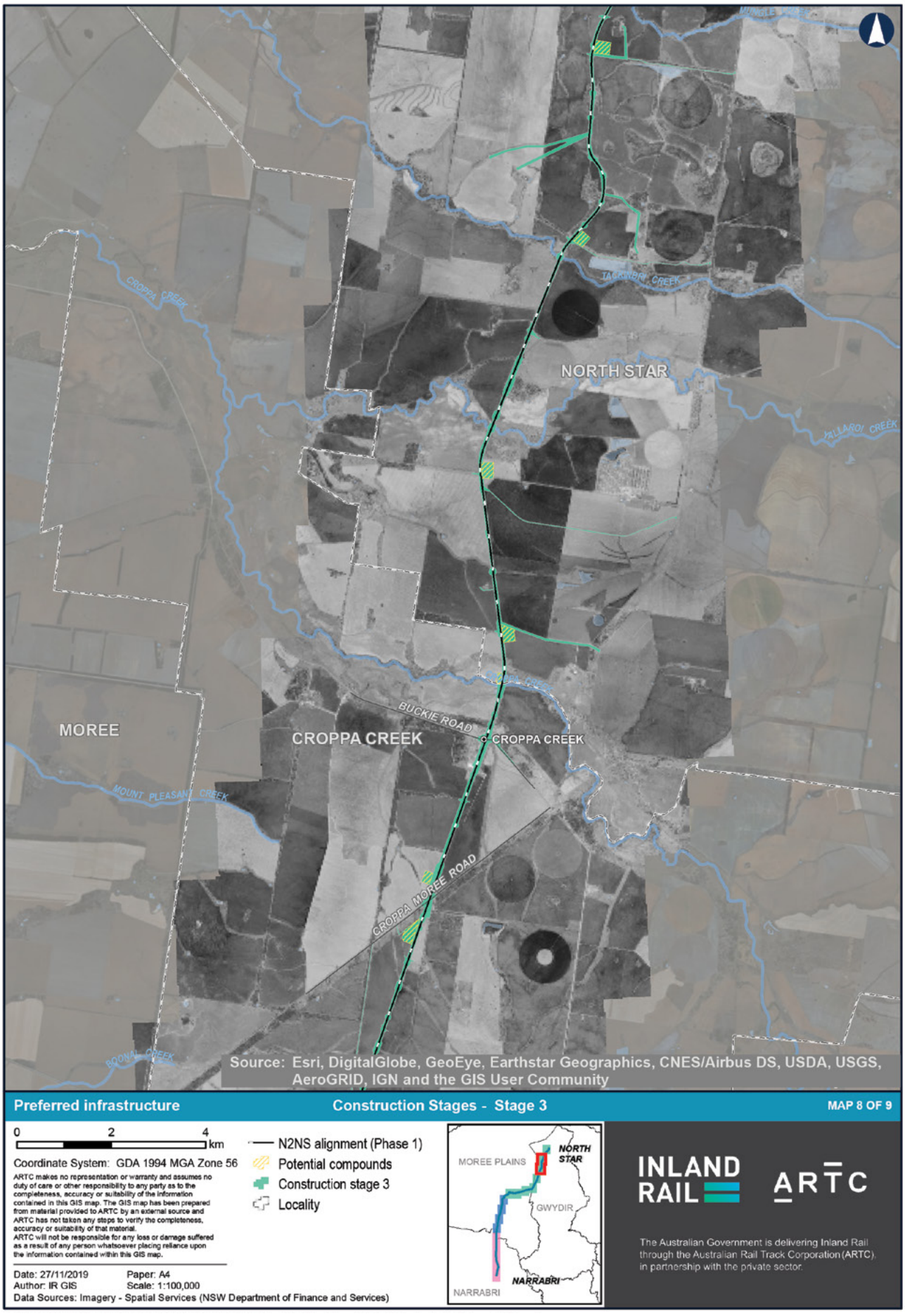

Preferred infrastructure **Construction Stages - Stage 3** **MAP 8 OF 9**

0 2 4 km

Coordinate System: GDA 1994 MGA Zone 56

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N2NS alignment (Phase 1)
Potential compounds
Construction stage 3
Locality

