Adani Mining Pty Ltd

NORTH GALILEE BASIN RAIL PROJECT

Environmental Impact Statement

Chapter 2 Project description

November 2013

Table of contents

Table index

Figure index

2. Project description

2.1 Purpose of this chapter

The purpose of this chapter is to describe the North Galilee Basin Rail Project (NGBR Project). This description of the NGBR Project forms the basis for the identification of impacts throughout this Environmental Impact Statement (EIS).

2.2 Overview of the Project

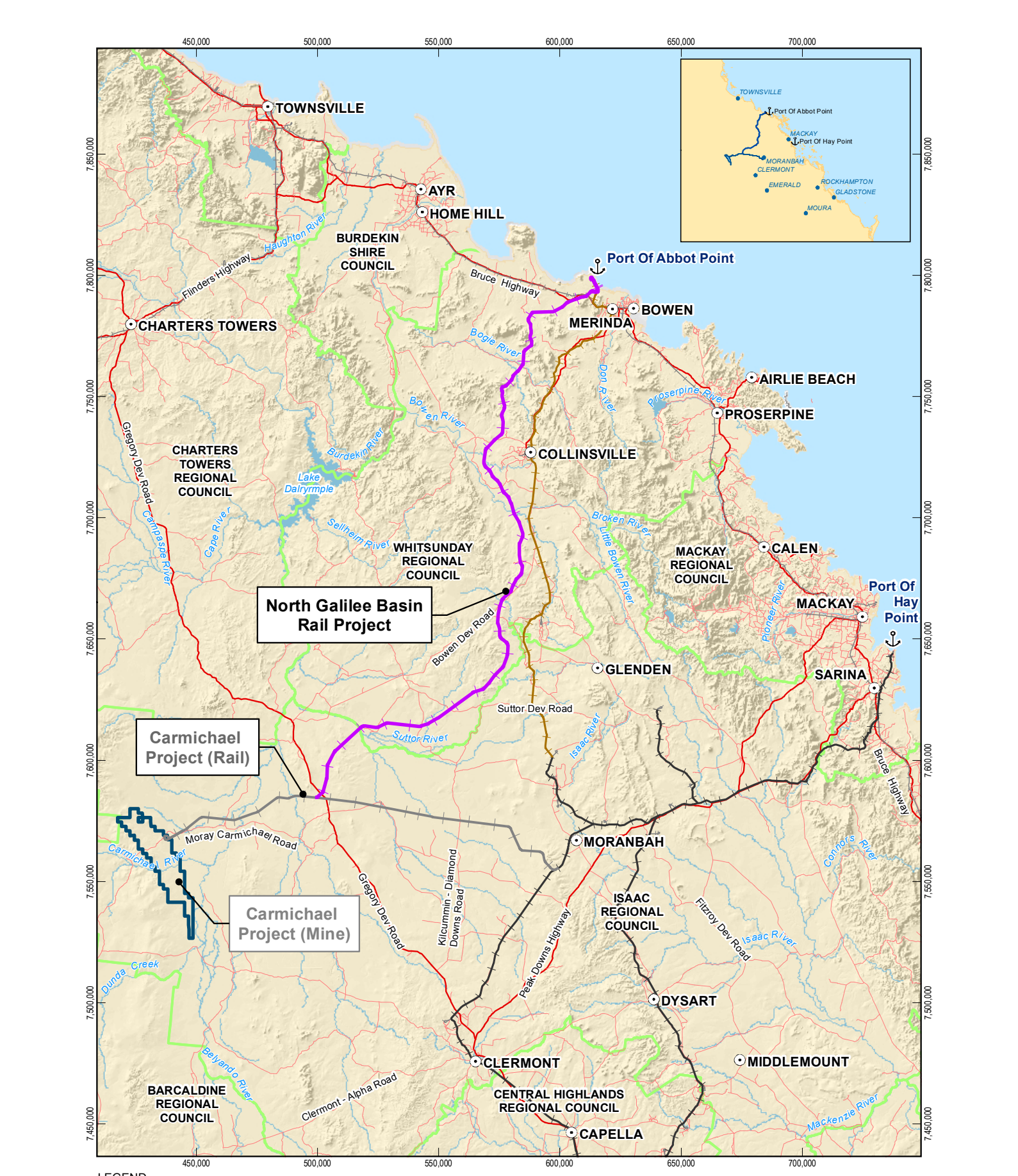
The NGBR Project is a 303.4 km standard gauge rail route connecting the proposed Carmichael Coal Mine and Rail Project (Carmichael Project) rail infrastructure to the Port of Abbot Point (refer Figure 2-1). The NGBR Project will service the Carmichael Project (Mine) and third-party users up to an operational capacity of 100 million tonnes per annum (mtpa).

For the purpose of this EIS, the NGBR Project begins at chainage 3.49 km, in the vicinity of the balloon loop for Adani's proposed Abbot Point Terminal 0 Project at the Port of Abbot Point in the north. The NGBR Project runs south from this point to its connection with the Carmichael Project (Rail) infrastructure at chainage 306.9 km, west of the Gregory Developmental Road towards Mistake Creek.

The NGBR Project provides a more direct route to the Port of Abbot Point in comparison with the existing Goonyella and Newlands rail systems, and meets Adani's objective of providing a long-term rail solution for the Galilee Basin.

The NGBR Project is proposed in accordance with the Galilee Basin Coal Infrastructure Framework (State of Queensland 2013a), being a north-south, multi-user, common access rail corridor from the northern Galilee Basin to the Port of Abbot Point. A north-south corridor promotes the minimisation of impacts to landholders and the broader region.

Throughout this EIS, the NGBR Project is describe in terms of a preliminary investigation corridor, a final rail corridor, and the NGBR Project footprint. The preliminary investigation corridor is nominally 1,000 m wide, whereas the final rail corridor is nominally 100 m wide. The NGBR Project footprint is defined as the final rail corridor and all ancillary activities, which are described in Section 2.3. The corridor selection process is described in Section 2.2.2.



LEGEND

- Town
- Major Port
- Other Rail Network
- Goonyella System
- Newlands System
- Major Road
- Local Road
- Watercourse
- Local Government Area
- Carmichael Project (Rail)
- North Galilee Basin Rail
- Carmichael Project (Mine)

1:2,000,000 (at A4)

0 10 20 30 40 50

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

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North Galilee Basin Rail Project

Project location

Job Number 41-26457
Revision B
Date 28 Aug 2013

Figure 2-1

G:\41\26457\06 GIS\Maps\MXD\0001_Overview\41_26457_0005_rev_b.mxd

Level 9, 145 Ann St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: © Commonwealth of Australia (Geoscience Australia): Town, Railways, Watercourses (2007); DNRM: LGA, (2011), Hillshade (2009); DMR: State Roads (2008); DME: EPC1690 (2010), EPC1080 (2011); Adani: Alignment Opt9 Rev3 (2012), NGBR: Alignment Opt6 Rev 2 (2013).

2.2.1 Relationship to other Adani projects

The NGBR Project will operate in accordance with Adani's Carmichael Project (Mine) and the Terminal 0 Project's balloon loop offloading infrastructure. At full capacity, the Carmichael Project (Mine) will supply up to 60 mtpa of the total 100 mtpa capacity of the NGBR Project. The Carmichael Project (Mine) and Terminal 0 Project at Abbot Point are subject to separate environmental assessment and approval processes.

2.2.2 Corridor selection

The NGBR Project final rail corridor assessed in this EIS is the product of a corridor selection study and multi-criteria analysis (Worley Parsons 2013) in addition to ongoing optimisation and refinement. The corridor selection study considered the following aspects:

- Topography
- Geology
- Hydrology
- Environment
- Railway operation
- Existing infrastructure.

One of the early stages in the corridor selection study was the identification of 'no go' zones, for which maximum avoidance was exercised. These zones included national parks, severe topographical features, major floodplains, social centres and current or proposed mining lease areas.

Three initial corridor options were developed and refined into a further five, based on the above constraints and 'no go' zones. A multi-criteria analysis was lastly applied to rank the alignments and select the most preferred option for further investigation, development and optimisation.

This multi-criteria analysis recommended one option (named Option 4C) as the preferred corridor. This preferred corridor was refined to the preliminary investigation corridor and subsequently to the final rail corridor and adjacent ancillary infrastructure areas through concept level engineering and design work undertaken by Aarvee Associates.

The term 'final rail corridor' is used throughout the NGBR Project Environmental Impact Statement (EIS) to describe this corridor. It is acknowledged that further constraints could be identified through the EIS process that would further refine the final rail corridor.

Investigations for the purposes of the EIS and ongoing engineering design, including field surveys, were generally undertaken over the preliminary investigation corridor (or broader areas, as required by individual studies) to ensure a robust assessment and to allow for potential future design changes to be adequately considered.

Further detail on the corridor selection process is provided in Volume 1 Chapter 1 Introduction.

2.2.3 Key components

For the purposes of the EIS, the NGBR Project has generally been considered to occur in two phases: construction and operation.

The key components of the NGBR Project during the construction phase are provided in

Table 2-1. It is noted that cut and fill quantities include an additional 3.49 km section of the NGBR Project situated within the Terminal 0 Project area. The key components of the operation phase are provided in Table 2-2.

The key features of the Project are shown on Figure 2-2 and each of the key components during construction and operation are described further in Section 2.3.

Table 2-1 Key components (construction phase)

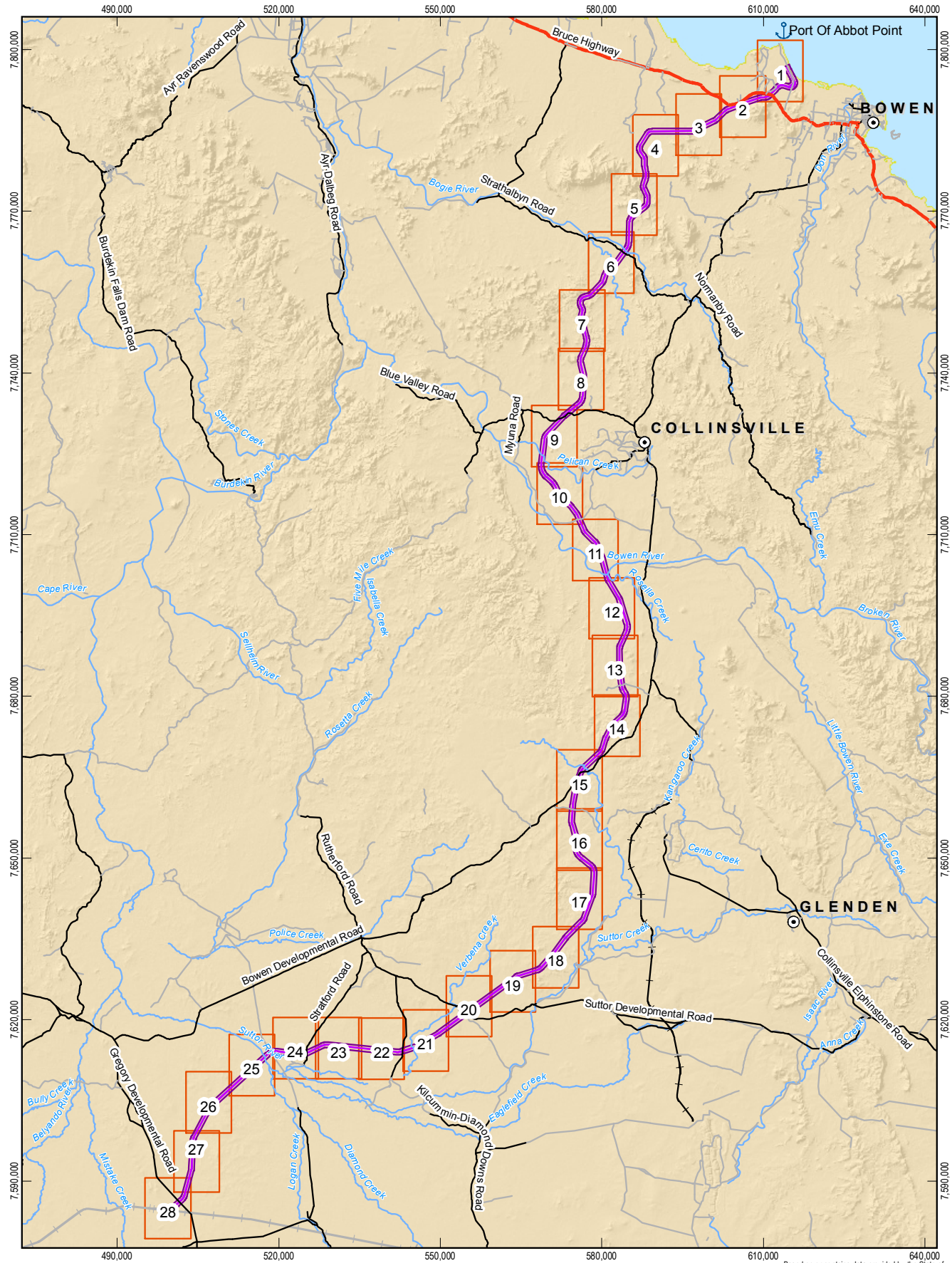
Component	Quantity	Unit
Construction camps	5	no.
Concrete batch plants	5	no.
Bridge laydown area	21	no.
Track laydown area	46	no.
Construction depot	2	no.
Construction yard	1	no.
Turning circle	69	no.
Cut length (total)	103.45	km
Cut volume (total)	15.28 million	m^3
Deep cut length (>15 m depth)	4.5	km
Maximum cut depth	24.2	m
Fill length (total)	213.15	km
Fill volume (total)	15.68	million m^3
Deep fill length (>15 m depth)	3.4	km
Maximum fill depth	24.5	m
Bridge crossings	18	no.
Bridge length (total)[1]	2.57	km

[1] 127 bridge spans at 20.2m length

Table 2-2 Key components (operations phase)

Component	Quantity	Unit
Route length (chainage 3.49 km to 306.9 km)	303.41	km
Passing loops	7	no.
Public road treatments	22	no.
At-grade crossings	13	no.
Grade-separated crossings	4	no.
Possible closures	5	no.
Occupational crossings	137	no.
At-grade crossings	38	no.
Grade-separated crossings	16	no.
Closures	83	no.
At-grade stock route crossings[1]	7	no.
Rolling stock maintenance depot	1	no.

[1] Queensland Stock Route Network (State of Queensland 2013b)



LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Local Road
- Carmichael Project (Rail)
- Railway
- Watercourse (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor
- Map Sheet

1:1,000,000 Paper Size A4

0 7.5 15 30

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Key features of the NGBR Project - Overview

Job Number	41-26457
Revision	C
Date	27 Aug 2013

Figure 2-2

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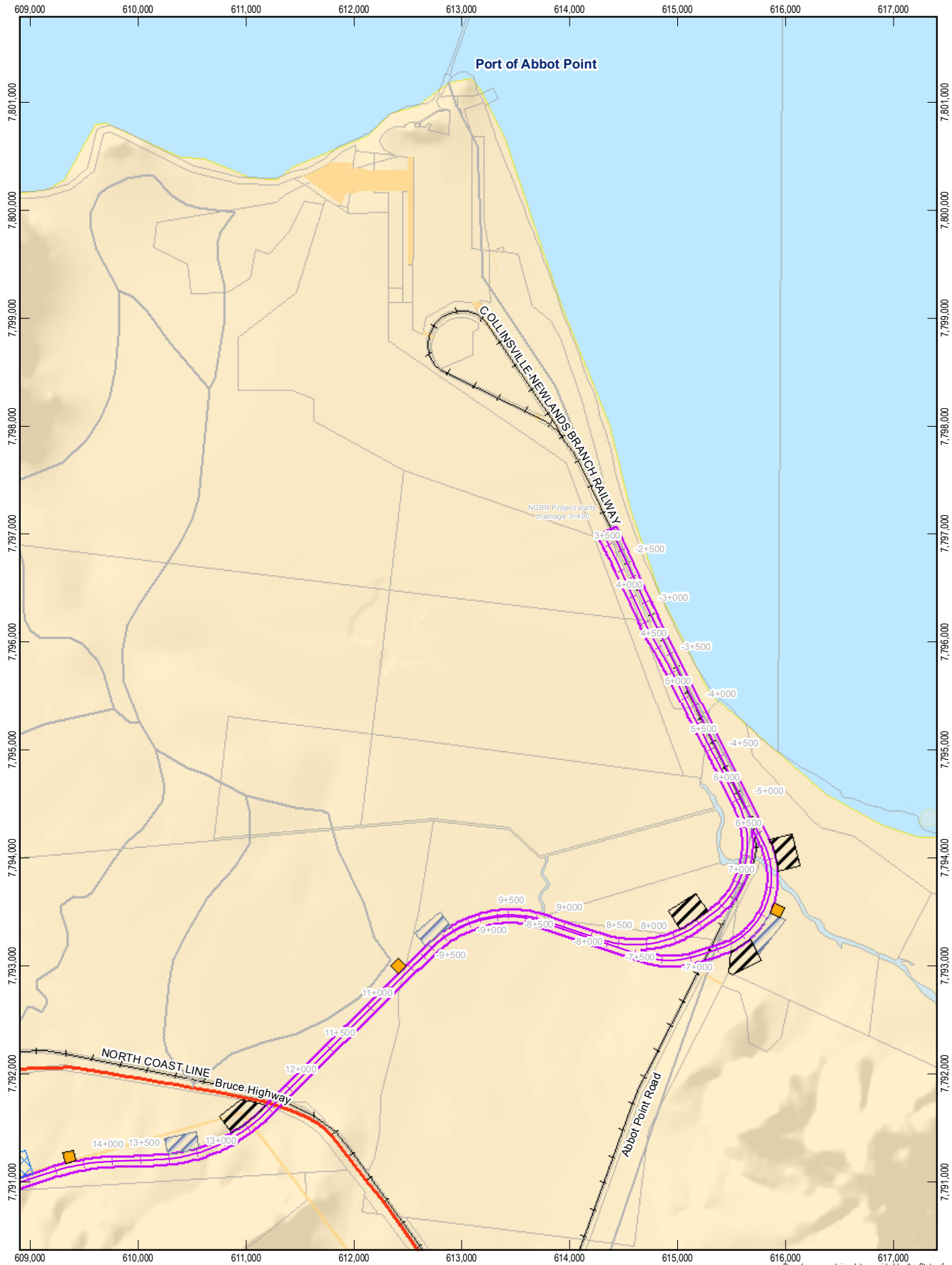
145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013, NGBR Corridor 06/06/2013, Carmichael Project (Rail) 18/06/2013, Quarry Locations /2013 DNRM: Roads/2010. Created by:MS



LEGEND

- Major waterway crossing structures
- Highway
- Main Road
- Local Road
- Carmichael Project (Rail)
- Railway
- Watercourse (Major)
- Watercourse (Minor)
- Easement
- Lot
- Water
- North Galilee Basin Rail Alignment
- North Galilee Basin Rail 100m Corridor
- Alignment Functional Areas
- Bridge Laydown Area
- Concrete Batch Plant
- Construction Camp
- Construction Yard
- Construction Depot Area
- Rail Precinct Area
- Rolling Stock Maintenance Depot
- Track Laydown Area
- Turning Circle

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 1 of 28

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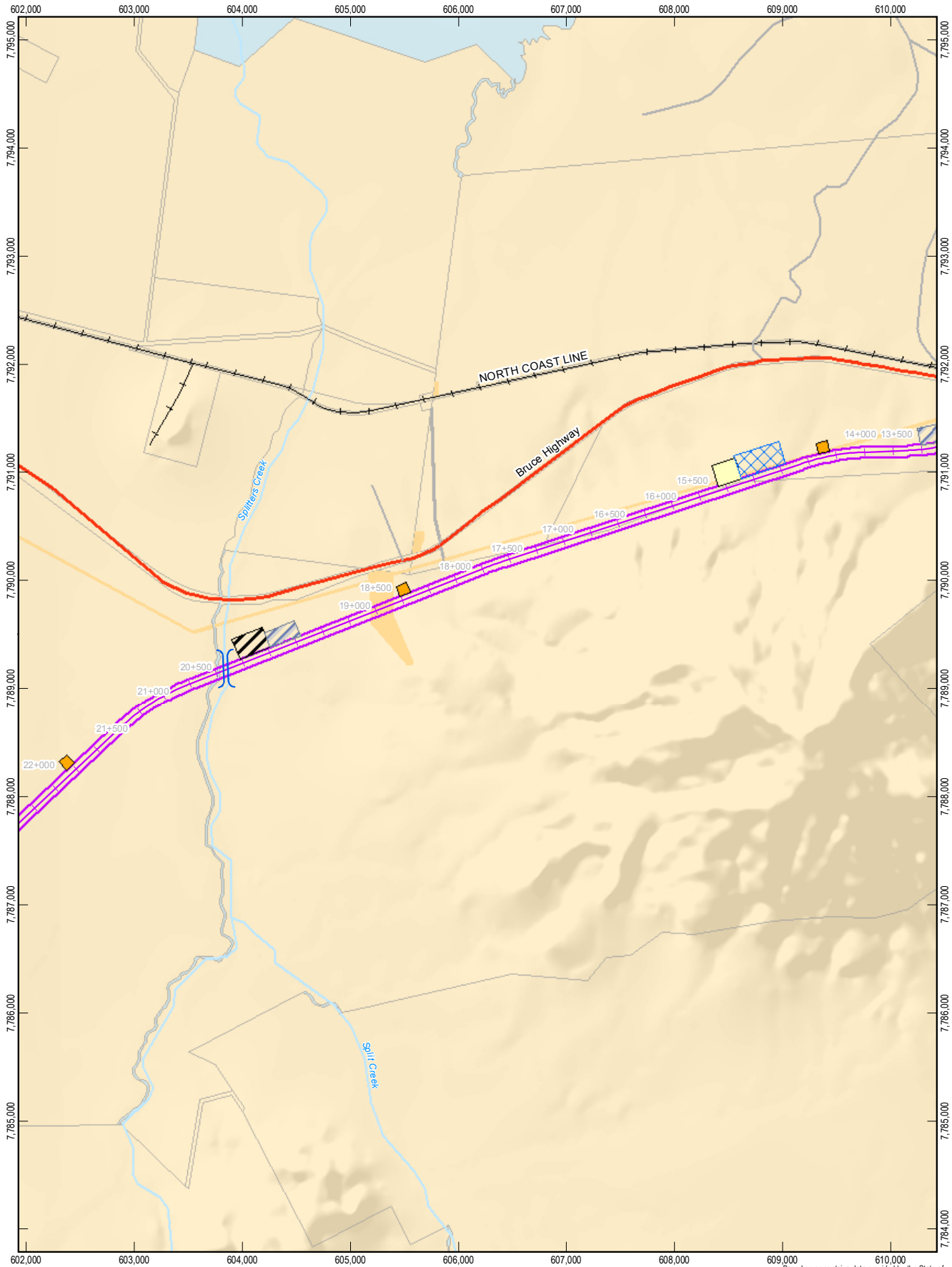
145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM: DEM (2008), Cadastre (2013), Roads (2010), © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Watercourse (2007); Adani: Project Rail Alignment, Camp Sites, Alignment Functional Areas (2013); GHD: Major waterway crossing structures (2013). Created by: MS



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North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 2 of 28

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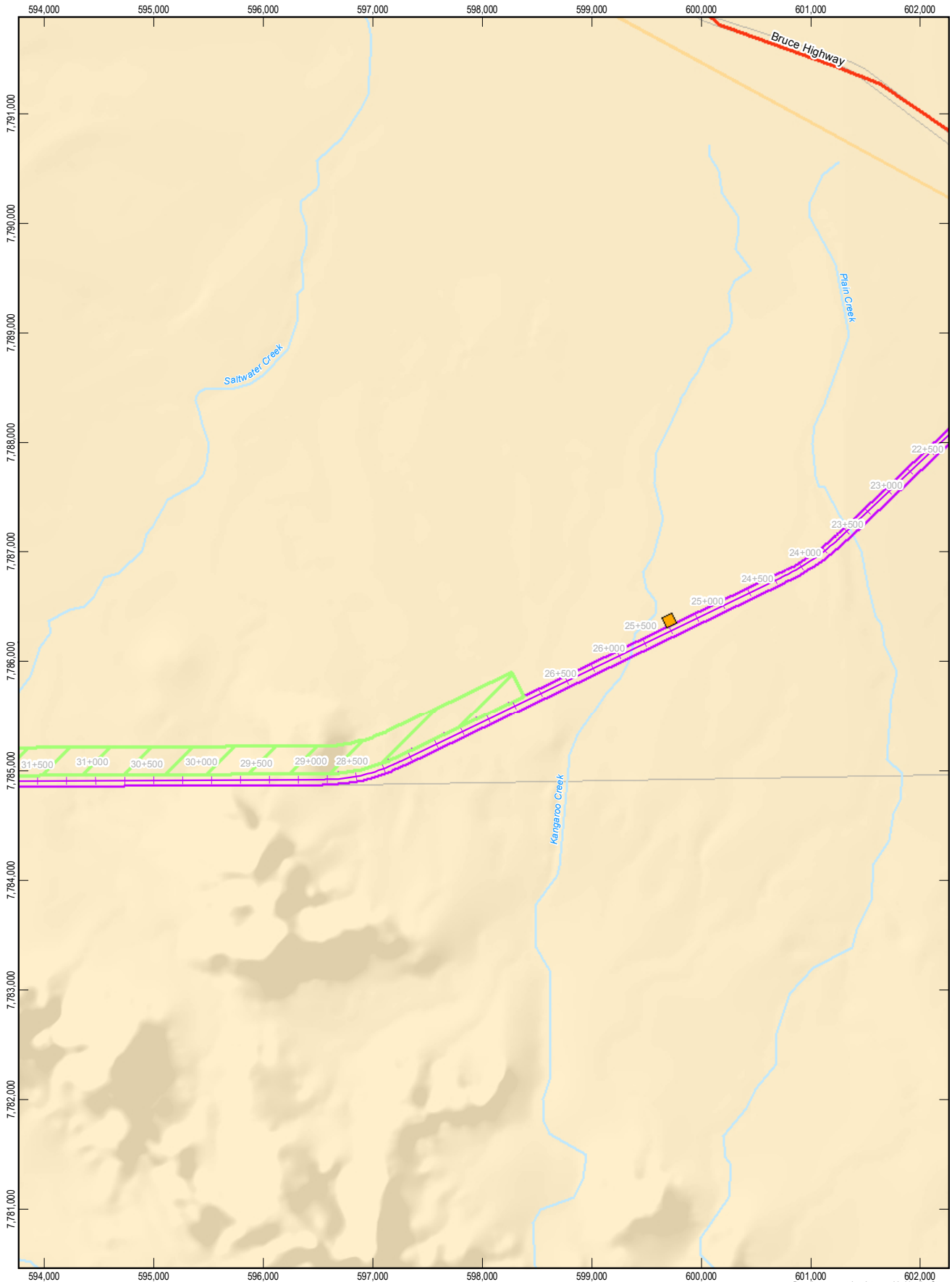

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Kilometres

Map Projection: Transverse Mercator
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North Galilee Basin Rail Project

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Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 3 of 28

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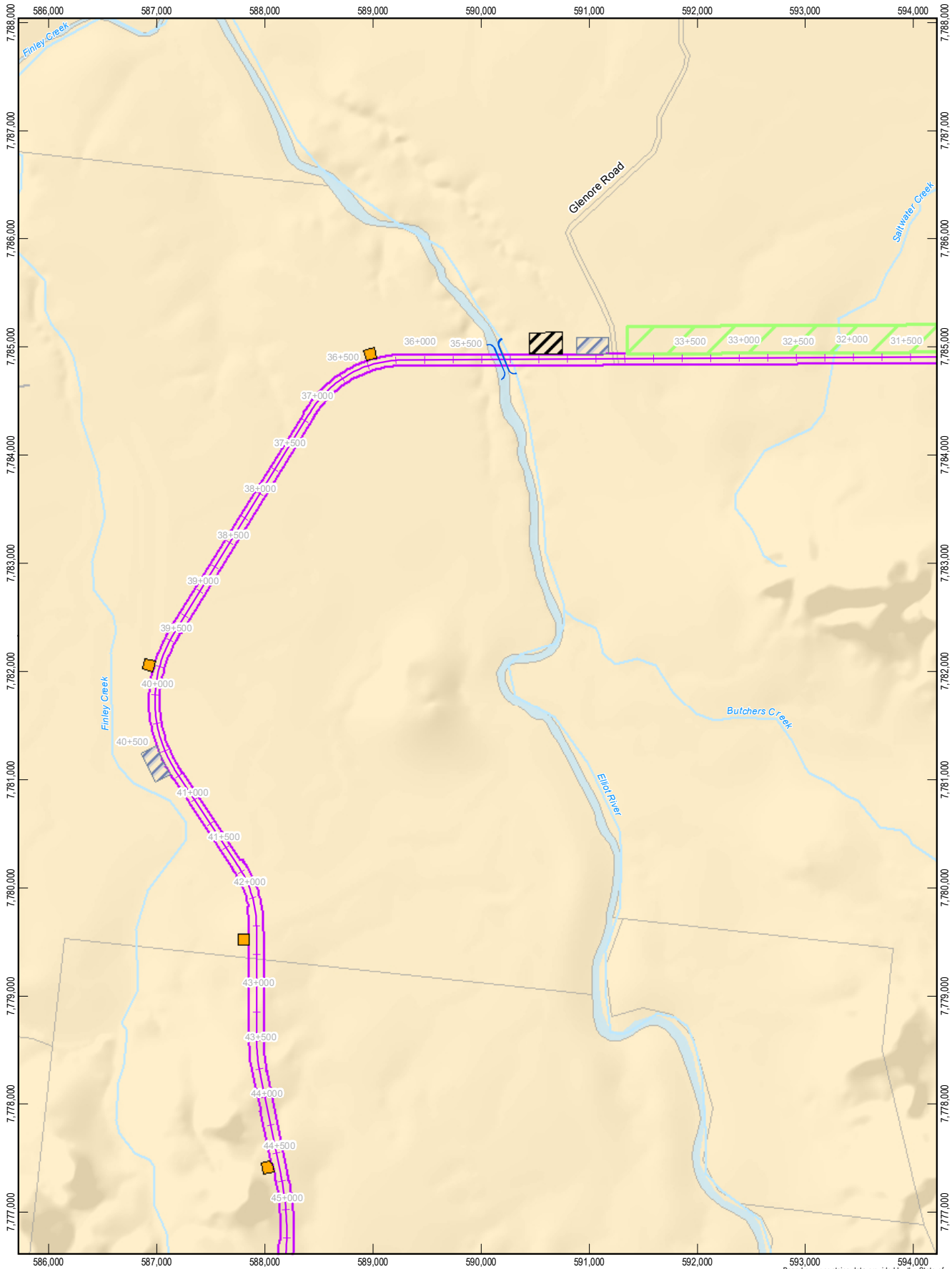

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Grid: GDA 1994 MGA Zone 55

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Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 4 of 28

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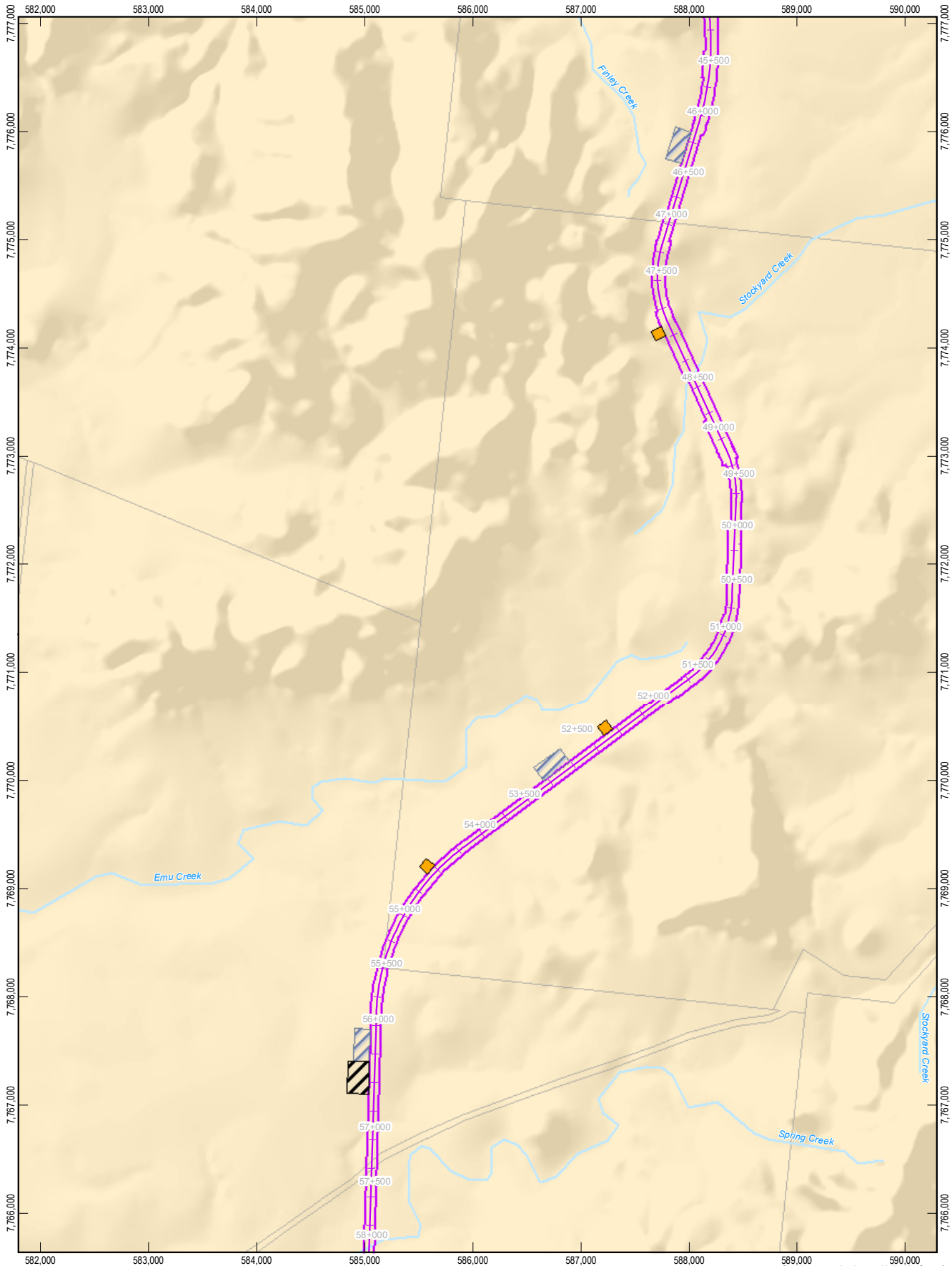

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North Galilee Basin Rail Project

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Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 5 of 28

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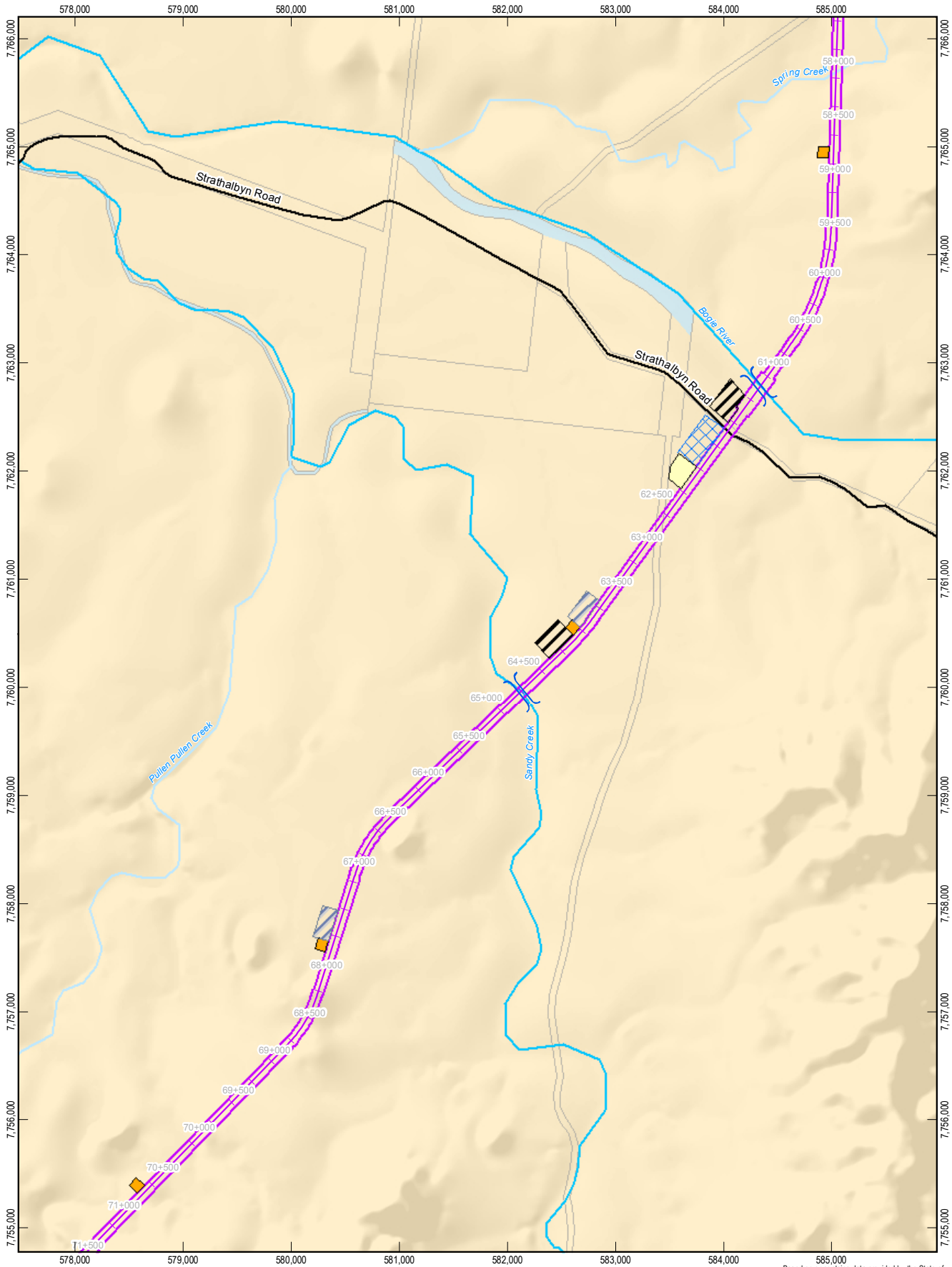

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North Galilee Basin Rail Project

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Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 6 of 28

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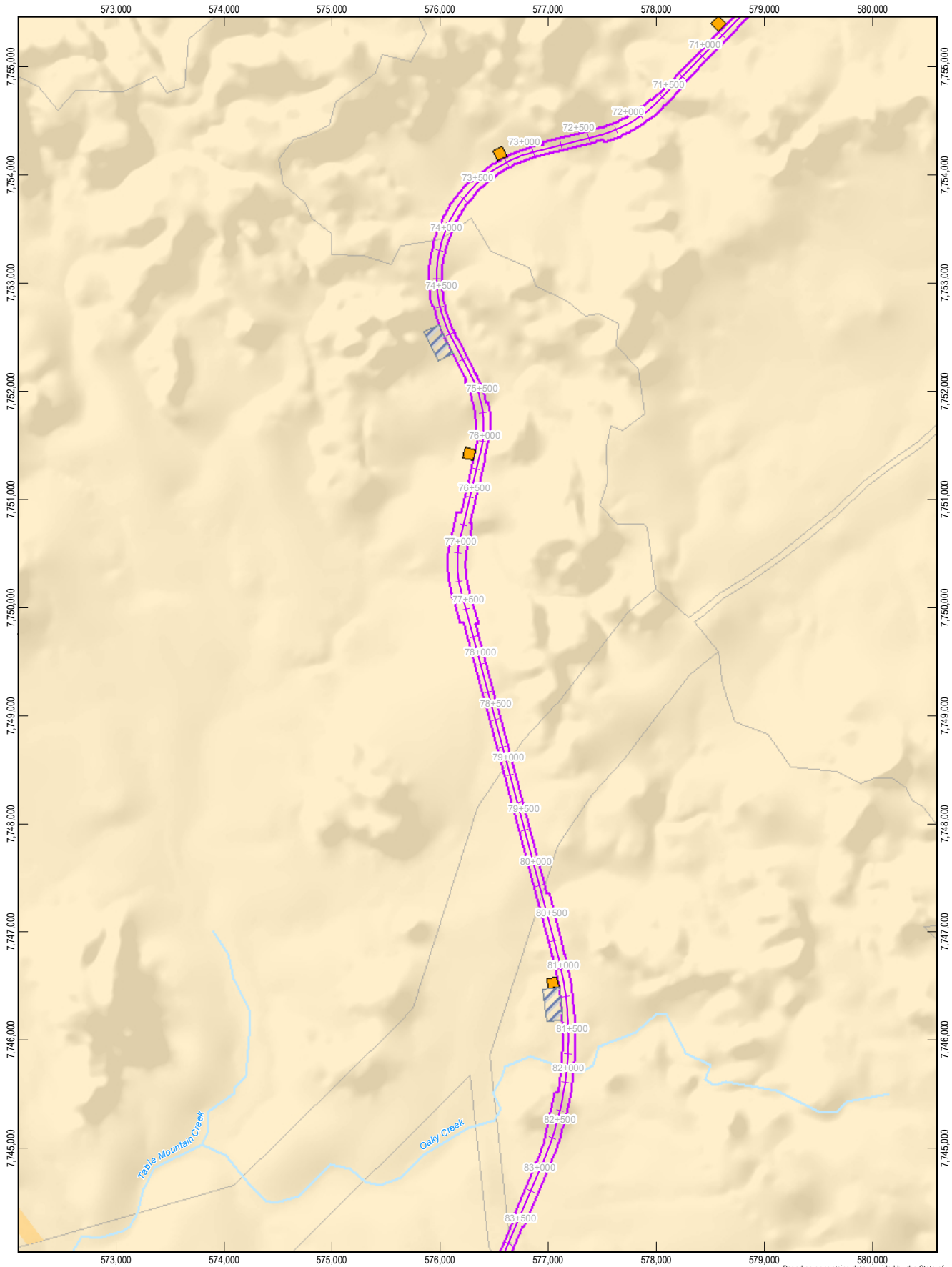

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North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 7 of 28

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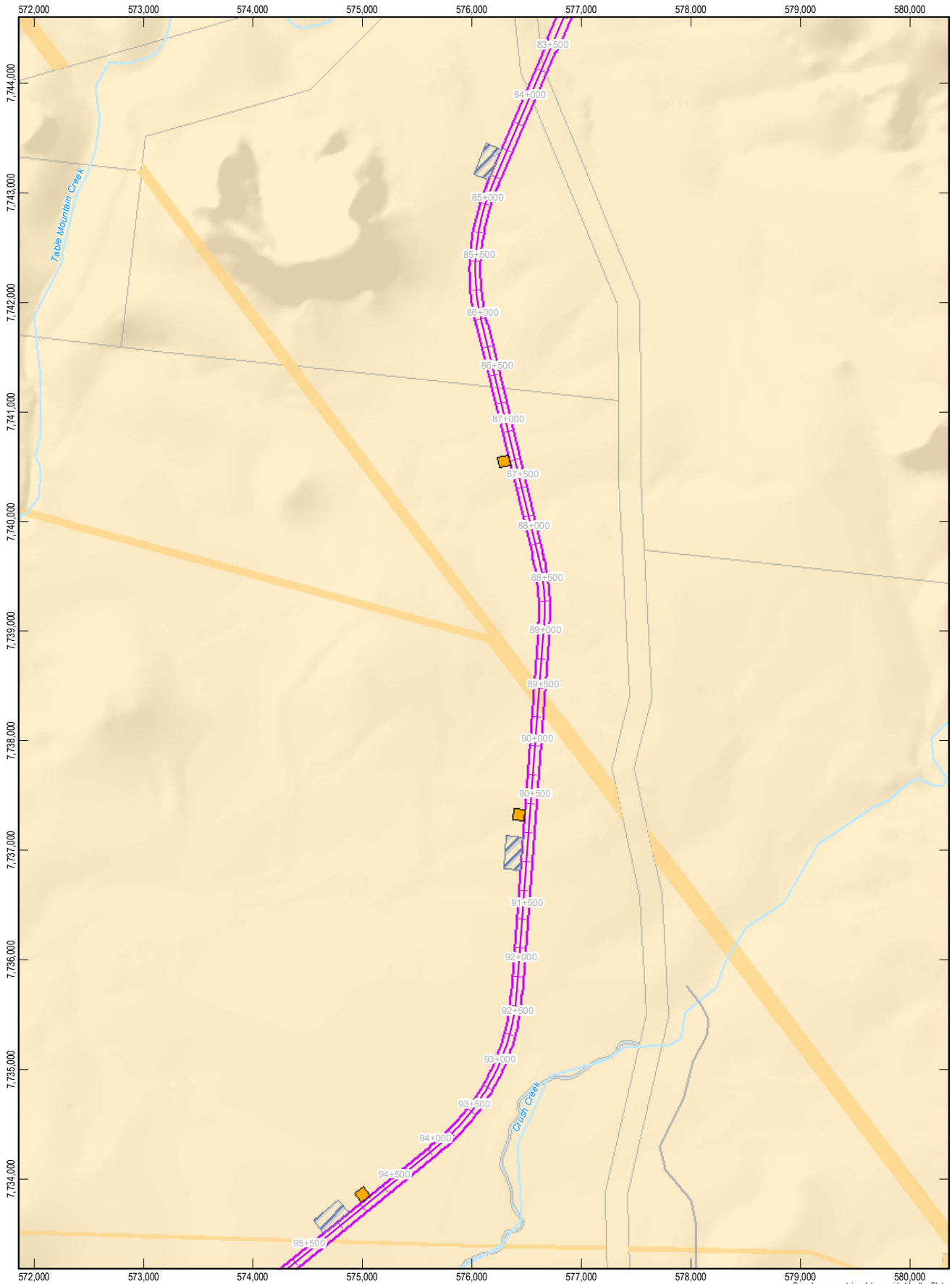

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North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 8 of 28