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Preferred infrastructure | **Construction Stages - Stage 3** | **MAP 9 OF 9**

0 2 4 km

Coordinate System: GDA 1994 MGA Zone 56

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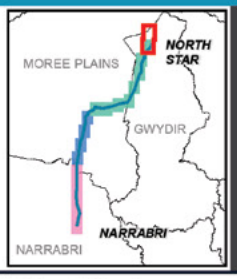
- N2NS alignment (Phase 1)
- Potential compounds
- Construction stage 3
- Locality



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2.3.2 Construction working hours

Construction work would be undertaken during the following primary proposal construction hours in the majority of locations:

- Monday to Friday: 6.00am to 6.00pm
- Saturday: 6.00am to 6.00pm
- Sundays and public holidays: 6.00am to 6.00pm.

Works would also be undertaken on a 24-hour basis rs where one or more of the following conditions are met:

- there are no sensitive receivers located within 700 metres of construction works and 1500 metres of bridge works
- an alternative arrangement with an individual or a group of impacted property occupiers has been reached
- a temporary rail possession is required to complete work for safety reasons (such as installation of bridge spans for the Jones Avenue overbridge)
- delivery of materials is required out of hours for safety reasons in accordance with the requirements of relevant authorities (such as the NSW Police Force, Roads and Maritime Services, National Heavy Vehicle Regulator or other)
- works are required in an emergency to avoid injury or the loss of life, damage or loss of property, or environmental harm.

Location-specific impacts would be assessed by implementing the Inland Rail NSW Construction Noise and Vibration Management Framework (provided in Appendix E), which includes procedures to manage works outside of the primary proposal construction hours.

2.4 Construction compounds

Two types of compound areas are proposed; minor compound/storage areas and larger compound sites.

Minor compounds/storage areas are areas that would be used for the assembly of adjacent infrastructure such as culverts and turnouts. These compounds would be located within the rail corridor.

Larger compound sites would be established for general construction activities associated with each stage of work. For the purposes of the EIS, it is assumed that temporary compounds would be sited outside the existing rail corridor every 4.5 to five kilometres (one for each work area described in section 2.3.1). Indicative compound locations are shown in Figure 2.2.

Each larger compound site would contain:

- stockpiles
- track infrastructure laydown area
- bunded refuelling area
- fencing as required
- office area including parking, offices and ablutions
- mobile plant and equipment
- hazardous material storage.

The design of the preferred infrastructure has been developed so that infrastructure would either be constructed in place (for example, welding of track) or prefabricated structures would be used (for example, culverts). Therefore, activities undertaken at compound sites would include the following:

- site office operations
- delivery and stockpiling of various construction materials including rail, sleepers, ballast, culverts and structural fill
- movement of plant and equipment
- maintenance of site environmental management controls
- operation of mobile concrete batching plants (where present).

Not all of the above activities would be undertaken at every compound site.

The location of compounds would be determined based on the following criteria:

- at least 50 metres from watercourses and outside the five percent AEP flood zone
- where no or only minor clearing would be required, and not within areas identified as threatened communities or species habitat
- no significant impacts to utilities, primarily gas and electricity
- at least one kilometre from the nearest residence or other noise sensitive receiver where possible
- not on or near sites with known Aboriginal or non-Aboriginal heritage value
- minimise use of private land
- where safe access to the road network and rail corridor can be provided
- relatively flat land.

2.5 Construction resources

2.5.1 Workforce

For the majority of the construction period, the workforce would average about 200 people. For some limited items of work an additional short-term workforce may be required.

2.5.2 Materials

The preferred infrastructure would require quantities of various materials including fill, ballast, concrete sleepers, rail, precast concrete units, ready mix concrete and water. The majority of these materials would be used during track formation works, with the exception of precast concrete units and ready-mix concrete, which would be used for construction of concrete structures including culverts and bridges.

Subject to confirmation and the gaining of any necessary approvals, local quarries are proposed to be used for structural fill, capping and ballast (ballast would be delivered by train, other materials by truck).