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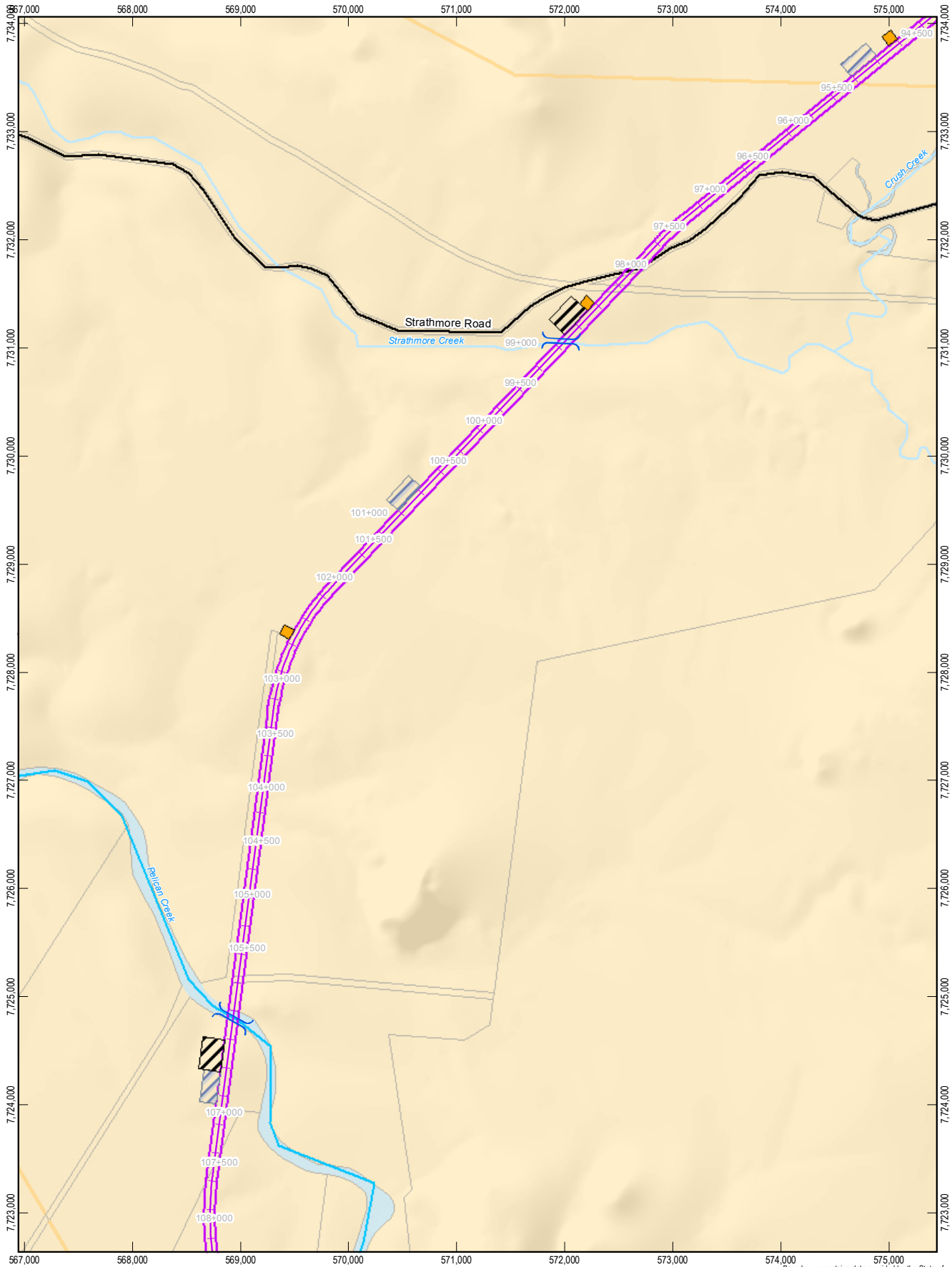

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Adani Mining Pty Ltd

North Galilee Basin Rail Project

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Figure 2-2
Sheet 9 of 28

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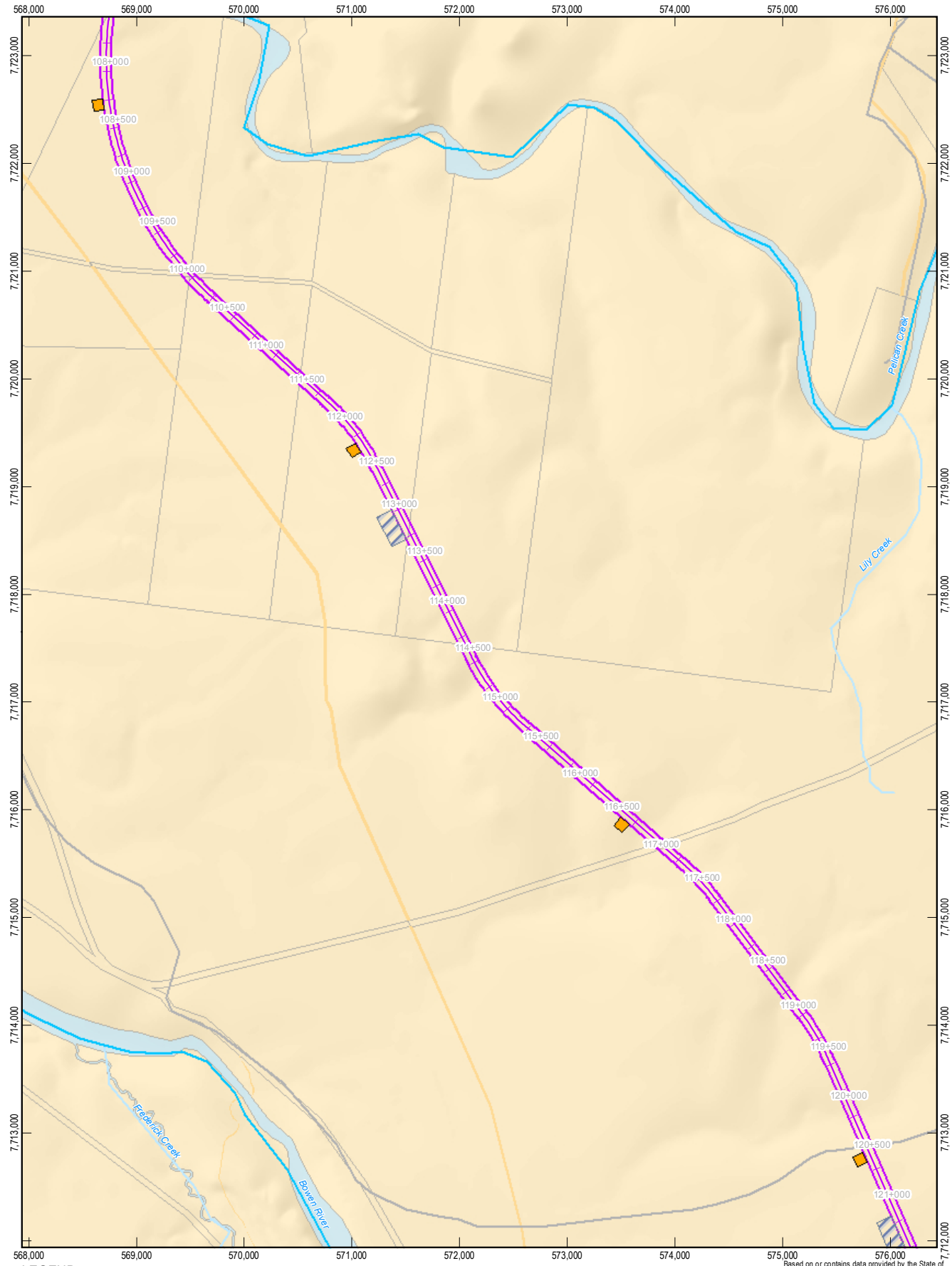

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Sheet 10 of 28

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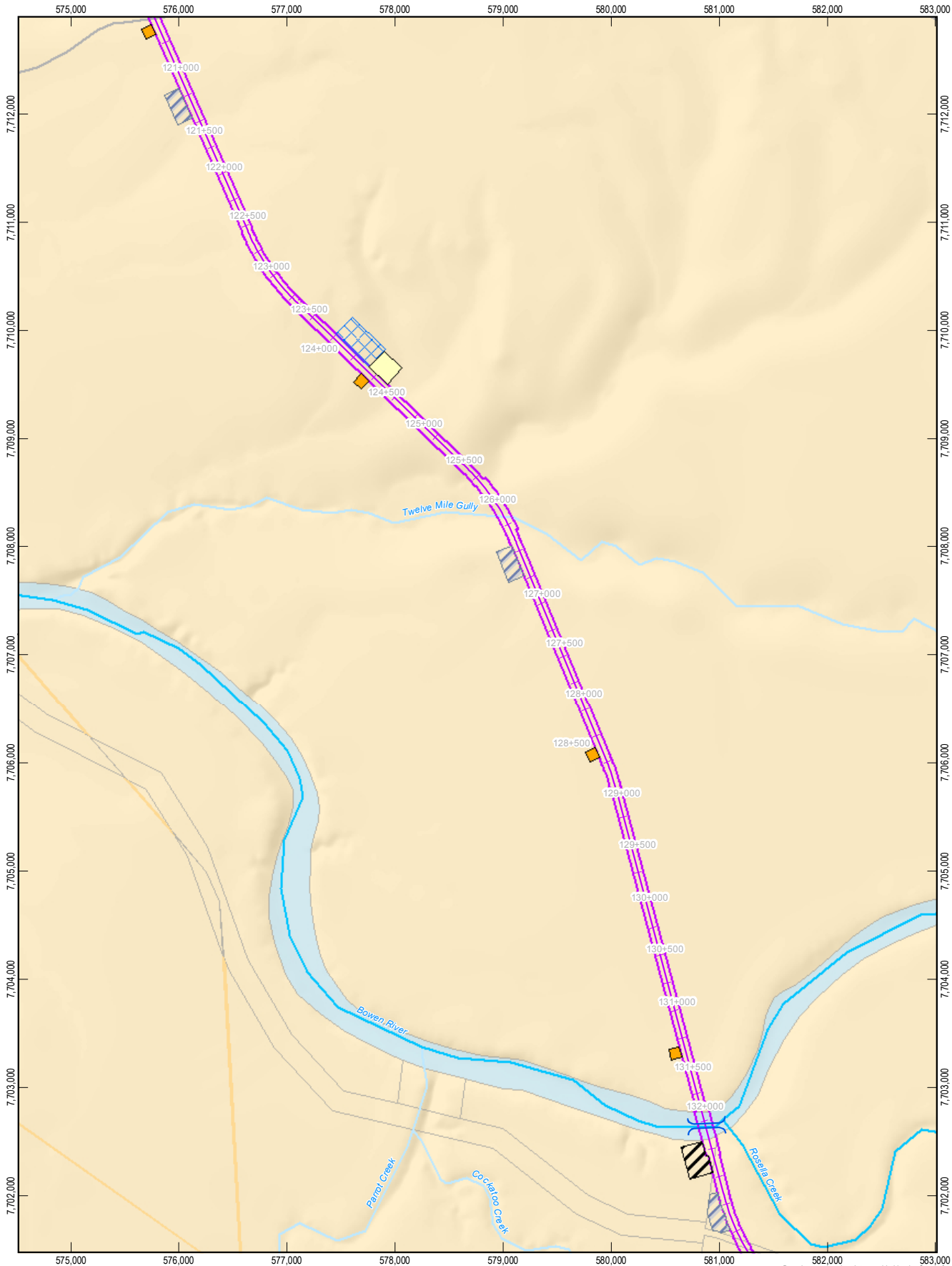

LEGEND

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- Highway
- Main Road
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- Turning Circle

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number 41-26457
Revision D
Date 26 Nov 2013

Figure 2-2
Sheet 11 of 28

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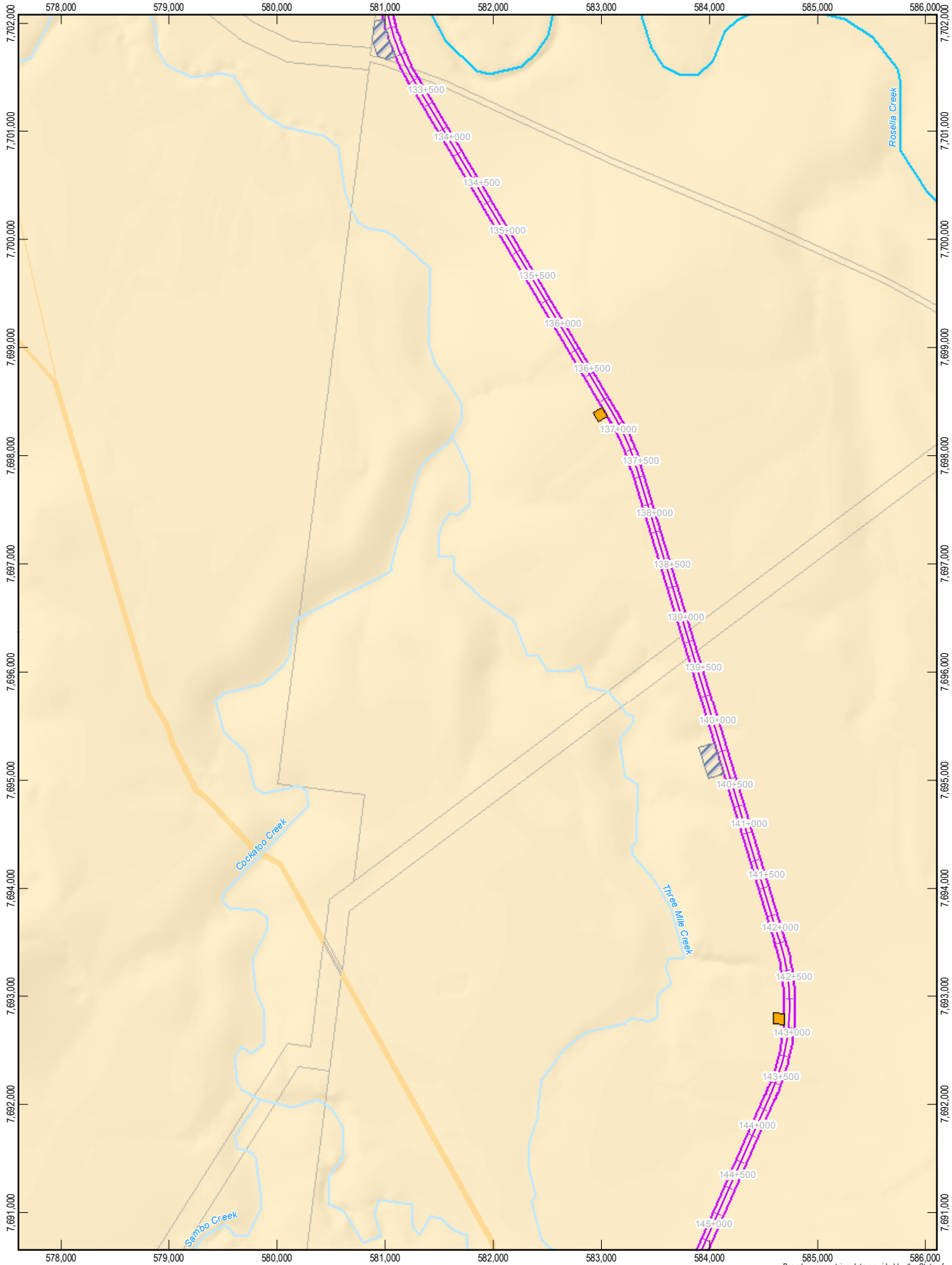

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Kilometres

Map Projection: Transverse Mercator
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Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd

North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 12 of 28

G:\41\26457\06 GIS\Maps\MXD\0001_Overview\41_26457_0006_rev_d.mxd

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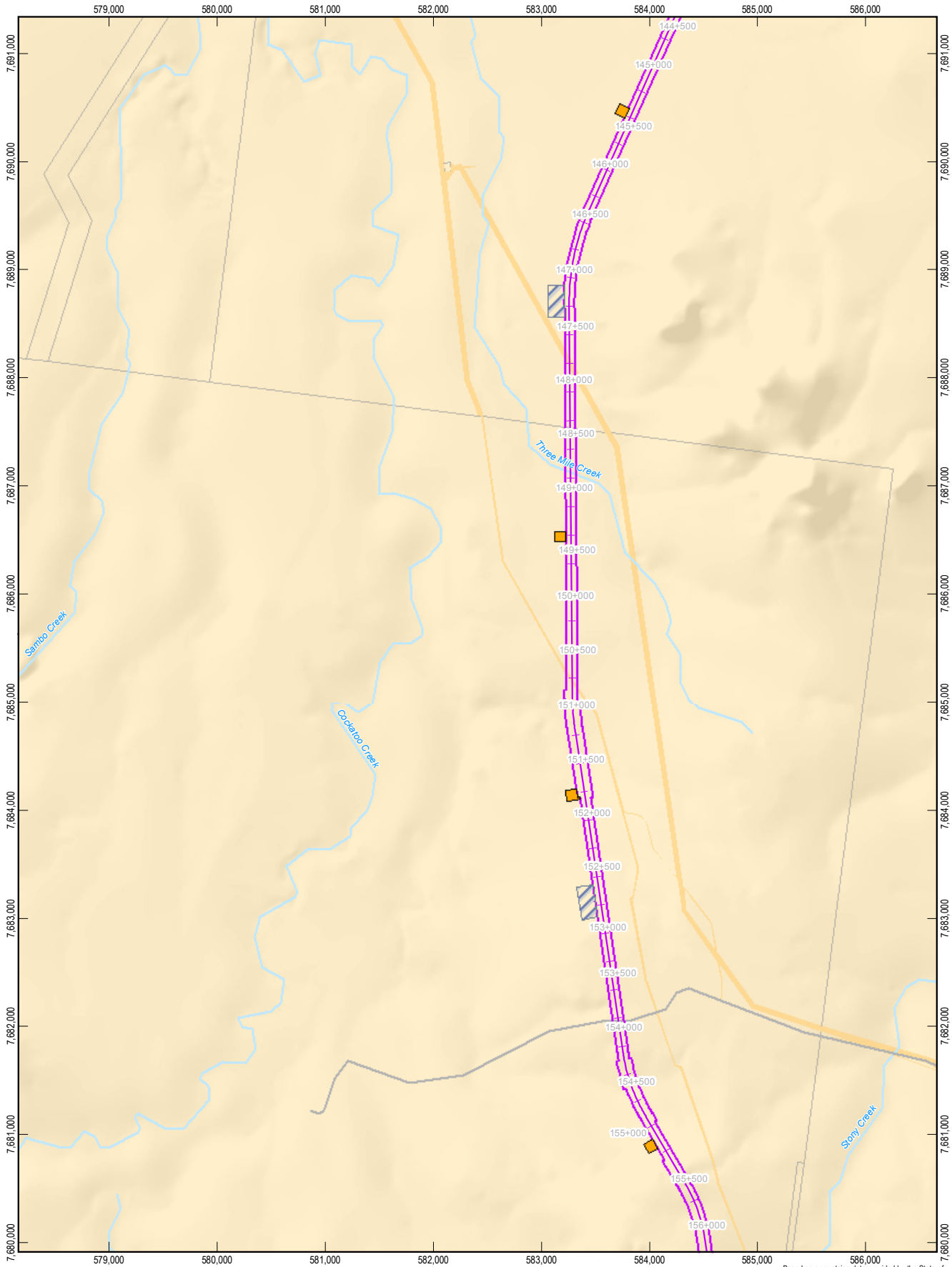

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Adani Mining Pty Ltd

North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 13 of 28

G:\41\26457\06 GIS\Maps\MXD\0001_Overview\41_26457_0006_rev_d.mxd

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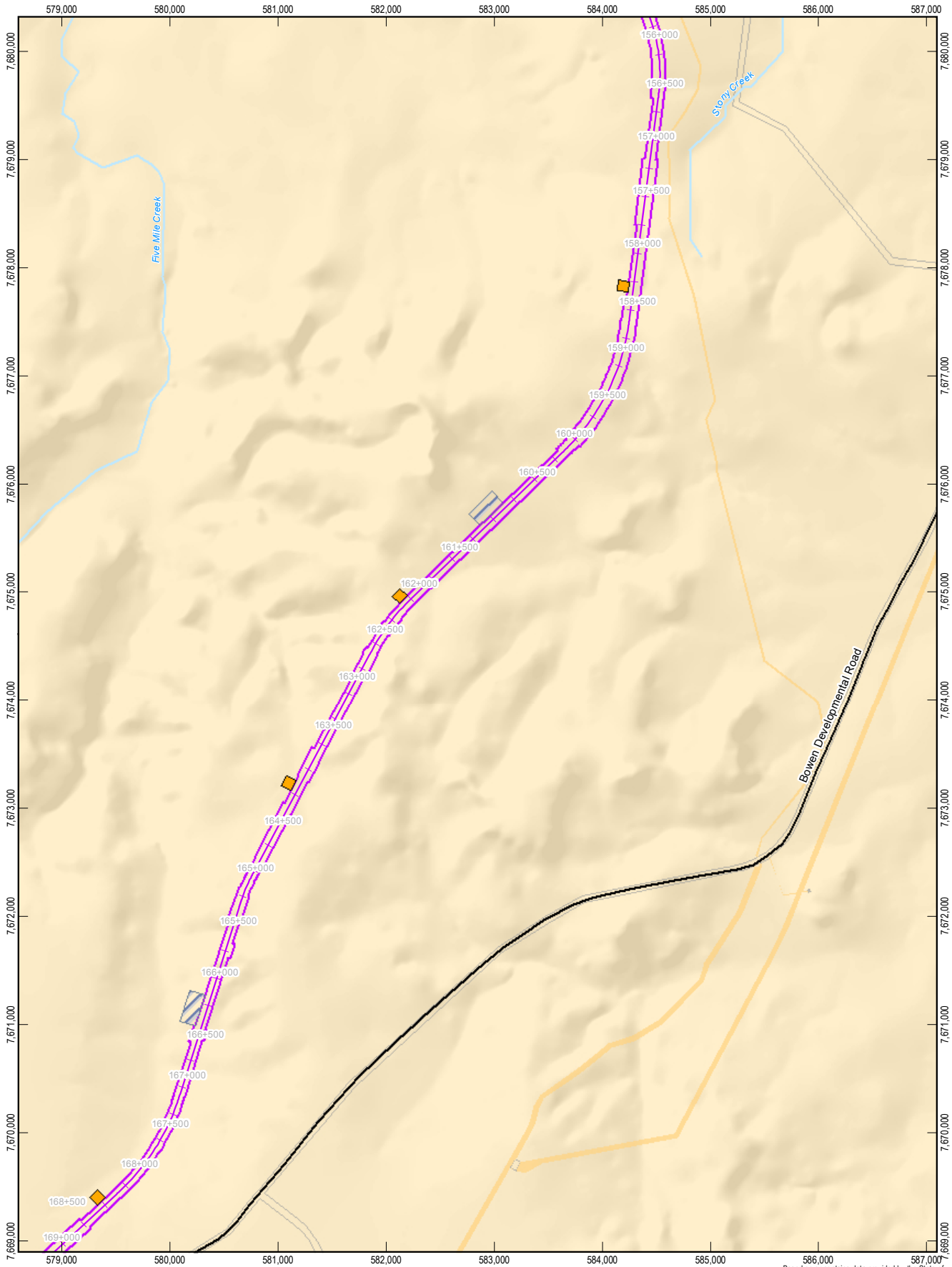

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 14 of 28

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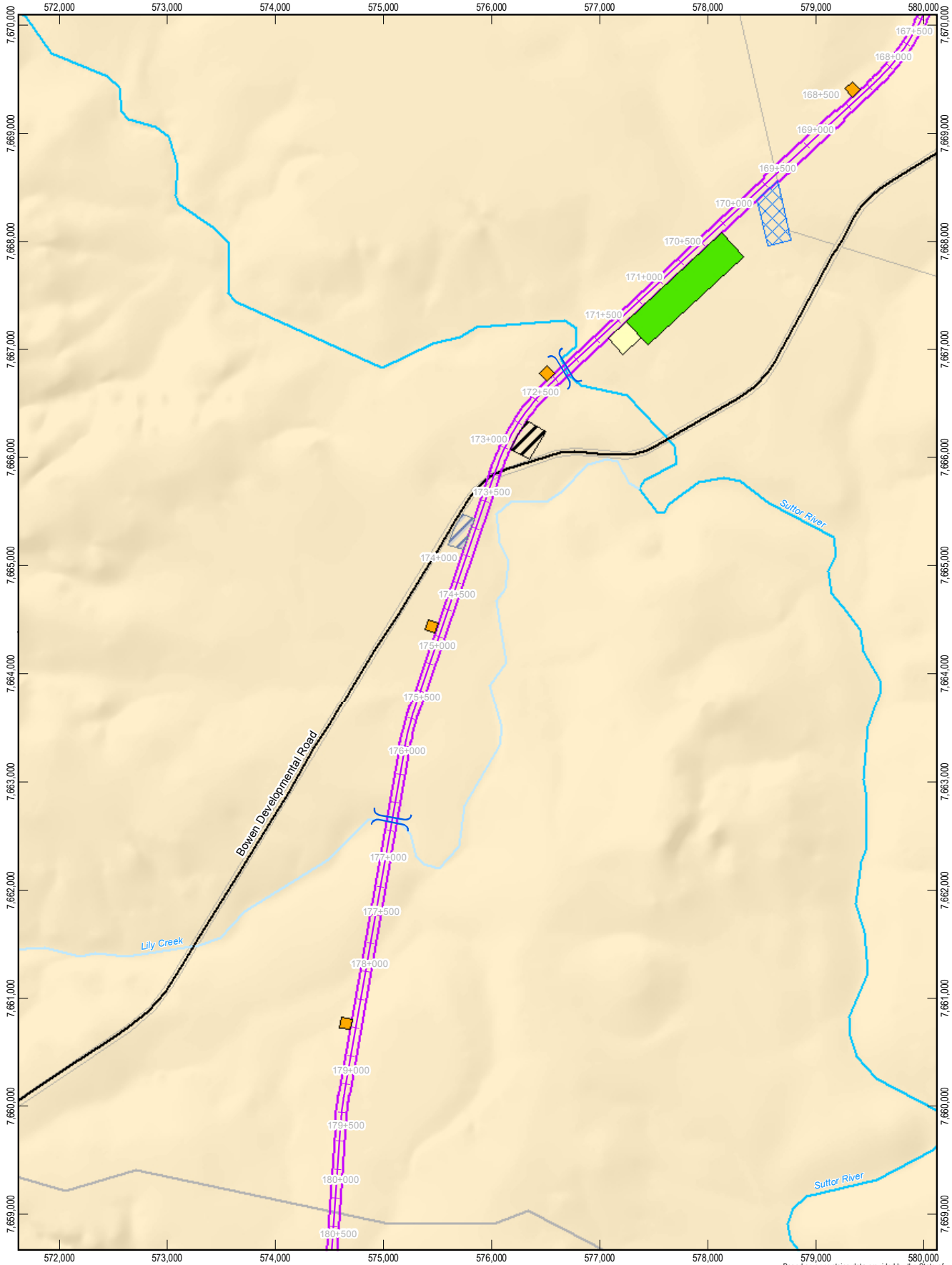

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Kilometres

Map Projection: Transverse Mercator
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Adani Mining Pty Ltd

North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 15 of 28

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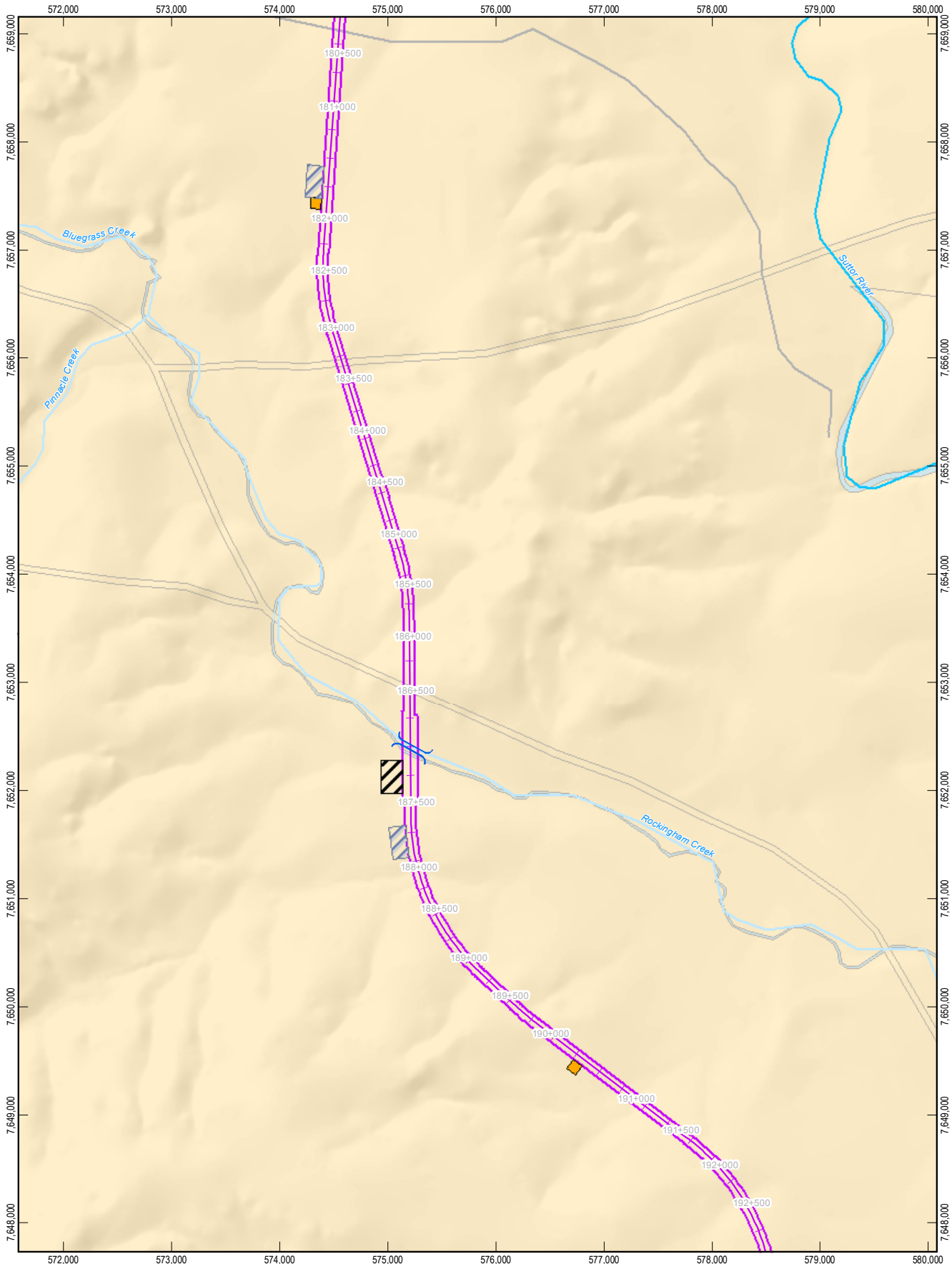

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North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 16 of 28

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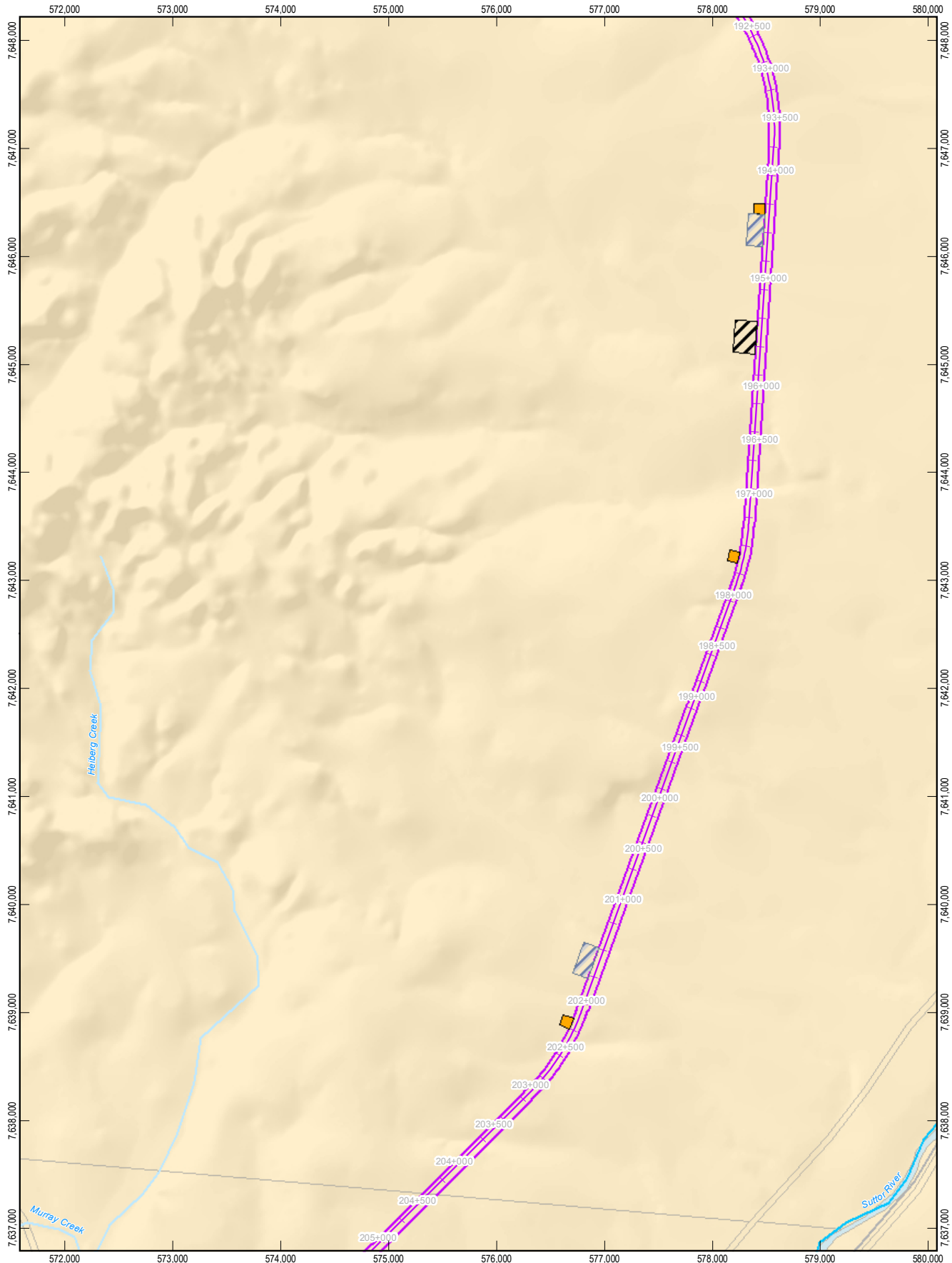

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North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 17 of 28

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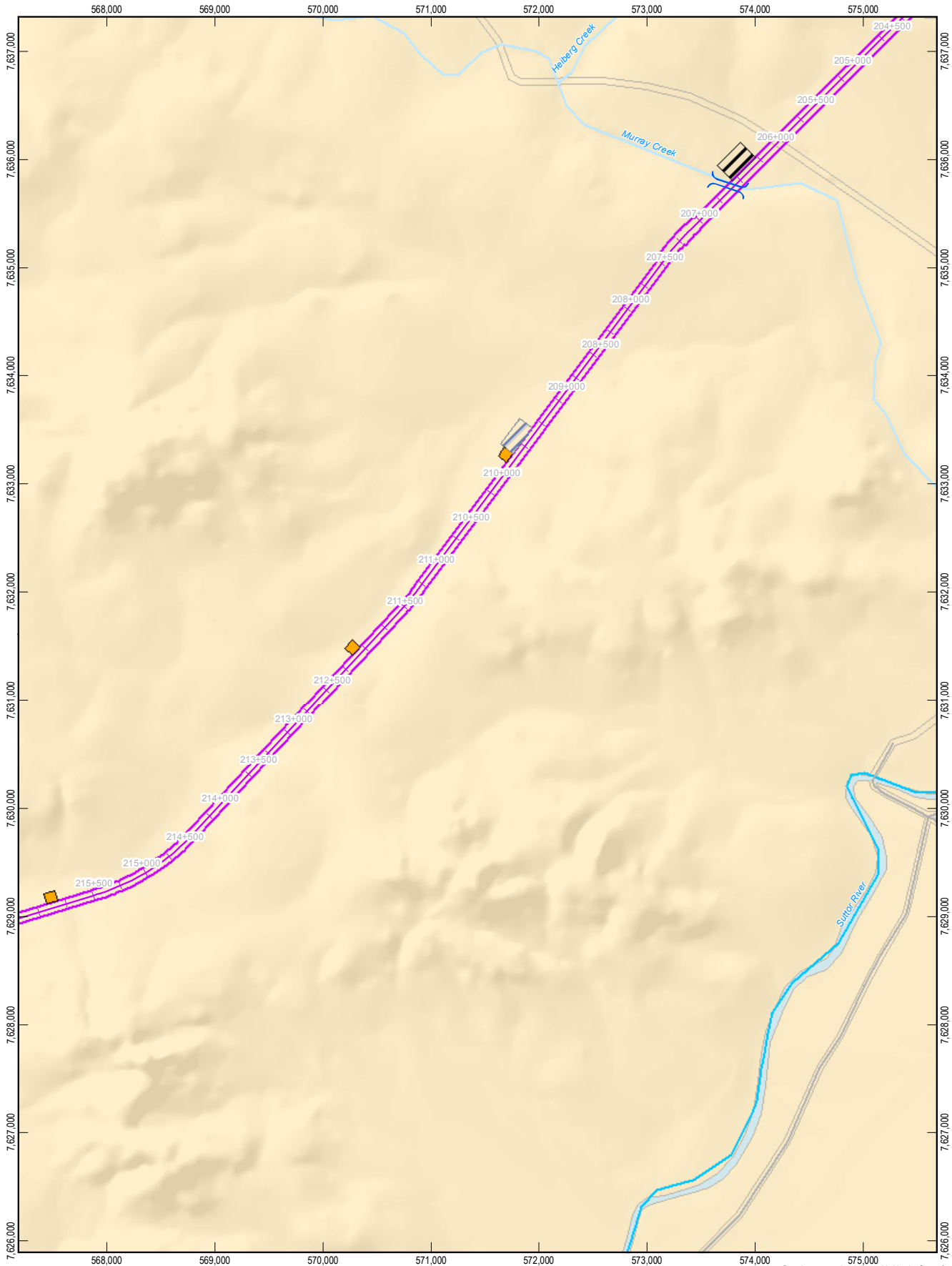

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North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 18 of 28

G:\41\26457\06 GIS\Maps\MXD\0001_Overview\41_26457_0006_rev_d.mxd

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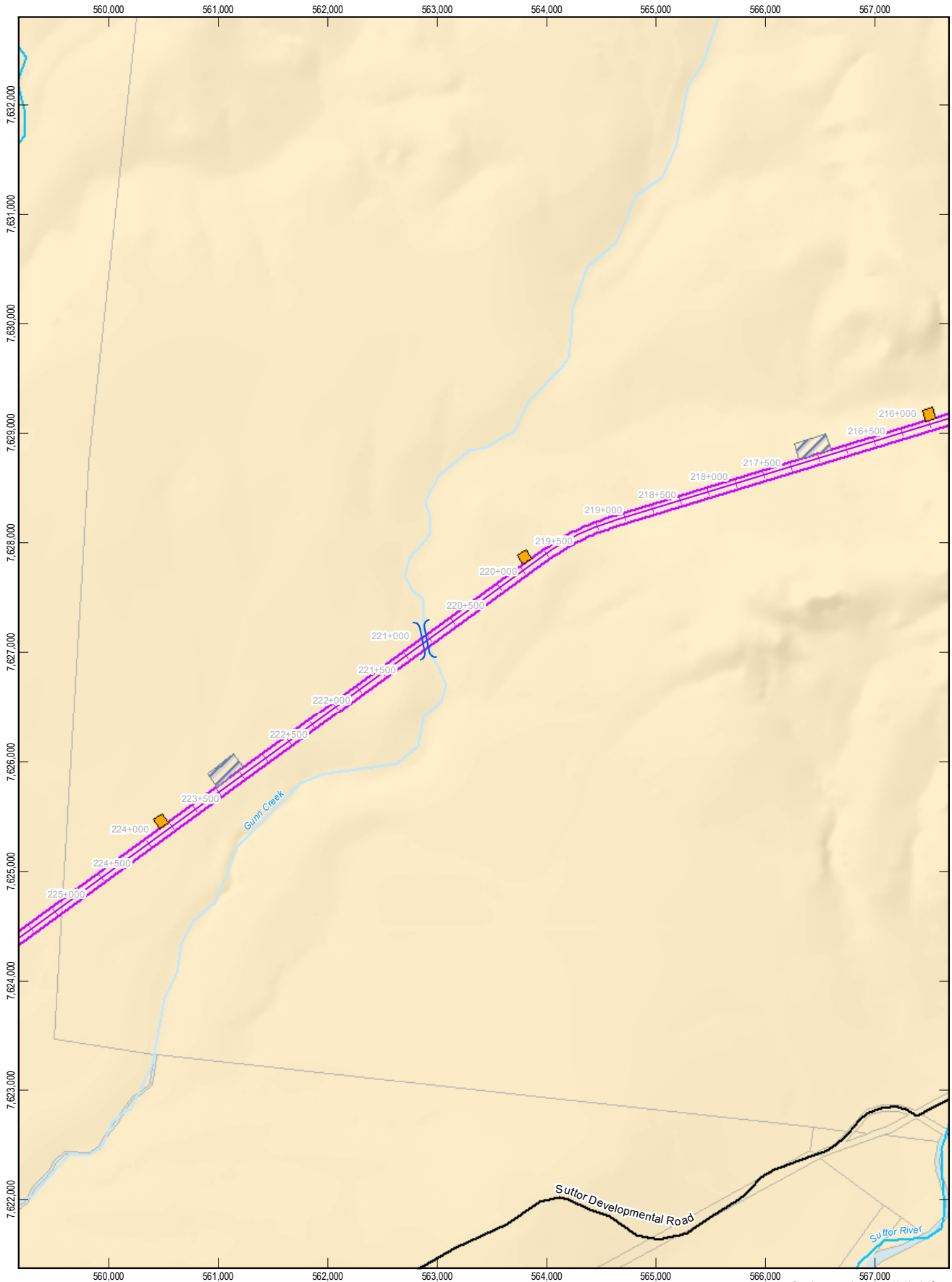

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
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North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 19 of 28

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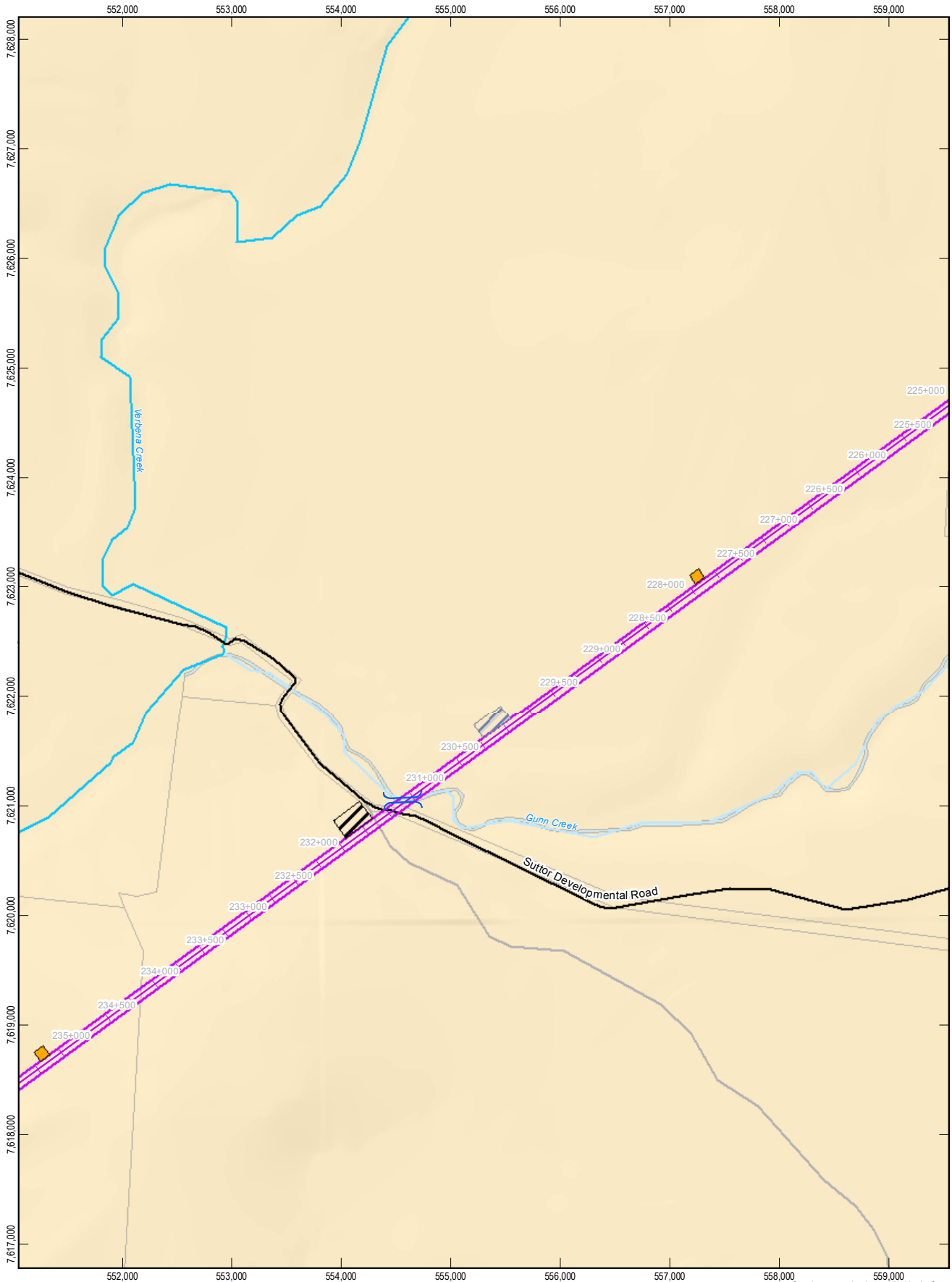

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Adani Mining Pty Ltd
North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 20 of 28