2.5.3 Plant and equipment

A range of plant and equipment would be used during construction. The final equipment and plant requirements would be identified by the construction contractor. An indicative list of plant and equipment that would be used for each construction stage is provided in Table 2.2.

TABLE 2.2: INDICATIVE CONSTRUCTION PLANT AND EQUIPMENT

CONSTRUCTION PHASE	PLANT AND EQUIPMENT	
Establishment	▸ trucks ▸ cranes	▸ clearance equipment such as chainsaws and chippers
Utility relocations and property adjustments	▸ excavators ▸ rigid and articulated trucks ▸ jackhammers ▸ cranes ▸ concrete pumps ▸ welding equipment	▸ concrete saws ▸ light vehicles ▸ concrete trucks ▸ generators ▸ oxy-cutting equipment
Earthworks and drainage	▸ excavator ▸ jackhammers ▸ rigid and articulated trucks ▸ compactors ▸ water carts ▸ generators	▸ bulldozers ▸ boring machines ▸ graders ▸ profilers ▸ vibrating rollers ▸ trucks and trailers
Track works	▸ 25-30 tonne excavators ▸ 40 tonne dump truck ▸ vibratory roller ▸ water cart ▸ crane ▸ trucks and trailers ▸ tampers	▸ graders ▸ bulldozer ▸ lighting ▸ skid steer loader ▸ front end loader ▸ sleeper layer ▸ rail saw/clipping machines
Road overbridges, underbridges and pavement works	▸ excavators ▸ rigid and articulated trucks ▸ drilling rigs and boring machines ▸ cranes ▸ concrete trucks and pumps ▸ generators ▸ welding equipment ▸ trucks and trailers	▸ compactors ▸ graders ▸ paving machines ▸ slip-forming machines ▸ vibrating rollers ▸ water carts ▸ road marking machine ▸ piling rigs
Finishing and landscaping	▸ milling machines ▸ piling machines ▸ trucks ▸ rollers	▸ generators ▸ oxy-cutting equipment ▸ sprayers ▸ trucks

Mobile concrete batching plant

Mobile concrete batching plants would be used to supplement supply from existing batching plants for the following works:

- earthworks and drainage
- road overbridges
- underbridges.

The size of the plant would be about 15 metres by 10 metres, and up to eight metres high. The plant and ancillary features would have a footprint of about 100 metres by 150 metres to account for a water tanker, concrete trailer and storage of materials including aggregate and sand. The location of the plant would be wholly within the preferred infrastructure site and would be subject to the same criteria as per that for the construction compounds, described in Section 2.4. Plants may be established within each construction stage.

The combined total output from mobile batch plants is estimated to be less than 10 000 metres cubed per annum.

2.5.4 Site servicing requirements

Utilities and services such as water, sewer, electricity and telecommunications would need to be supplied to each of the work and compound sites for use in site offices and amenities. Where these utilities are located close to the sites, opportunities to connect to existing sources would be explored with relevant providers, particularly for electricity. Where connections are not available, power would be provided by generators.

Water would be required for dust control, site compaction and reinstatement during construction. A number of potential water sources have been investigated, including extraction of groundwater or surface water, private bores and watercourses. This would be further explored prior to construction in consultation with local councils and landowners. Where water is not available, it would be transported to the site via tanker truck and stored in temporary storage tanks. Potable water for human consumption would be supplied via bottled water or potable water tanks. Non-potable wash water would be supplied by the use of trailer-mounted storage tanks.

Portable toilet facilities would be used where existing infrastructure is unavailable and sewage pump out services utilised to remove waste off site.

2.6 Transport, access and haulage arrangements

2.6.1 Access to construction work areas

Access to the construction work areas would mainly be from public roads or existing access routes which are located within the rail corridor. An access track runs parallel to the rail line along the majority of the alignment.

Potential access routes to each construction stage are listed in Table 2.3. Generally, access to construction stage 2 would be from Narrabri, access to construction stage 3 would be from Moree and access to construction stage 1 would be from Moree and North Star. Some areas would have two access points, and some would have alternative routes available, depending on the origin.