G:\41\26457\06 GIS\Maps\MXD\0001_Overview\41_26457_0006_rev_d.mxd

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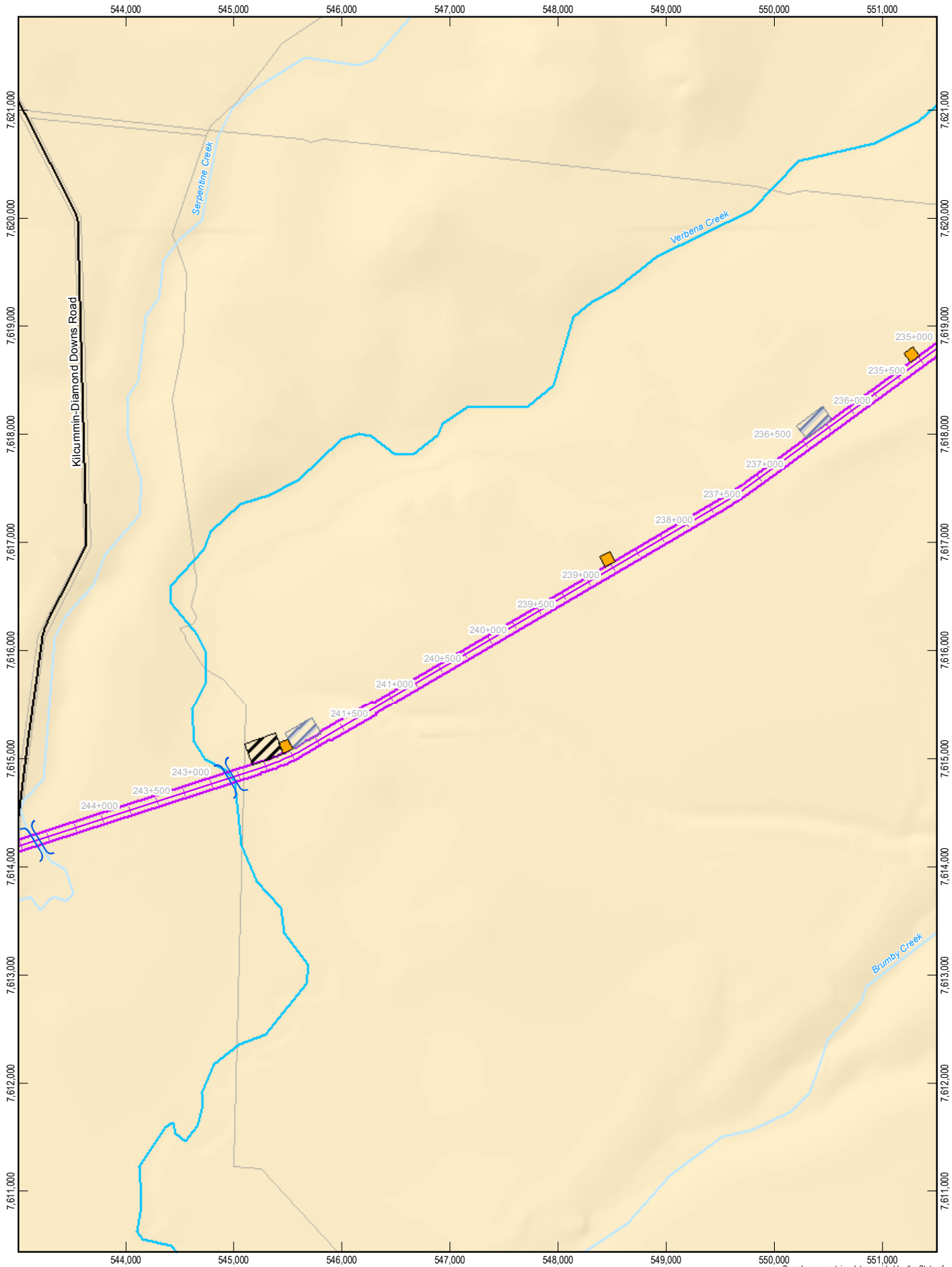

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Map Projection: Transverse Mercator
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Adani Mining Pty Ltd

North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 21 of 28

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Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd
North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 22 of 28

G:\41\26457\06 GIS\Maps\MXD\0001_Overview\41_26457_0006_rev_d.mxd

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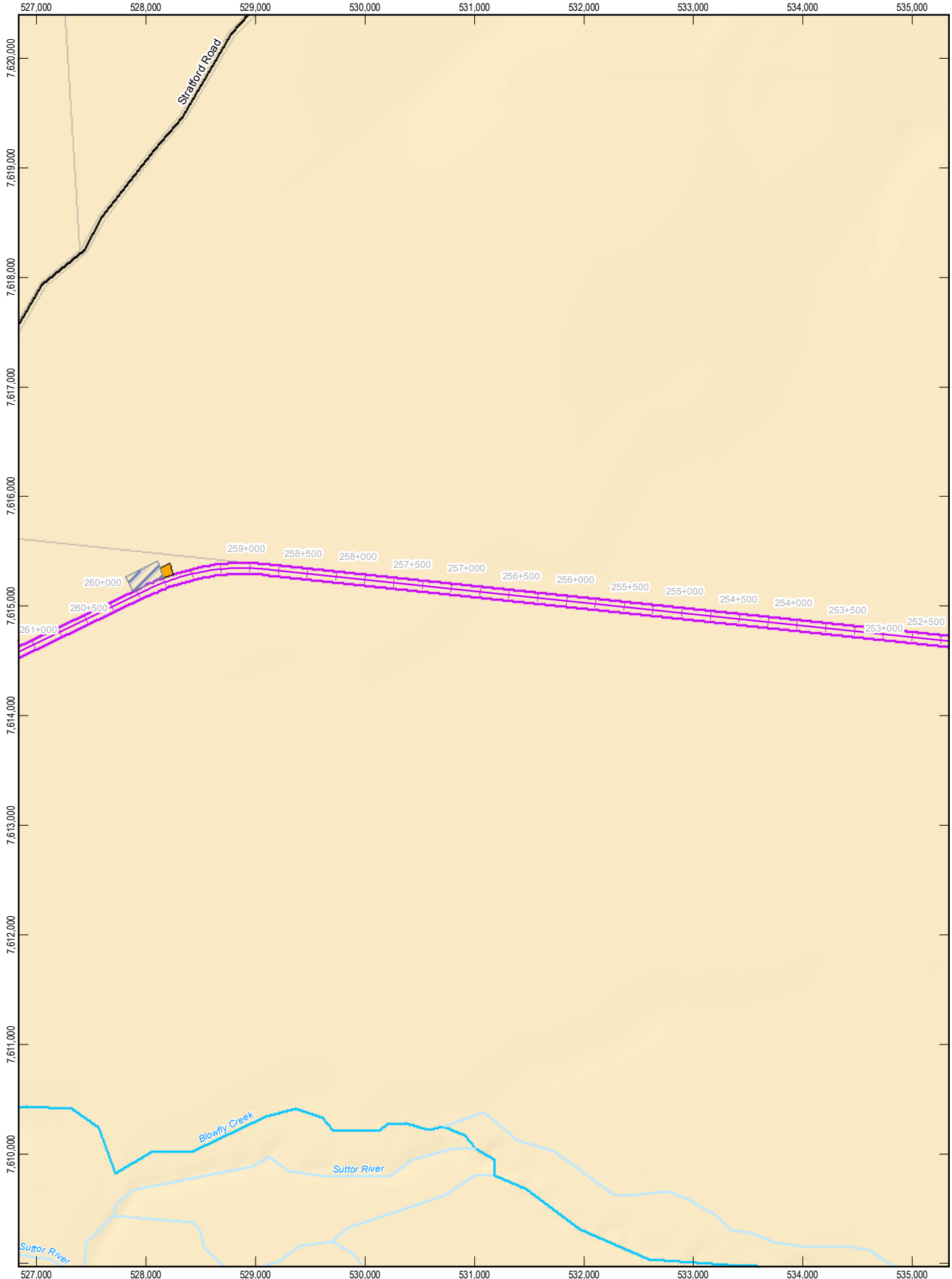

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Adani Mining Pty Ltd

North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 23 of 28

G:\41\26457\06 GIS\Maps\MXD\0001_Overview\41_26457_0006_rev_d.mxd

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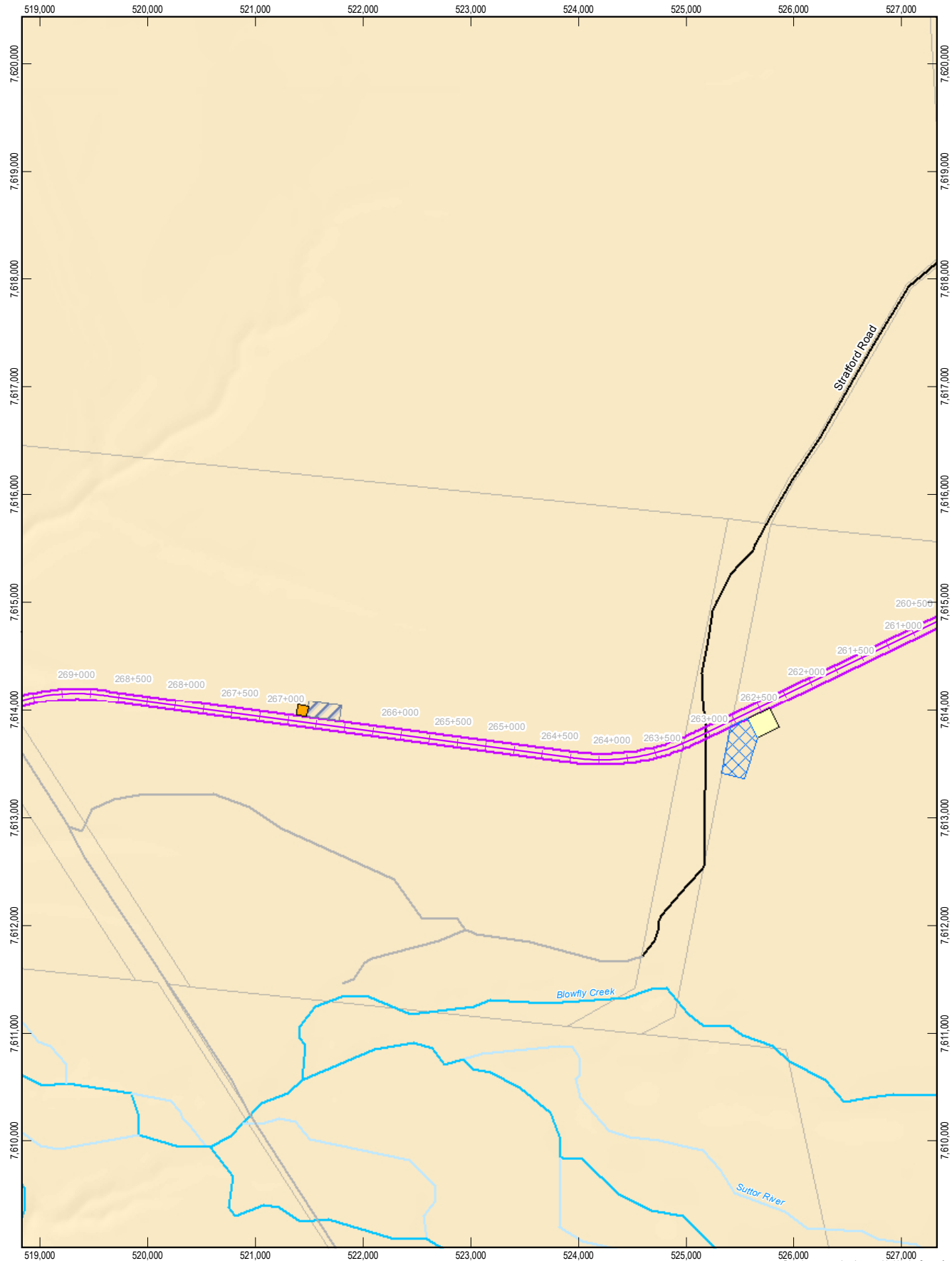

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Adani Mining Pty Ltd
North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 24 of 28

G:\41\26457\06 GIS\Maps\MXD\0001_Overview\41_26457_0006_rev_d.mxd

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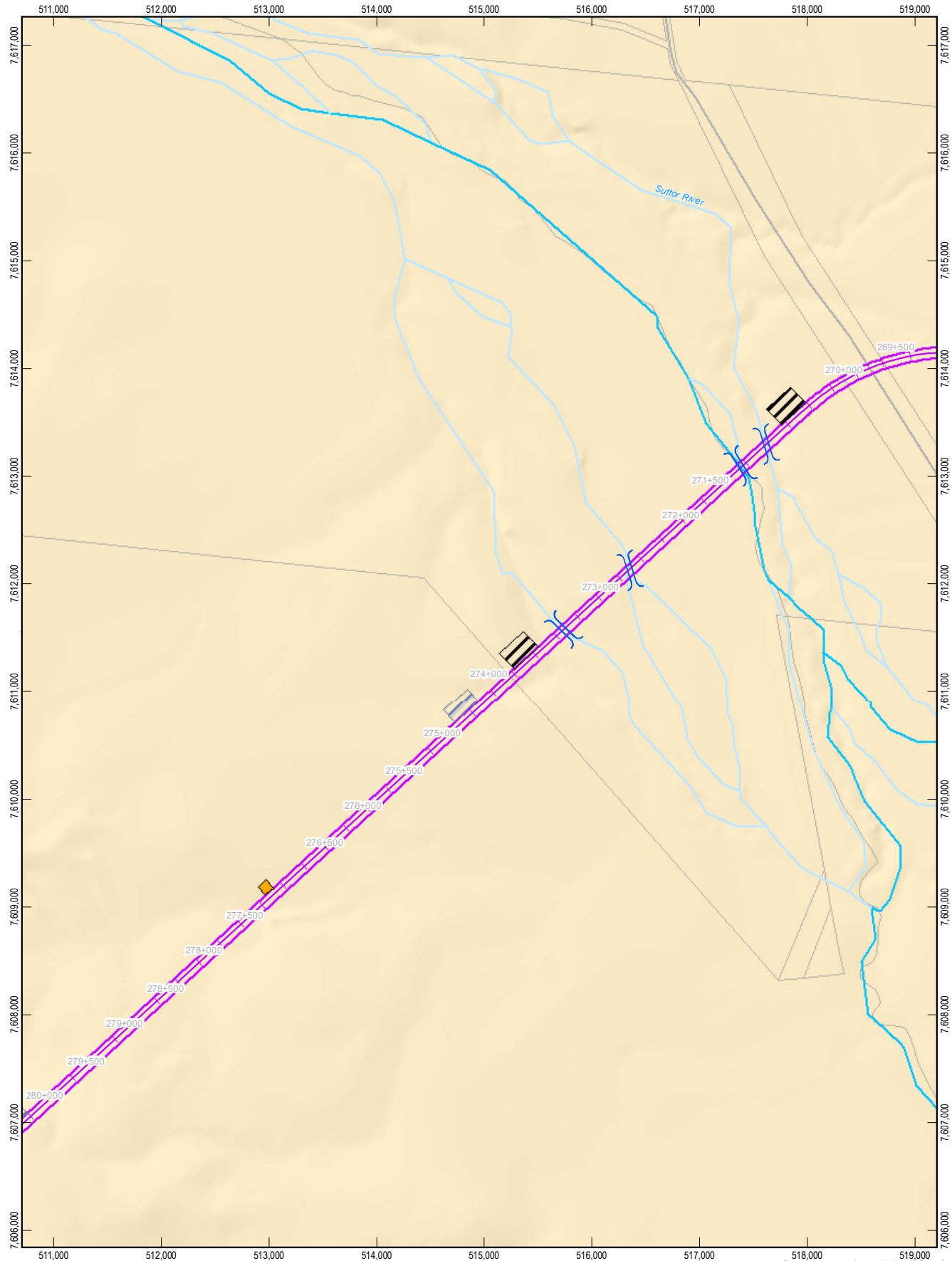

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Key features of the NGBR Project

Job Number	41-26457
Revision	D
Date	26 Nov 2013

Figure 2-2
Sheet 25 of 28

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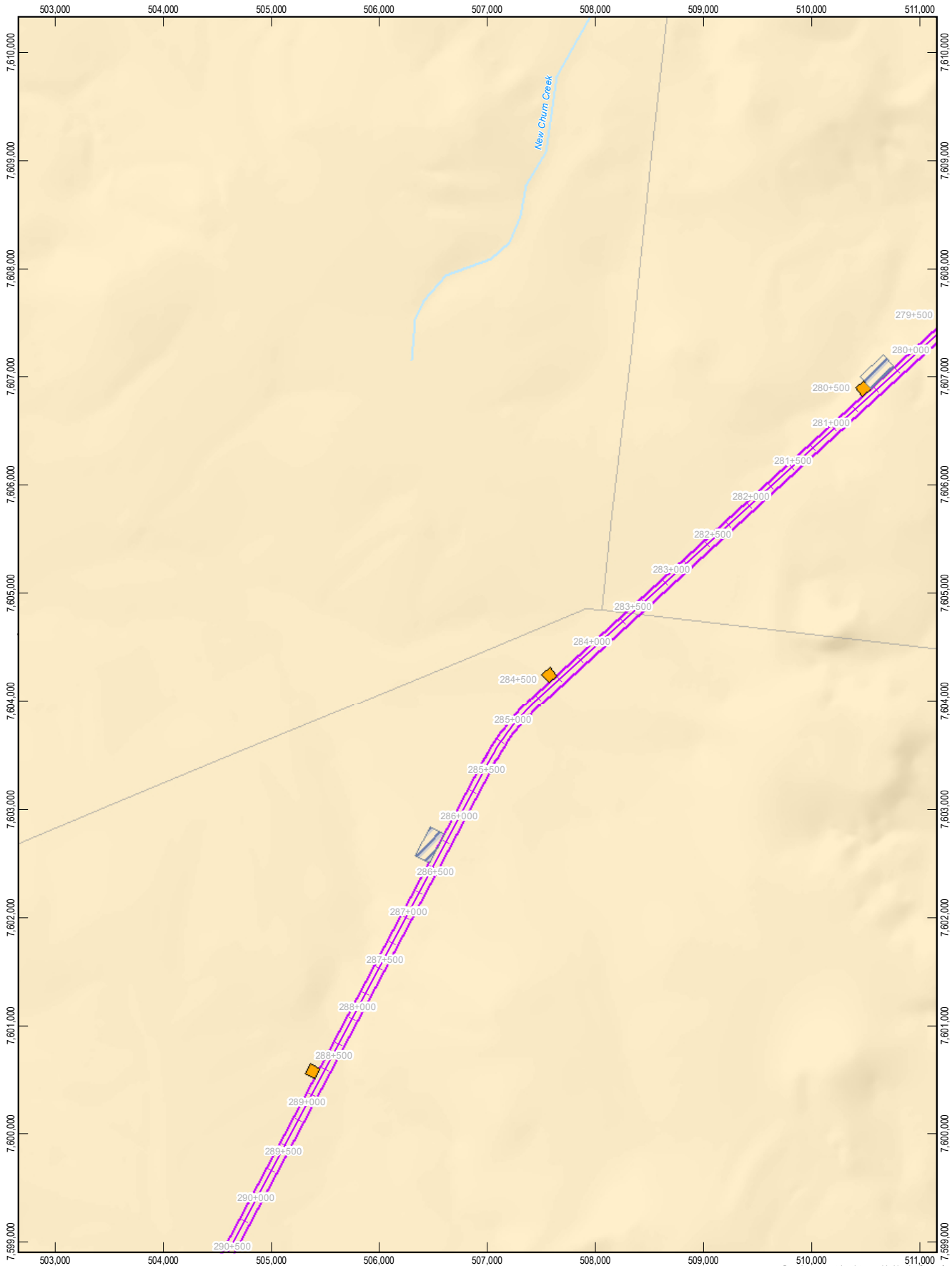

LEGEND

- Major waterway crossing structures
- Highway
- Main Road
- Local Road
- Carmichael Project (Rail)
- Railway
- Watercourse (Major)
- Watercourse (Minor)
- Easement
- Lot
- Water
- North Galilee Basin Rail Alignment
- North Galilee Basin Rail 100m Corridor
- Alignment Functional Areas
- Bridge Laydown Area
- Concrete Batch Plant
- Construction Camp
- Construction Yard
- Construction Depot Area
- Rail Precinct Area
- Rolling Stock Maintenance Depot
- Track Laydown Area
- Turning Circle

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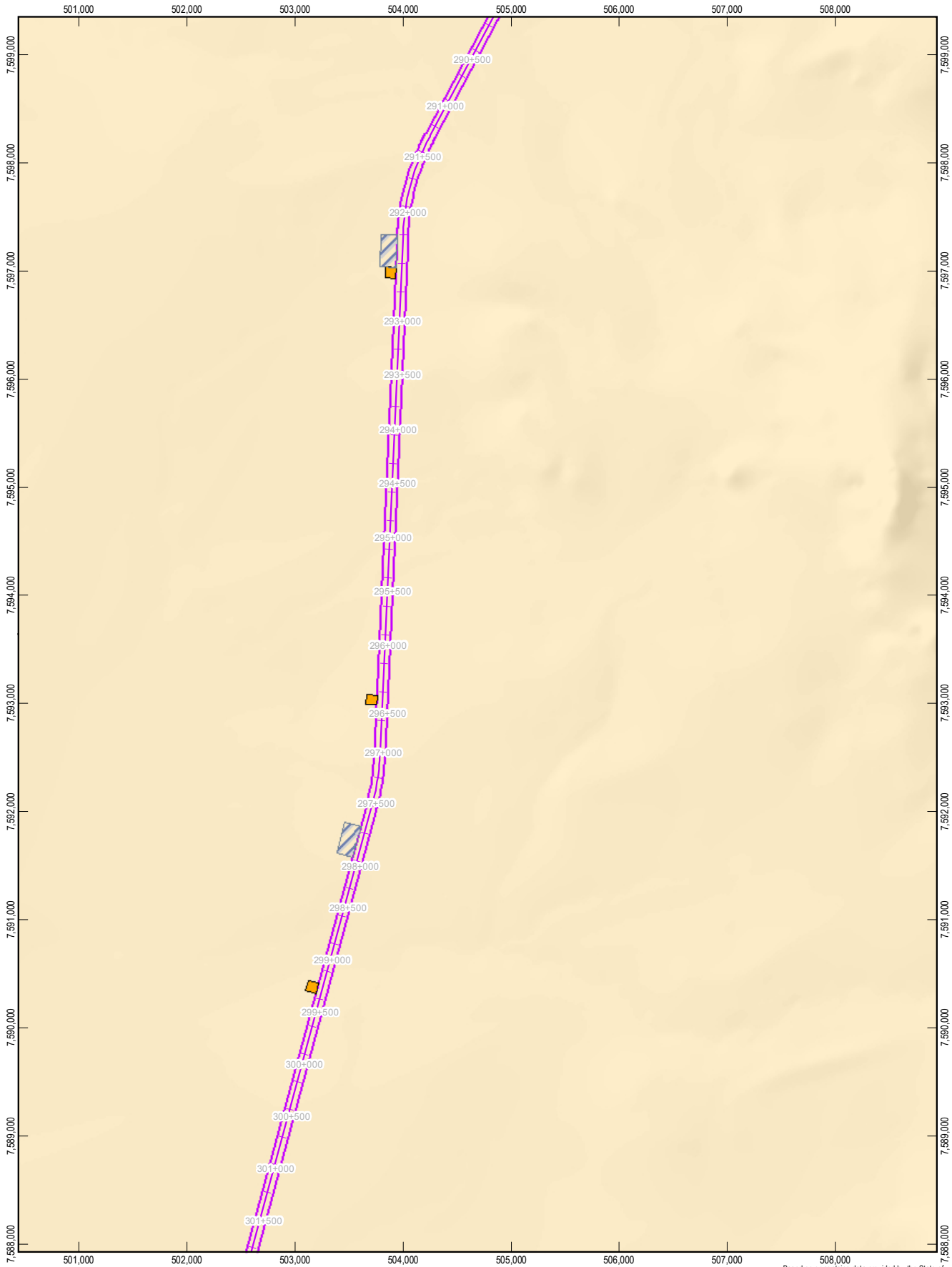

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North Galilee Basin Rail Project

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Date	26 Nov 2013

Figure 2-2
Sheet 27 of 28

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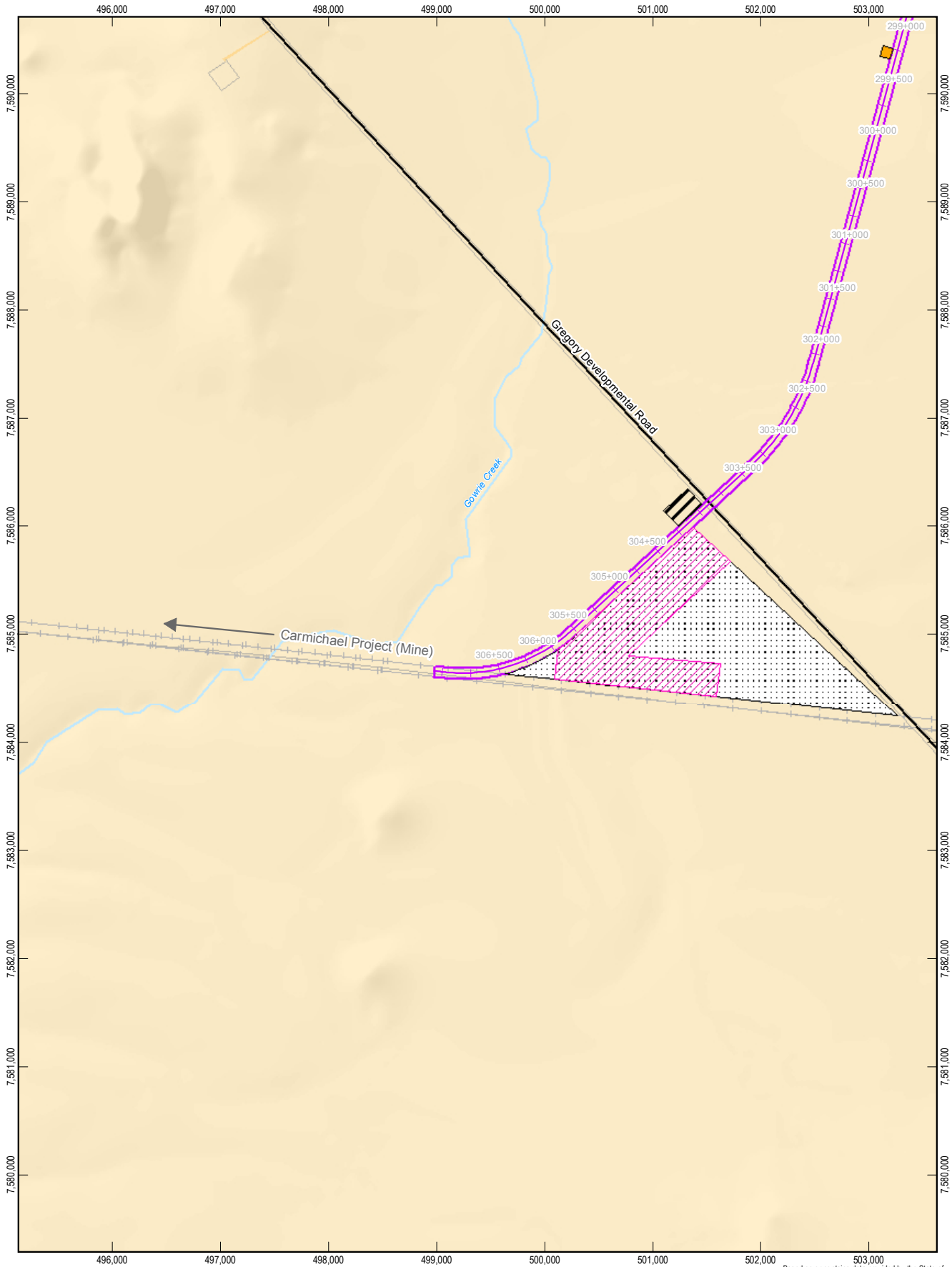

LEGEND

- Major waterway crossing structures
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North Galilee Basin Rail Project

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Figure 2-2
Sheet 28 of 28

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Data source: DNRM: DEM (2008), Cadastre (2013), Roads (2010), © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Watercourse (2007); Adani: Project Rail Alignment, Camp Sites, Alignment Functional Areas (2013); GHD: Major waterway crossing structures (2013). Created by: MS

2.2.4 Environmental design

Environmental design has been incorporated throughout the development of the NGBR Project. The corridor selection stage accounted for environmental constraints in the identification of options and subsequent multi-criteria analysis (refer Section 2.2.2). During the concept design stage, design criteria for rail formation (refer Section 2.3.3), waterway crossings (refer Section 2.3.15) and road crossings (refer Section 2.3.11) were developed through methodologies that account for environmental impacts. Drainage design is also subject to the afflux design criteria listed in (refer Section 2.3.15).

Throughout the EIS a number of environmental design requirements have been recommended and included within the Volume 2 Appendix P Environmental management plan framework. These elements will continue to be refined during the detailed design stage and will be incorporated into the final design of the NGBR Project, as necessary to avoid and/or mitigate impacts.

Indicative concept design drawings for hydrological infrastructure (i.e. bridges and culverts) are provided in Volume 2 Appendix T Concept design drawings.

2.2.5 Cost and timing

Capital expenditure (CAPEX) for construction of the NGBR Project including all ancillary infrastructure is expected to be in the order of $2.2 billion. Construction is scheduled to start in late 2014 and be completed within approximately two years.

Operational expenditure (OPEX) for the operation and maintenance of the NGBR Project is expected to be in the order of $2.50 per tonne. Operation of the NGBR Project will coincide with completion of construction and commencement of Carmichael Project (Mine) output, currently expected in 2016. The NGBR Project will service the Carmichael Project (Mine) and third-party users throughout its proposed 90 year lifespan.

2.2.6 Property and tenure

The NGBR Project crosses 64 properties (refer Table 2-3). The area and tenure of these properties are described in Volume 1 Chapter 3 Land use and tenure.

Table 2-3 Properties

Lot on plan			
10BL49	1RP748625	3HR1711	53SP243724
10DK17	1RP748626	3RP737838	56SP243724
13SP232519	1RP748627	3RP748508	58SP243726
1510SP171920	1SB279	3RP748509	5DC90
151SP122338	24RP805036	3RP748510	5DK103
152SP122339	2DK232	3SB236	5DK17
1943SP221555	2HR1724	3SB514	5SP194888
1DK150	2RP748511	3SP132678	618PH2106

Lot on plan			
1DK244	2RP748626	3SP194889	62SP195387
1RP705785	2RP748627	47SP227557	667PH1321
1RP737838	3235PH752	4SB687	6DK17
1RP748508	335SP227560	4SP116046	6SP194888
1RP748509	336SP227560	4SP171921	7DK17
1RP748510	3821PH1304	4SP194889	80K12450
1RP748511	3DC91	5047PH370	86DK154
1RP748512	3HR1686	5088SM101	9DK17

A resource sterilisation study was undertaken for the NGBR Project, which determined that no major resource potential for coal, hydrocarbons or minerals existed (Xenith 2013). Assessment of the NGBR Project in relation to resource related exploration permits and leases is provided in Volume 1 Chapter 3 Land use and tenure.

Land acquisition

Land acquisition for the NGBR Project will be approached in accordance with a land acquisition protocol (refer Volume 2 Appendix R). In accordance with the protocol, Adani will consult with stakeholders of potentially affected properties. Voluntary land access agreements or acquisition through voluntary negotiation will be sought. Where voluntary acquisition is unsuccessful, Adani will pursue compulsory acquisition through an approvals strategy, which may include designations under the *State Development and Public Works Organisation Act 1971* (SDPWO):

- State Development Area (SDA)
- Private Infrastructure Facility (PIF).

The NGBR Project comprises a range of activities which will trigger approval across multiple planning instruments at the Commonwealth, State and local government level. To simplify this process and achieve consistency in conditioning, it is the preferred option to have the NGBR Project designated an SDA, PIF or Community Infrastructure Designation (CID). This approach will coordinate and simplify matters associated with acquisition of land for the NGBR Project.

Under the SDPWO Act, the Governor in Council may designate land as an SDA to facilitate future development. The CG then establishes a development scheme for each SDA, which allows proponents to lodge a ‘material change of use’ application for any proposed development within that area. The CG may,via the Governor in Council to the extent lawfully able to do so, compulsorily acquire land (or easements) in land the subject of an SDA, should voluntary negotiations be unsuccessful.

Further, under the SDPWO Act, a road, railway, bridge or other transport qualifies for consideration as a private infrastructure facility (PIF). A PIF designation represents the first step in a process under which the CG may, to the extent lawfully able to do so, compulsorily acquire land (or easements) prescribed in the *Acquisition of Land Act 1967*. Under Section 125 of the SDPWO Act, the CG is authorised to take land for certain purposes, including a PIF.

Additionally, the approval pathway for the NGBR Project may include a designation by the Minister for Transport and Main Roads or local government as a Community Infrastructure Designation (CID) in accordance with Chapter 5 of the *Sustainable Planning Act 2009*. If the NGBR Project is granted a CID, the development will not require approval under the local planning schemes regulating land use in the area nor need to meet any scheme requirements. Under Section 206 of the SP Act, the CID must be identified in the local planning scheme; and subsequently, land uses inconsistent with the CID will be prohibited through the provisions of the planning scheme.

Further detail on processes for SDA, PIF and CID is provided in Volume 1 Chapter 20 Legislation and approvals.

2.2.7 Potential sensitive receptors

Nearest potential sensitive receptors were identified within approximately six kilometres of the preliminary investigation corridor, including 23 homesteads. Distances between the identified homesteads and the final rail corridor are provided in Table 2-4.

Table 2-4 Potential sensitive receptors (homesteads)

Homestead	Lot on plan	Distance from final rail corridor (m)	Chainage (km)
Homestead 1	255HR2027	2,690	11.8
Homestead 2	3HR1712	1,152	18.9
Homestead 3	4SB687	2,198	38.6
Homestead 4	25SB353	2,581	38.7
Homestead 5	1SB279	4,680	45.6
Homestead 6	3SB514	3,776	47.9
Homestead 7	76SP167797	5,674	48.9
Homestead 8	355K124696	3,572	61.4
Homestead 9	5047PH370	2,071	66.7
Homestead 10	3SB236	2,877	84.4
Homestead 11	86DK154	1,514	84.3
Homestead 12	3SP132678	6,158	99.6
Homestead 13	14DK18	5,316	107.8
Homestead 14	4914PH1791	3,863	111.9
Homestead 15	618PH2106	4,263	115.6
Homestead 16	62SP195387	3,819	136.2

Homestead	Lot on plan	Distance from final rail corridor (m)	Chainage (km)
Homestead 17	4SP171921	2,772	156.3
Homestead 18	1510SP171920	4,120	184.6
Homestead 19	1DK244	4,931	218.6
Homestead 20	1943SP221555	4,694	232.5
Homestead 21	5088SM101	5,159	258.9
Homestead 22	3821PH1304	1,059	269.9
Homestead 23	4SP116046	6,584	306.8

2.3 Concept design

2.3.1 Overview

The NGBR Project runs in a general north-south direction, from the Port of Abbot Point to its connection with the Carmichael Project (Rail) infrastructure. The NGBR Project begins at chainage 3.49 km, on coastal plains of the Don River basin, in the vicinity of Abbot Point. To the south near chainage 5.7 km is the first major waterway crossing, at Saltwater Creek, followed by a crossing of Abbot Point Road at chainage 6.1 km. At chainage 12.3 km, in the vicinity of Mount Roundback, the NGBR Project crosses the Aurizon North Coast Line and the Bruce Highway (via a single grade-separated crossing).

At chainage 20.2 km the NGBR Project crosses Splitters Creek. A construction depot is located between chainage 28.2 km and chainage 35.4 km, which will be repurposed as a rolling stock maintenance facility. The next major topographical features are the northern extremities of the Clarke Range at chainage 29.5 km. The rolling stock maintenance depot is located in a flat area to the north of these ranges. The NGBR Project crosses Glenore Road at chainage 34.1 km and Elliot River at chainage 35.1 km, before swinging south between Mt Abbot and Mt Mackenzie.

From approximate chainage 41 km, the NGBR Project moves through areas of high relief, associated with the Clarke Range, where significant cut and fill earthworks will occur, up to an approximate chainage of 112 km. Throughout this area, the NGBR Project crosses two minor roads, Strathalbyn Road at chainage 61.58 km, Strathmore Road at chainage 97.9 km, and Bogie River, Sandy Creek, Strathmore Creek and Pelican Creek – within the Lower Burdekin River and Bowen River catchments. The second largest NGBR Project bridge crossing occurs at Bowen River, at chainage 132.2 km.

The NGBR Project moves through another region of high relief, associated with the Leichhardt Range, where significant cut and fill earthworks will occur, between approximate chainages 151 km and 229 km. At chainage 153.9 km, the NGBR Project crosses another minor road. The intermediate construction yard is located at chainage 170.2 km to 171.3 km. The NGBR Project then crosses Bowen Developmental Road at chainage 173.3 km, followed by two minor road crossings, and the Suttor Developmental Road at chainage 231.2 km. Throughout this area, the NGBR Project crosses the Upper Suttor River, Rockingham Creek, Murray Creek, Gunn Creek, Verbena Creek and Serpentine Creek, within the Suttor River catchment.

At chainage 244.7 km and 262.6 km, the NGBR Project crosses Kilcummin Diamond Downs Road and Stratford Road respectively. The largest NGBR Project bridge crossing occurs over the Suttor River between chainages 271.1 and 273.4. The NGBR Project crosses the Gregory Developmental Road at chainage 303.8 km and ends at chainage 306.9 km, where the construction depot, a major ancillary construction facility, will be established. Part of this area will be used for ongoing operational maintenance purposes. The NGBR Project ends at interface with the Carmichael Project (Rail), west of the Gregory Developmental Road toward Mistake Creek, in the Belyando River catchment.

2.3.2 Rail

The design and configuration criteria of the NGBR Project rail are listed in Table 2-5.

Table 2-5 Rail design criteria

Parameter	
Minimum horizontal curve radii	Mainline – 1,000 m
Maximum vertical grade	Mainline loaded – 1 in 220
	Mainline unloaded – 1 in 100
	Passing loops – 1 in 400
	Maintenance sidings – 1 in 400
Minimum track centre spacing	Mainline – 6 m
	Passing loops – 6 m
	Maintenance sidings – 10 m

Passing loops

The NGBR Project is a single line, with passing loops (PL) to allow for bidirectional train passage. Passing loops are nominally 4.5 km long (minimum clear length, excluding turnouts). A total of seven passing loops are proposed to meet the requirements of 100 mtpa (Aarvee Associates 2013; Table 2-6). It should be noted that PL1 is incorporated into the rolling stock maintenance depot (refer Section 2.3.19).

The location and the number of passing loops will continue to be refined during subsequent design stages, to ensure the optimum number and location of passing loops are available to meet operational capacity requirements. All passing loops will be contained in the nominal 100 m wide final rail corridor. Maintenance sidings will be located at each end of the passing loops.

Table 2-6 Passing loops

Component	Start (km)	End (km)
PL1[1]	26.8	34
PL2	72.6	77.7
PL3	115.8	120.3
PL4	164.7	169.2
PL5	201.5	206
PL6	235	239.5
PL7	238.6	288.1

[1] Situated at rolling stock maintenance depot

Ruling gradient

The ruling gradients of the NGBR Project are 1:100 for unloaded trains and 1:220 for loaded trains. Thirty-two per cent of the alignment is close to the ruling gradients, due to the following factors:

- Challenging terrain, particularly through the Leichhardt Range and Clarke Range
- Adherence to the natural ground profile, where practicable, in order to minimise earthworks.

Typical fill batter slopes are proposed to be 1:1.75 (H:V). In rock areas, slopes up to 1:1 (H:V) are proposed in cuts up to 14 m, and slopes up to 0.5:1 (H:V) in deeper cuts. In residual soil areas, flatter slopes up to 1:2 (H:V) are proposed in cuts up to 14 m, and slopes up to 1:1 in deeper cuts. Standard 3 m wide benches are proposed to assist in stability and drainage.

Construction materials

Indicative quantities of construction materials required for the formation and rail line is provided in Table 2-7. A hazardous substance inventory is provided in Volume 1 Chapter 18 Hazard, risk, health and safety.

Table 2-7 Construction materials

Material	Quantity	Unit
Imported fill	310,000	m^3
Structure fill	1,960,000	m^3
Capping material	700,000	m^3
Concrete	55,000	m^3
Ballast	650,000	m^3
Sleepers	580,000	no.
Rail lengths (25 m)	30,000	no.
Long welded rail lengths (300m)	2,500	no.

2.3.3 Cut and fill earthworks

Despite the adherence of the NGBR Project to the natural ground profile where practicable (refer Section 2.3.2), significant cut and fill activities (refer

Table 2-1) will be required to maintain ruling gradients (refer Section 2.3.2) and flood resilience. The majority of significant cut and fill operations will be concentrated around the Leichhardt Range and Clarke Range due to the high relief of these areas.

The distribution of cut and fill earthworks along the NGBR Project is depicted in Figure 2-3. The NGBR Project is expected to include areas of unbalanced earthworks (cut not equal to fill), including the coastal plains at Abbot Point, and flood plains associated with the Bowen River and Suttor River. Potential quarry and borrow areas have been identified to supplement the fill

requirement (refer Section 2.3.8). Mass haul calculations show that haul distances will vary from 3 km to 100 km.

Deep cuts (>15 m) and deep fills (>15 m) will occur over a relatively small portion of the alignment. The need for deep cuts has been identified at nine discrete locations and the need for deep fills has been identified at 11 discrete locations. Significant cut and fill operations such as these will be concentrated around the Leichhardt Range and Clarke Range.

An earthworks model of the NGBR Project was developed as part of the North Galilee Basin Railway Concept Design Report (Aarvee 2013), with reference to a preliminary geotechnical investigation report undertaken for the NGBR Project (Cardno 2013). The geotechnical investigation divided the NGBR Project into roughly equal areas classified as 'residual soil' or 'rock'. The majority of cuts are in areas defined as rock (refer Table 2-8), and may require the use of explosive blasting where other extractive means, such as ripping and grading, prove unsuccessful.

Cut and fill treatments will continue to be refined during detailed design and with the availability of more detailed geotechnical field data. The predicted earthwork volumes are expected to reduce significantly.

Figure 2-3 Volume of cut and fill earthworks

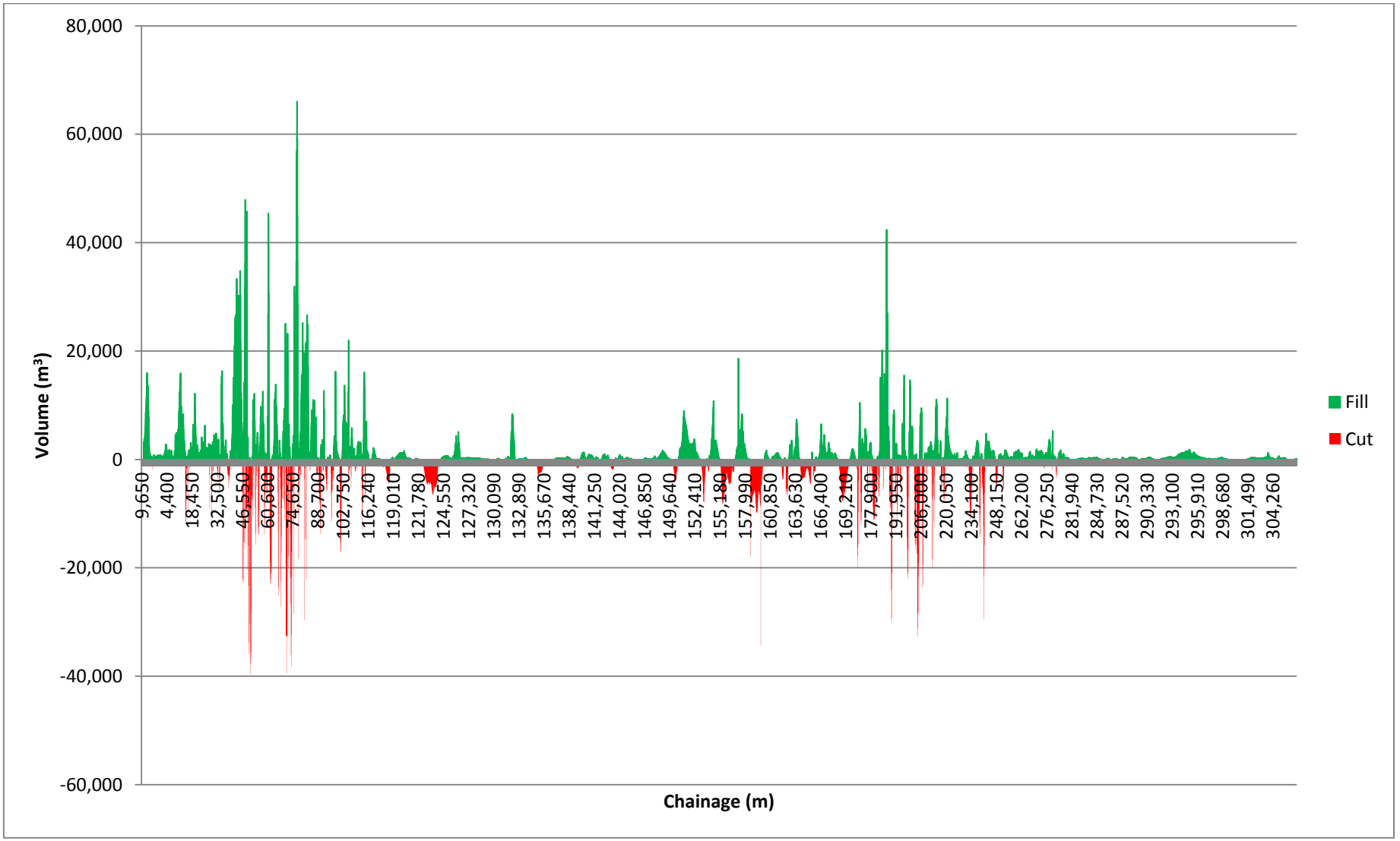


Table 2-8 Geotechnical characterisation and length of cut

Component	Quantity (km)
Area defined as 'rock'	152.3
Cut in 'rock'	65.7
Area defined as 'residual soil'	154.6
Cut in 'residual soil'	37.8

2.3.4 Construction camps

The NGBR Project includes five construction camps to accommodate the construction workforce. The location of the construction camps along the NGBR Project is shown in Figure 2-4.

The location and capacity (no. of beds) of the five construction camps is listed in Table 2-9. Construction camp 2 and construction camp 4 are major construction camps, with a 400 person capacity at peak construction, which is based on the distribution of earthworks and concrete works across the NGBR Project. The proximity of camps to the major elements of work ensures that each work crew maximises productive time on site and reduces lost time due to travel.