TABLE 2.3: POTENTIAL CONSTRUCTION ACCESS ROUTES TO CONSTRUCTION STAGES

CONSTRUCTION STAGES (AS SHOWN IN)	PRIMARY ROUTE	SECONDARY ROUTE
Stage 1	Newell Highway Gwydir Highway	Croppa Moree Road County Boundary Road Buckie Road I B Bore Road
Stage 2	Newell Highway	Gurley Creek Road Millie Road Gurley Settlers Road
Stage 3	Newell Highway	Gwydirfield Road Mosquito Creek Road Croppa Creek Road County Boundary Road

2.6.2 Access to compounds

Access routes to compounds would be determined based on the following criteria:

- use of existing access tracks/roads within and adjacent to the rail corridor and existing property access roads (where agreed with the landowner) where practicable
- provision of an appropriate width to provide single lane, two-way access
- provision of adequate turning circles, with a radius of at least 25 metres, for cranes and heavy vehicles
- provision of more than one access point (where practicable).

2.6.3 Alternative public transport arrangements

The Northern Tablelands Xplorer travels between Sydney and Moree. It stops within the preferred infrastructure site at Bellata and Moree stations. One train per day operates in each direction, consisting of two carriages.

Xplorer services between Narrabri and Moree would be suspended for the duration of construction activities between Narrabri and Moree, including during the 'grain freight season' (November to April).

During construction, buses would be used in place of trains to transport passengers to the nearest active station. Bus stops would be located taking into consideration safe access for passengers and proximity to the existing station.

2.6.4 Haul routes

While a detailed haulage program has not yet been developed, it is expected that some of the preferred infrastructure's components would be delivered by rail. Other transport would be undertaken by heavy vehicles using the Newell Highway, Gwydir Highway / Alice Street and Kamilaroi Highway and then local roads and existing access roads along the rail corridor.

Ballast may also be delivered by rail, but during construction of the preferred infrastructure, while pre-fabricated concrete units, fill and equipment deliveries would most likely be via road from suppliers or town centres.

2.6.5 Construction traffic numbers

Construction vehicle movements would comprise both heavy and light vehicles as listed in Table 2.4.

Light vehicle movements would largely be based on the amount of construction workers travelling to site each day. Based on an average workforce of 200 people, up to 200 private vehicles could travel to and from the preferred infrastructure site per day. However, given the remote nature of many of the construction work areas, buses would be provided for construction workers. Workers are likely to use a combination of buses and light vehicles to travel to the preferred infrastructure site.

TABLE 2.4: VEHICLE MOVEMENTS FOR EACH STAGE OF CONSTRUCTION

VEHICLE TYPE		NUMBERS ON SITE PER DAY	MOVEMENTS PER DAY	INDICATIVE PEAK HOUR MOVEMENTS (ONE-WAY)
Light vehicles	Cars and utilities	75	170	75
	Total light vehicles	**75**	**170**	**75**
Heavy vehicles	Light trucks	8	24	8
	25-seater buses	5	10	5
	Haulage and delivery trucks	28	200	28
	Total heavy vehicles	**41**	**234**	**41**

2.7 Public utilities

Preliminary investigations have indicated that a number of utilities would need to be protected, relocated or adjusted to construct the preferred infrastructure. Consultation with public utility authorities is being undertaken as part of the design process to identify and locate existing utilities and incorporate utility authority requirements for works to utilities.

The number and length of potential interactions with utilities within the rail corridor is listed in Table 2.5. Additional services investigations would be undertaken during detailed design.

TABLE 2.5: SERVICES CROSSINGS AND LENGTH

SERVICE TYPE	NUMBER OF CROSSINGS	APPROX. LENGTH OF SERVICE IN THE CORRIDOR (KM)
Electricity (Essential Energy)	64	8
Communications (Telstra/Soul/ Nextgen)	385	139
Sewer (Moree Plains Shire Council and Narrabri Councils)	3	0.1
Water (Moree Plains Shire Council and Narrabri Council)	18	1.2
Stormwater (Moree Plains Shire Council)	1	0.1