Table 2-9 Construction camps

Chainage (km)	Component	Capacity	Area (ha)
15	Construction camp 1	300	9.5
62	Construction camp 2	400	9.5
124	Construction camp 3	300	9.5
170	Construction camp 4	400	10.9
263	Construction camp 5	300	11.7

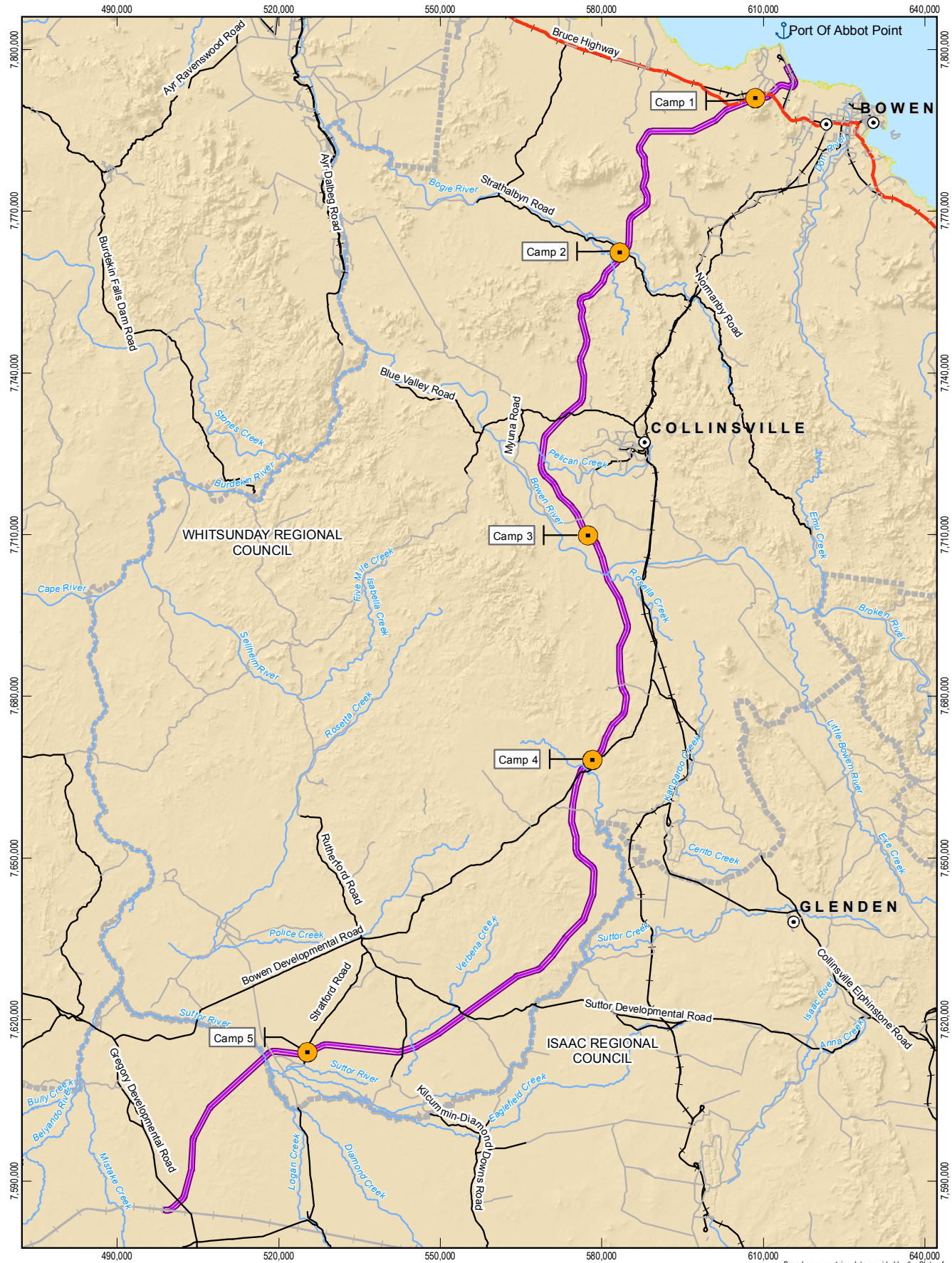
Construction camps will be equipped with the following services.

- Storage of potable water – approximately 50,000 litres per camp, per day
- Water and wastewater treatment – portable treatment and collection facilities, including temporary sewage treatment works
- Electricity – three 500 kilovolt-ampere generators per camp
- Solid waste management – segregated waste collection bins
- Washing facilities for workforce.

Wastewater will be treated in portable treatment plants comprising modular units with numbers dependent on the final size of the camps. Treated effluent can be reticulated to designated areas (irrigation, dust suppression), irrigated underground or pumped to evaporation ponds. Discharge limits and thresholds will be dependent on the site location, ground conditions, proximity to watercourses and groundwater sources, and the nature of vegetated areas.

One electricity generator will operate 24 hours per day and a second will operate 12 hours per day. Both will operate with an efficiency factor of 80 per cent and a load factor of 50 per cent. A third generator will provide backup capacity.

Waste generated at the construction camps will be regularly collected and disposed at the nearest registered landfill or recycling facility, where appropriate (refer Volume 1 Chapter 13 Waste).



LEGEND

- Population Centres
- Major Port
- Construction Camp
- Highway
- Main Road
- Local Road
- Carmichael Project (Rail)
- Railway
- Watercourse (Major)
- Local Government Area
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd
North Galilee Basin Rail Project

Job Number	41-26457
Revision	A
Date	28 Aug 2013

Construction Camps

Figure 2-4

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145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013, NGBR Corridor 06/06/2013, Carmichael Project (Rail) 18/06/2013, Camps; DNRM: Roads/2010. Created by:MS

2.3.5 Construction depot

During construction, the site of the rolling stock maintenance depot from chainage 26.8 km to 34.0 km (refer Section 2.3.19), adjacent to Glenore Road, will be used as a construction depot. A second construction depot (113.33 ha) will be established from chainage 304.1 km to 305.9 km, adjacent to Gregory Developmental Road. This construction depot will be established as part of the Carmichael Project (Rail), and subsequently be used for the NGBR Project.

The construction depot areas will include a flash butt welding yard for welding and storage of track and sleepers, and house diesel storage tanks with a capacity of greater than 20,000 litres. Hardstands will be established for the flash butt welding yard and workshops within the construction depot areas. The construction depots will be used for:

- Storage and handling of 25 m rail lengths and concrete sleepers
- Welding operations, at the flash butt welding yard
- Storage of 300 m long welded rail lengths
- Loading via gantries of 300 m long welded rail lengths to work trains
- Ballast storage and loading
- Culvert and bridge girder stacking areas.

Both construction depots will serve as permanent maintenance facilities for the NGBR Project.

2.3.6 Construction yard

A secondary construction yard (36 ha) will be established from chainage 170.2 km to 171.3 km, adjacent to Bowen Developmental Road, to support intermediate construction activities. The construction yard will house diesel storage tanks with a capacity of greater than 20,000 litres.

2.3.7 Ancillary construction facilities

The construction of the NGBR Project will require a number of temporary ancillary facilities, additional to construction camps (refer Section 2.3.4), construction depots (refer Section 2.3.5) and the construction yard (refer Section 2.3.6). These components will be situated adjacent to the final rail corridor, in the vicinity of associated works, and include the following –

- Bridge laydown areas – for storage of bridge construction materials
- Concrete batch plant – for housing of concrete batching machinery and materials
- Track laydown areas – for storage of track and sleepers
- Turning circles – to facilitate movements of construction and delivery vehicles.

The area and location of bridge laydown areas and concrete batch plants are provided in Table 2-10. Track laydown areas will be approximately 4.5 ha in area and occur at six to eight kilometre intervals. Turning circles will be approximately one hectare in area and occur at three to four km intervals. Hard stands will be established for concrete batch plant and laydown areas.

Table 2-10 Temporary construction infrastructure

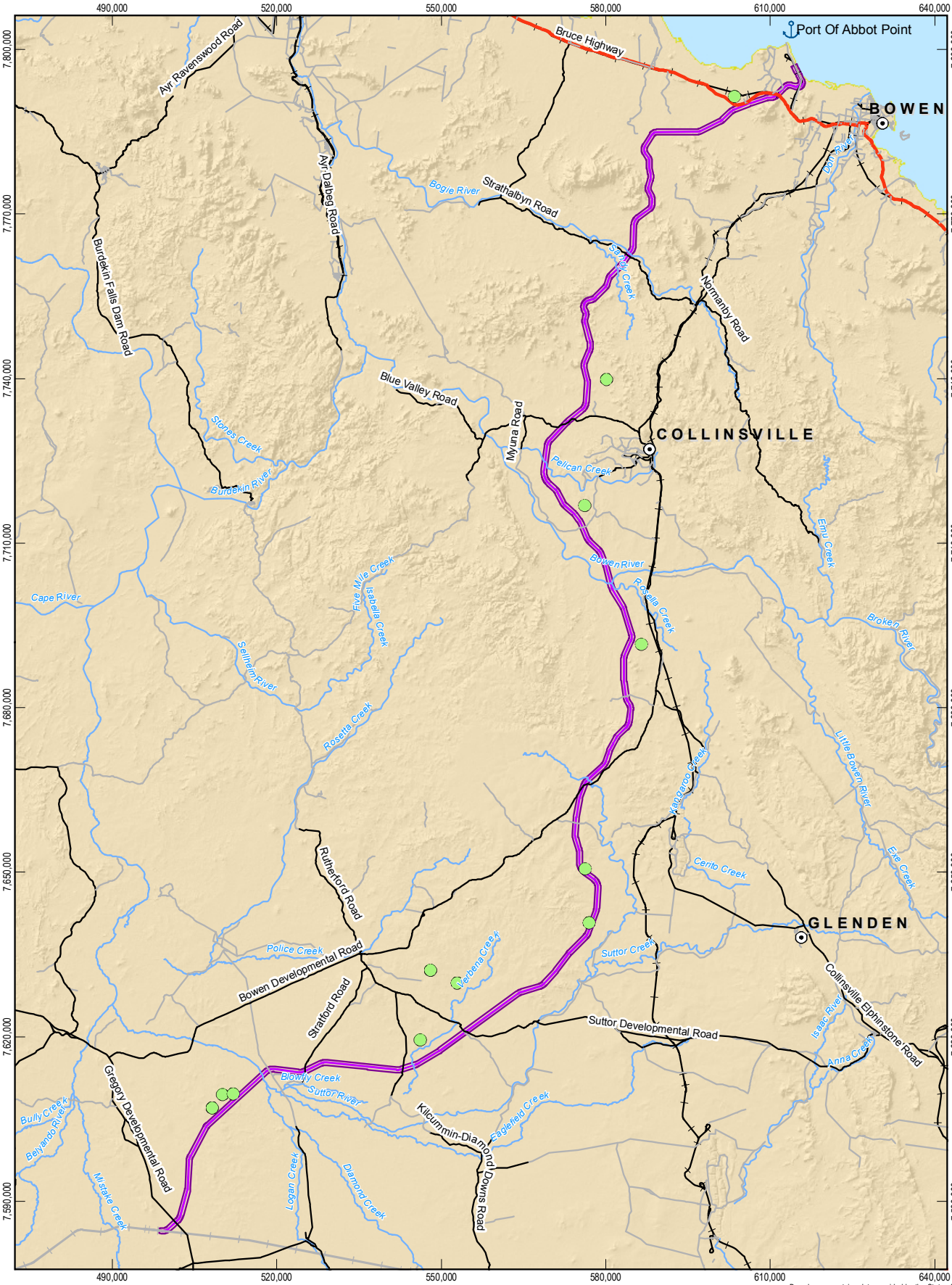
Chainage (km)	Component	Area (ha)
-5.5[1]	Bridge laydown area	6.16
-6.5[1]	Bridge laydown area	5.6
7.6	Bridge laydown area	6.12
12.6	Bridge laydown area	6.52
15.2	Concrete batch plant 1	4.6
19.9	Bridge laydown area	6
34.7	Bridge laydown area	6
56.5	Bridge laydown area	6
61.4	Bridge laydown area	6.51
62.2	Concrete batch plant 2	4.72
64.2	Bridge laydown area	6.04
98.6	Bridge laydown area	6
106.4	Bridge laydown area	6
124.5	Concrete batch plant 3	4.6
132.5	Bridge laydown area	6.29
171.5	Concrete batch plant 4	4.6
172.8	Bridge laydown area	6.12
187.3	Bridge laydown area	6
195.5	Bridge laydown area	6
206.3	Bridge laydown area	6
231.6	Bridge laydown area	6
242.3	Bridge laydown area	6.1
262.4	Concrete batch plant 5	4.6
270.5	Bridge laydown area	6
273.8	Bridge laydown area	6
304	Bridge laydown area	6

[1] Refers to chainage on balloon loop, off mainline; within the bounds of the NGBR Project for the purpose of the EIS.

2.3.8 Quarries and borrow areas

Quarries and borrow areas will be required to support the construction of the NGBR Project. Materials to be sourced from quarries and borrow areas include general fill, gravel, aggregates, ballast and capping layer material. The quantity of materials required during construction is provided in Table 2-7. Quarries and borrow pits may include screening and crushing plant to process materials to allowable standards. Potential locations for quarry and borrow areas are depicted in Figure 2-5. Investigation work is ongoing to identify additional sources of appropriate material.

Ballast stockpiles will be established in the construction depots and construction yard. Passing loops may also be utilised as ballast stockpiles. The location of these and other stockpiles will be refined, subject to identification of suitable quarries and borrow areas.



LEGEND

- Population Centres
- Major Port
- Potential Quarry Locations
- Highway
- Main Road
- Local Road
- Carmichael Project (Rail)
- Railway
- Watercourse (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

1:1,000,000 Paper Size A4

0 2.5 5 10 15 20

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

Adani Mining Pty Ltd
North Galilee Basin Rail Project

Potential quarry and borrow locations

Job Number	41-26457
Revision	B
Date	28 Aug 2013

Figure 2-5

145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013, NGBR Corridor 06/06/2013, Carmichael Project (Rail) 18/06/2013, Quarry Locations /2013 DNRM: Roads/2010. Created by:MS

2.3.9 Water supply infrastructure

Water supply options have been investigated to support concrete batching, cut and fill earthworks and potable consumption at construction camps (refer Volume 2 Appendix H3 Construction water supply strategy). It is expected that water supply to support the NGBR Project will be a combination of the following.

- In-stream water storages
- Off-stream water storage
- Groundwater bores
- River harvesting
- Purchase of potable water from
  - Isaac Regional Council
  - Whitsunday Regional Council.

Rainwater harvesting is also proposed at the rolling stock maintenance depot during operation.

The water supply strategy will continue to be refined during detailed design. Any water supply dams will be designed in accordance with the *Water Supply (Safety and Reliability) Act 2008* (refer Volume 1 Chapter 20 Legislation and approvals). Construction water demand is detailed in Section 2.4.4.

2.3.10 Haul roads and access roads

Construction of the NGBR Project will be supported by a combination of upgrades to local roads and construction of new haul roads and access roads.

A haul road will be established within the final rail corridor, parallel to NGBR Project rail alignment, on the northern side. The construction road will be a minimum of 10 m in width, allowing for two-way semi-trailer movement.

The haul road will be repurposed as a rail maintenance access road, constructed of 200 mm crushed rock material, at the end of construction. Within cuts, the rail maintenance access road will be four metres wide and at formation level. Within fills, the rail maintenance access road will be six metres wide and adjacent to the foot of the embankment.

Upgrades to local roads and construction of new access roads will be undertaken to provide access to the construction road or rail maintenance access road, as well as laydown areas, quarries and borrow areas, from the external road network. Access roads utilised during construction will be variously rehabilitated or repurposed as maintenance access roads.

2.3.11 Road crossings

The NGBR Project includes 22 road crossings (refer Table 2-12). Proposed treatments for each crossing were determined in accordance with the criteria shown in Table 2-11. The criteria are subject to further consultation with Department of Transport and Main Roads (DTMR) and local councils, and will undergo further review during subsequent design stages.

Indicative concept design drawings of road crossings are provided in Volume 2 Appendix T Concept design drawings.

Table 2-11 Treatment criteria

Classification	Criteria	Treatment
Major road / DTMR State-controlled road	Traffic volume > 200 – 250 vehicles[1]	Grade-separated
	Commercial vehicles > 20%	
	High interregional significance	
	Poor sight distance	
Minor road / Local road	Traffic volume < 200 vehicles[1]	At-grade (active)[2]
	Commercial vehicles 5 – 20%	
	Poor sight distance	
Minor road / Local road	Traffic volume < 200 vehicles[1]	At-grade (passive)[3]
	Commercial vehicles < 5%	
	Adequate site distance	

1 Average Annual Daily Traffic

2 Flashing warning signs and / or boom gates triggered by approaching train

3 Give way or stop signs and advanced warning signs

Table 2-12 Road treatments

Chainage (km)	Name	Treatment
6.1	Abbot Point Road	At grade (passive)
-5.3[1]	Abbot Point Road	At grade (passive)
-6.3[1]	Abbot Point Road	Below-grade
12.3	Bruce Highway	Below-grade
34	Glenore Road	At-grade (passive)
57.3	Minor Road	At grade (passive)
61.6	Strathalbyn Road	At-grade (passive)

Chainage (km)	Name	Treatment
79.6	Minor Road	At grade (passive) Realignment
83.7	Road reserve	Closure
97.9	Strathmore Road	At-grade (passive) Realignment
117.1	Road reserve	Closure
120.5	Minor road	At-grade (passive)
139.3	Road reserve	Closure
153.9	Minor road	At-grade (passive) Realignment
173.2	Bowen Developmental Road	Above-grade Realignment
177.8	Minor road	Closure
180.3	Minor road	At-grade (passive) Realignment
205.8	Road reserve	Closure
231.3	Suttor Developmental Road	At grade[2] Realignment
244.7	Kilcummin Diamond Downs Road	At-grade (passive)
263	Stratford Road	At-grade (passive)
303.8	Gregory Developmental Road	Above-grade

[1] Refers to chainage on balloon loop, off mainline

[2] An appropriate level of protection for the at-grade crossing subject to risk assessment (for example using the Australian Level Crossing Assessment Model (ALCAM)), and negotiation with DTMR.

2.3.12 Occupational crossings and stock route crossings

The NGBR Project includes 54 occupational crossings and seven national stock route crossings. Proposed treatments for each crossing (refer Table 2-14) were determined in accordance with the criteria shown in Table 2-13. The criteria are subject to further consultation with Department of Natural Resources and Mines (DNRM), local government and landholders, and will undergo further review during subsequent design stages.

Indicative concept design drawings of occupational crossings are provided in Volume 2 Appendix T Concept design drawings.

Table 2-13 Treatment criteria

Classification	Criteria	Treatment
Stock route	Sufficient vertical clearance	Through large culvert
	Insufficient vertical clearance	At-grade with holding yards
Occupational crossing	Sufficient vertical clearance	Through large culvert
	Insufficient vertical clearance	At-grade (passive)

Table 2-14 Stock route crossings

Chainage (km)	Gazettal no.	Treatment
57.3[1]	U398BOWN05	At-grade with holding yards
62.8	U398BOWN04	At-grade with holding yards Realignment
79.6[1]	U398BOWN04	At-grade with holding yards Realignment
97.9[1]	U321BOWN01	At-grade with holding yards Realignment
133.3	U409BOWN02	At-grade with holding yards
186.4	U403BOWN02	At-grade with holding yards
269.6	U402BOWN01	At-grade with holding yards

[1] Shared with road crossing

2.3.13 Service crossings

A ‘dial before you dig’ search was undertaken for the NGBR Project, which identified two pipeline crossings, three optic fibre cable crossings and 13 power line crossings (refer Table 2-15). Treatments for each crossing will be negotiated with service authorities.

Table 2-15 Service crossings

Chainage (km)	Service
12.24	Optic fibre cable (Optus)
12.24	Optic fibre cable (Telstra)
12.24	Optic fibre cable (Reef Networks)
12.55	Power line
37.65	Power line
50.28	Power line
63.45	Power line
89.5	Power line
95.25	Power line
101.65	Power line
110.82	Power line
147.53	Power line
150.7	SunWater Water Pipeline
150.77	North Queensland Gas Pipeline
155.98	Power line
189.54	Power line
232.13	Power line
266.29	Power line

2.3.14 Rail network crossings

At chainage 12.1 km, the NGBR Project crosses the existing North Coast Line, part of the Queensland Rail network. The proposed treatment for this crossing is for the NGBR Project to cross over the North Coast Line via a grade-separated crossing.

At chainage 6.75 km, the NGBR Project crosses the existing Abbot Point branch of the Newlands system, part of the Aurizon network. The proposed treatment for this crossing is for the NGBR Project to cross over the Abbot Point branch via a grade separated crossing.

The final treatment at this crossing, and any subsequent interfaces with the rail network will be subject to negotiations and infrastructure agreements between all relevant asset owners.

2.3.15 Waterway crossings

A desktop hydrological study of the NGBR Project identified 567 waterway crossings (refer Volume 2 Appendix H2 Hydrology and hydraulics).

Preliminary engineering design of drainage structures at identified waterway crossings has been undertaken for the 50 year ARI event. A combination of bridges, pipe culverts, and box culverts are proposed. Bridges were selected at locations with design flow rate greater than or equal to

250 m^3/s, major culverts were selected at locations with design flow rate greater than or equal to 50 m^3/s and minor culverts were selected at locations with design flow rate less than 50 m^3/s. The particular cross-drainage structure applied was determined by the design flow rate and annual recurrence interval (ARI) rainfall event, as well as desired freeboard, maximum velocity and scour protection (refer Table 2-16 and Table 2-17). A span of 20.2 m was adopted for all bridge structures; box culverts and pipe culverts were variously sized. Pipe culverts and boxed culverts are expected to be reinforced concrete. Scour protection will be provided as per *Guide to Road Design* (Austroads 2013). Crossing structures at major waterways are summarised in Table 2-18 and shown in Figure 2-2.

Drainage design is also subject to the afflux design criteria and is listed in Table 2-19.

Flood immunity for lowest edge of formation and top of rail is provided in Table 2-20.

Indicative concept design drawings of drainage structures are provided in Volume 2 Appendix T Concept design drawings.

Table 2-16 Bridge design criteria

Criteria	Value
ARI event	50 year
Freeboard	600 m
Maximum velocity	3.8 m/s

Table 2-17 Culvert design criteria

Criteria	Value
ARI event	50 year (major culverts)
	20 year (minor culverts)
Freeboard	300 mm
Maximum velocity	2.5 m/2
Maximum headwater	150% of culvert diameter or box height

Table 2-18 Major waterways and crossing structures

Chainage (km)	Waterway	Crossing structure
20.23	Splitters Creek	Bridge (3 span) Box culverts (4 cell)
35.08	Elliot River	Bridge (4 span)
61.22	Bogie River	Bridge (9 span)
64.78	Sandy Creek	Bridge (3 span)
98.78	Strathmore Creek	Bridge (2 span)
106.05	Pelican Creek	Bridge (8 span)

Chainage (km)	Waterway	Crossing structure
132.20	Bowen River	Bridge (20 span) Box culverts (15 cell)
172.06	Suttor River (Upper)	Bridge (2 span)
176.58	Lily Creek	Box culverts (15 cell) Pipe culverts (4 cell)
187.00	Rockingham Creek	Bridge (2 span)
206.51	Murray Creek	Bridge (3 span)
220.86	Upper Gunn Creek	Box culverts (6 cell)
231.20	Gunn Creek	Pipe culverts (25 cell) Box culverts (13 cell)
242.53	Verbena Creek	Bridge (3 span)
244.49	Serpentine Creek	Box culverts (12 cell)
271.06 - 273.37	Suttor River (Lower)	Bridge (55 span) Box culverts (18 cell)

Table 2-19 Afflux design criteria

Feature	Afflux design criteria
Housing areas	0.1 m maximum
Critical infrastructure	0.2 m maximum
Non-critical housing / infrastructure or uninhabited areas	0.5 m maximum

Table 2-20 Flood immunity

Component	Criteria	Value
Lowest edge of formation	ARI event	50 year
	Freeboard	300 mm
Top of rail	ARI event	100 year

2.3.16 Longitudinal drainage

In areas along the final rail corridor where multiple drainage lines are clustered together, it may be practical to link these by means of longitudinal drainage on the upstream side. The proposed longitudinal drainage would combine flows and direct them through an appropriately sized cross drainage structure. Where the final rail corridor passes through significant cuts, longitudinal drainage may also be required to convey overland flow to the next viable cross drainage structure (for example, at the top and toe of batters).

Longitudinal drainage will continue to be developed and refined during detailed design.

2.3.17 Corridor fencing

The entire NGBR Project corridor will be fenced, due to the concentration of stock on adjacent properties. Livestock-type fencing would typically comprise of four strand barbed wire, however fencing design will be finalised in consultation with landholders. Consideration will be given to the use of 'spear gates' (i.e. non-lethal exit-only gates) or similar mechanisms that allow for stock to escape the rail corridor. Security fencing will also be provided around the construction depots, construction yards, construction camps, construction laydown areas and the rolling stock maintenance depot.

2.3.18 Signalling and communications

The signalling and communications system will be rolled out gradually via a staged approach through construction and operation of the NGBR Project (refer Table 2-21). During construction, a communications backbone of underground cables (optical fibre) will be laid. The communications backbone will facilitate communication during construction and operation. Main signalling control will be operated out of the Adani office, based in Brisbane, Queensland.

Rail movement during construction will be supported by a paper-based system. As the NGBR Project enters operation, the train order system will be sequentially upgraded up to a voice-based train order system, an electronic train order system, a driver advice mode system, and finally driverless system.

Table 2-21 Signalling and communications

Phase	Stage	System
Construction	Stage 1	Communications backbone
Construction	Stage 1a	Rail construction train order mode
Operations (up to 30 mpta)	Stage 2	Voice based train order system
Operations (up to 60 mtpa)	Stage 3	Electronic train order system
Operations (up to 90 mtpa)	Stage 4	Driver advice mode (cruise control system)
Operations (up to 100 mtpa)	Stage 5	Driverless system

From Stage 3 onward, full automatic train protection will be implemented, which will limit the authority of the train driver to exceed a speed limit determined by brake distance. Emergency stop commands may also be issued from the main signalling control.

2.3.19 Rolling stock maintenance depot

The NGBR Project includes a rolling stock maintenance depot (178.22 ha) located between chainage 26.8 km and chainage 34.0 km. The depot will include the following components:

- Train test and examination area – for servicing and repairs
- Two locomotive maintenance areas (2) – for fuelling and under body maintenance
- Wagon maintenance area – for wagon repair

- Warehouse and storage area – for component storage
- Diesel storage area – for storage of diesel for locomotive refuelling; 10 diesel storage tanks of 264,150 litre capacity
- Hazardous and dangerous chemicals storage area – for storage of oil, lubricants, cleaning goods and so forth
- Mobile equipment storage area – for storage of heavy vehicles and equipment
- Train washing area – for washing of locomotives and wagons
- Water storage area – for storage of 300,000 litres of rainwater for potable uses, and storage of one million litres of stormwater for train washing
- Rainwater treatment area – for treatment of rainwater and stormwater for their respective uses
- Administrative facilities, parking and security.

2.3.20 Rolling stock

The locomotives and wagons proposed to operate on the NGBR Project, from the Carmichael Project (Mine), are described in Table 2-22.

Table 2-22 Rolling stock specifications

Parameter	Locomotive	Wagon	Full consist
Model	SD70 ACe	Standard gauge	4 locomotives, 240 wagons
Length	22.63 m	16.18 m	3,974 m
Weight (empty)	191 tonne	22 tonne	6,044 tonne
Weight (loaded)	191 tonne	130 tonne	31,964 tonne
Axles	6	4	984
Continuous power	3,200 kW	NA	12,800 kW

2.4 Pre-construction and construction phase

2.4.1 Overview

Construction of the NGBR Project will occur over four phases. The phases and the activities that make them up are itemised below, and further discussed in Sections 2.4.6 to 2.4.9. Track laying is expected to progress at a rate of 1.8 km per day.

- Phase 1, Site preparation – including:
  - Construction camp establishment
  - Temporary drainage construction
  - Clearing and grubbing
  - Topsoil stripping
  - Service removal or treatment
  - Haul roads, access road and laydown construction
  - Installation of water supply infrastructure
  - Fencing (temporary and permanent)
  - Communication cable laying
- Phase 2, Drainage structure, earthworks and bridges – including:
  - Drainage construction
  - Cut and fill earthworks
  - Capping layer application
  - Bridge construction
- Phase 3, Track laying – including:
  - Welding
  - Track and sleeper laying
  - Ballasting and tamping
- Phase 4, Signal and communications – including:
  - Installation of signalling equipment
  - Installation of wayside equipment
  - Provision of main signalling control centre.

2.4.2 Schedule

Construction of the NGBR Project will be separated across the following construction fronts:

- Front 1, Northern section – Chainage 3.49 km to chainage 95 km
- Front 2, Central section – Chainage 95 km to chainage 205 km
- Front 3, Southern section – Chainage 205 km to chainage 306.9 km.

The schedule for construction of the NGBR Project is summarised in Table 2-23. Timing of activities may differ considerably from front to front, due to varying constraints.

The schedule for construction of the NGBR Project is preliminary and will continue to be refined during detailed design.

Construction will generally take place during daytime working hours (6 am to 7 pm). Night-time construction works may include those that would be inhibited during daytime working hours, such as:

- Embankment moisture conditioning
- Work within an operational rail corridor
- Road works where required to avoid peak traffic
- Materials delivery by oversize vehicles.

Other night-time construction works may be undertaken where they can be conducted safely and have limited noise and light impacts on sensitive receptors, such as:

- Welding to support track construction
- Concrete casting
- Utilities adjustment
- Investigations or testing.

Table 2-23 Schedule

Phase	Timeframe (estimated)
Phase 1, Site preparation	Late 2014 – 2nd quarter 2015
Phase 2, Drainage structure, earthworks and bridges	4th quarter 2014 – 1st quarter 2016
Phase 3, Track laying	4th quarter 2015 – 3rd quarter 2016
Phase 4, Signalling and communications	3rd quarter 2016 – 4th quarter 2016

2.4.3 Construction workforce

Workforce numbers

An estimate of the yearly peak workforce numbers (full-time equivalent) for each year of construction is provided in Table 2-24. This workforce will be accommodated at construction camps described in Section 2.3.4.

Table 2-24 Peak workforce

Occupation	2014	2015	2016
Management	15	35	15
Engineering	15	35	15
Trades	210	435	215
Construction operators	405	845	410
Construction management	85	225	85
Camp management, catering and security	45	125	45
Total	**775**	**1,700**	**785**

Origin and means of transport

The majority of the construction workforce will fly-in-fly-out from anywhere on the east coast of Australia, to regional airports in Townsville, Moranbah, Mackay, Emerald or Bowen. From these locations, the workforce will be transferred to any of the five construction camps by bus.

Some labour may be sourced from regional townships in the vicinity of the NGBR Project. Workforce local to these regional townships may drive-in-drive-out individually or by a group bus arrangement, to minimise transport risk.

Once accommodated at a construction camp, the construction workforce will be transported to and from work sites by four-wheel drive or bus.

Shift pattern

It is proposed that working rosters will include the following:

- Earthworks and drainage – 14 days on, 7 days off (rolling)
- Structures – 10 days on, 4 days off
- Track works – 14 days on, 7 days off (rolling).

2.4.4 Construction water

The NGBR Project will require water to support construction. A construction water supply strategy was prepared for the NGBR Project (refer Volume 2 Appendix H2 Construction water supply strategy). Water requirements for the construction of the NGBR Project include potable water and water compliant with AS 1379-2007 Specification and supply of concrete. The water supply strategy identified the following water requirements during construction:

- Cut and fill earthworks – 4,273.574 mega litres of raw water, over the two year construction period
- Concrete batch plant – 52,000 litres of AS 1379 compliant water per plant per day
- Construction camps 1, 3 and 5:
  - 60,000 litres per day
- Construction camps 2 and 4:
  - 60,000 litres per day
- Construction depot – 1.692 mega litres per day.

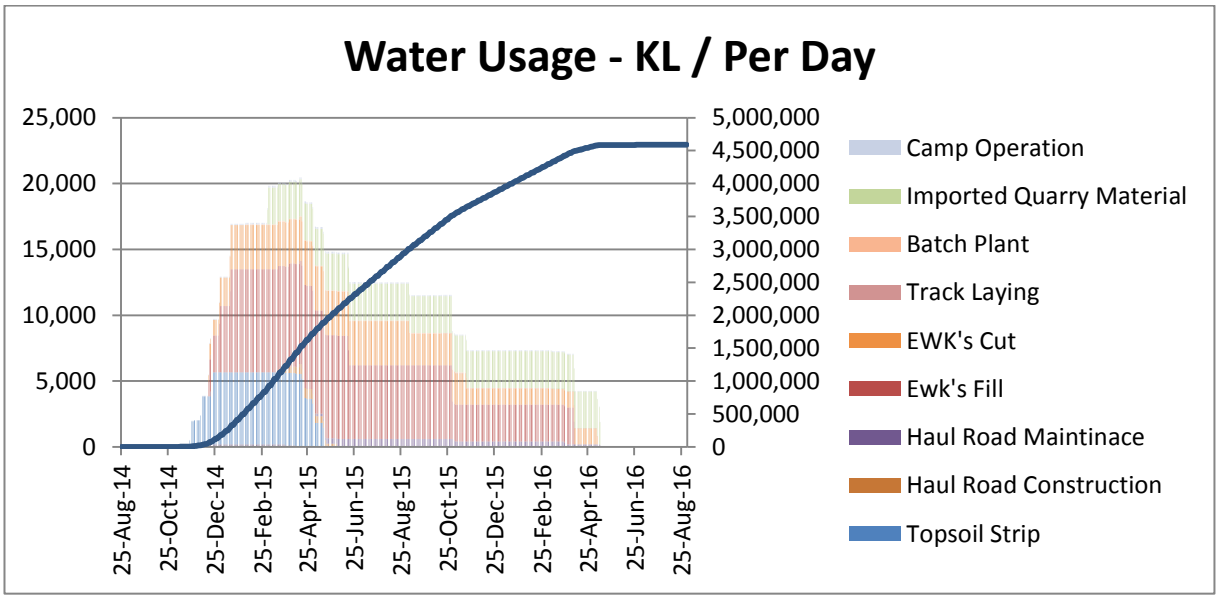
A preliminary estimate of additional construction water requirements has been undertaken:

- Clearing – 60,000 litres per day
- Topsoil – 203 litres per m3
- Haul road construction – 250,000 litres per section per day
- Haul road maintenance – 200,000 litres per section per day
- Imported quarry or borrow material – 119 litres per m^3
- Weed hygiene and management.

Estimated water usage throughout construction of the NGBR Project is graphed in Figure 2-6. Water supply during construction will be achieved utilising the NGBR Project water supply infrastructure described in Section 2.3.9.

Potable water may be sourced from regional townships (refer Section 2.3.9) and transported to the construction site by road train where it is not feasible to treat and supply from non-potable sources.

Figure 2-6 Construction water use



2.4.5 Plant and equipment

Indicative make and model of general construction plant and equipment required during construction is listed below.

- Cut and fill earthworks:
  - D10 dozers
  - D11 dozers
  - 651 open bowl scrapers
  - 631 open bowl scrapers
  - 623 elevating scrapers
  - 825 compactors
  - 16 G Graders
  - 30,000 L water carts
  - 85 tonne excavator
  - 740 rear dump trucks
  - Side tippers
- Drainage construction:
  - 30 tonne excavators
  - 60 tonne rough terrain hydraulic cranes
  - 20 tonne rough terrain Franna type cranes
  - Front end loaders / backhoes
  - 20,000 L water carts
  - 10 tonne self-propelled pad-foot rollers

  - Miscellaneous small hand held compaction equipment
- Capping layer application:
  - 140 G Graders (will have machine control)
  - 825 compactors
  - Paving machines
  - 15 tonne vibrating smooth drum rollers
  - 20,000 litre water carts
- Bridge construction:
  - 160 / 220 Tonne hydraulic cranes
  - 20 tonne rough terrain Franna type crane
  - Rough terrain Tele-hoist with forklift attachments
  - 30 tonne excavator (part time)
  - 950 front end loader
  - 10 tonne self-propelled pad-foot roller
  - Front end loader/backhoe
  - 20,000 litre water carts
- Haul road and access road maintenance:
  - 140 G grader
  - 30,000 L water carts x 4
  - 30 tonne excavator
- Track laying:
  - Plasser K355-ZW flash butt welder
  - Plasser / Harsco / Holland mobile flash butt welder
  - Harsco New Track Construction tracklaying machine
  - CAT 954 Track excavator
  - Plasser 09-3X main line tamper
  - Track lifter
  - UNIMAT 04-27C main line tamper
  - Plasser 08-16H switch tamper
  - SSP305 regulator
  - JBR -10 regulator
  - Harsco sleeper gantry
  - Ballast wagons and locomotives
  - Portal cranes and rollers
  - Cat 988H loaders
  - 16T track excavator
  - Volvo 120F loaders
  - Octopus attachment for excavator.

2.4.6 Construction traffic

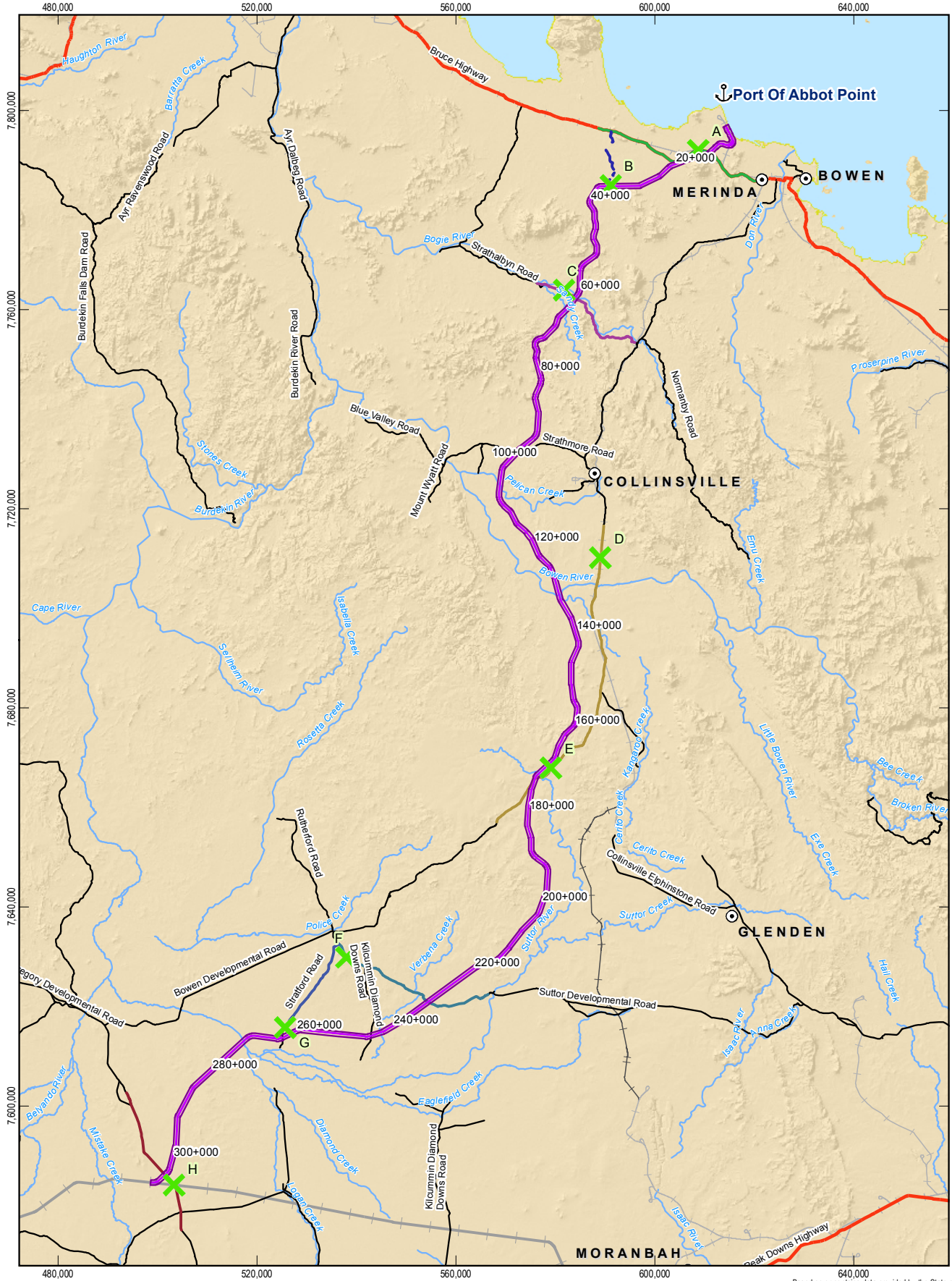
The construction of the NGBR Project will generate additional heavy and light vehicle traffic on the external road network. Key approach roads to be used by NGBR Project are:

- Bruce Highway, approaching chainage 14 km
- Glenore Road, approaching chainage 34 km
- Strathalbyn Road, approaching chainage 64 km
- Bowen Developmental Road, approaching chainage 120 km and 170 km
- Suttor Developmental Road, approaching chainage 230 km
- Stratford Road, approaching chainage 262 km
- Gregory Developmental Road, approaching chainage 305 km.

Construction materials to be delivered to site during the construction phase include cut and fill material, concrete (sand, cement, and aggregate), culverts, girders, ballast, track and sleepers. The volume of materials required is summarised in Table 2-7. Cut and fill material will be delivered to the NGBR Project via trucks or scrapers, depending on final source locations. Aggregate, sand and cement will be delivered to batching plants located along the NGBR Project (refer Section 2.3.7). Precast culverts may be procured from an existing supplier and delivered to a culvert site, or held at a bridge site. Girders may be stockpiled at Townsville Port before delivery to a bridge site. Ballast will be delivered to ballast stockpiles (refer Section 2.3.8). Track and sleepers will be delivered to the NGBR Project by B-double trailer.

Key access roads and intersections with the NGBR Project are depicted in Figure 2-7. Anticipated traffic volumes on these access roads are provided in Table 2-25. Further information on the road network in the vicinity of the NGBR Project, delivery of construction materials and potential traffic impacts are provided in Volume 1 Chapter 14 Transport.

Hazardous substances to be delivered to site during construction are discussed in Volume 1 Chapter 18 Hazard, risk, health and safety.



LEGEND

- Population Centres
- Major Port
- Key Intersections
- Highway
- Main Road

Key Roads

- Bowen Developmental Road
- Bruce Highway
- Glenore Road
- Gregory Developmental Road
- Stratford Road
- Strathalbyn Road
- Suttor Developmental Road
- Carmichael Project (Rail)
- Existing/Other Rail Network
- Watercourses (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

1:1,100,000 Paper Size A4

0 10 20 40

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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GHD

adani

Adani Mining Pty Ltd
North Galilee Basin Rail Project

Job Number	41-26457
Revision	B
Date	28 Aug 2013

Key access roads

Figure 2-7

Level 9, 145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2013, Chainage/2013; DNRM: Roads/2010; GHD: Study Intersections/2013. Created by:MS

Table 2-25 Construction traffic

Month	Bruce Highway	Glenore Road	Strathalbyn Road	Bowen Developmental Road[1]	Bowen Developmental Road[2]	Suttor Developmental Road	Stratford Road	Gregory Developmental Road
3	0	0	0	166	208	0	0	0
4	166	0	208	664	832	498	498	0
5	664	0	832	664	832	664	664	0
6	664	0	832	664	5,472	664	664	0
7	2,014	20,148	2,182	2,014	6,822	2,072	2,072	58
8	2,014	20,148	2,182	2,014	6,822	2,085	2,085	71
9	2,014	20,148	2,182	2,014	8,682	2,085	2,085	71
10	2,014	20,148	2,182	2,014	8,682	2,085	2,085	71
11	2,014	20,148	2,182	2,014	8,682	2,027	2,027	13
12	2,014	20,148	2,182	2,063	8,731	2,027	2,027	13
13	2,014	20,148	2,182	2,070	8,738	2,018	2,018	1,688
14	2,014	22,888	2,182	2,071	8,739	2,014	2,014	1,684
15	2,046	22,920	2,214	2,022	13,320	2,014	2,014	1,684
16	2,046	22,920	2,214	2,021	13,319	2,014	2,014	1,684
17	2,048	22,922	2,216	2,022	8,680	2,014	2,014	1,684

Month	Bruce Highway	Glenore Road	Strathalbyn Road	Bowen Developmental Road[1]	Bowen Developmental Road[2]	Suttor Developmental Road	Stratford Road	Gregory Developmental Road
18	2,024	22,898	2,192	2,014	8,672	2,014	2,014	1,684
19	2,022	22,896	2,190	2,014	8,672	2,014	2,014	1,684
20	2,014	22,888	2,182	2,014	8,672	1,350	1,350	1,684
21	664	22,888	832	664	5,462	0	0	0
22	664	0	832	498	5,254	0	0	0
23	664	0	832	0	0	0	0	0

[1] Near chainage 120 km

[2] Near chainage 170 km

2.4.7 Phase 1 – Site preparation

Construction camp establishment

All five construction camps (refer Section 2.3.4) will be established at the start of works.

Temporary drainage construction

Temporary drainage construction will be established in order to:

- Minimise runoff from NGBR Project construction activities to waterways
- Minimise disturbance to waterways crossed by the NGBR Project.

Clearing and grubbing

Clearing and grubbing will include removal of trees, stumps, brush, roots, rubbish and debris from the site, shortly in advance of earthworks.

Generally, clearing and grubbing for bulk civil earthworks will be undertaken immediately prior to the earthworks to prevent erosion. However, the following clearing and grubbing will occur during site preparation:

- Clearing and grubbing along final rail corridor fence lines to allow construction of fencing, the light vehicle access road, and communication cable laying
- Localised clearing and grubbing for construction camps and access roads, quarries and borrow areas, laydown areas, water supply infrastructure (particularly water storages) and construction depots
- Localised clearing and grubbing at major bridge or culvert crossings.

Topsoil stripping

Topsoil stripping will occur over the NGBR Project footprint and will be retained for rehabilitative purposes.

All vegetation, topsoil and other organic and unsuitable material shall be stripped where directed, within the final rail corridor, to a minimum depth as nominated by future geotechnical assessments. Wherever possible and appropriate, such material will be stockpiled and recycled. Topsoil stockpiles will be managed to maintain soil fertility and other soil properties.

Topsoil will be stockpiled where practicable for future use in landscaping and rehabilitation. Excess topsoil will be spoiled to nominated spoil areas which may be within the final rail corridor or on adjacent land, provided landholder and environmental approvals are in place.

Topsoil stripping recommendations are included in Volume 1 Chapter 6 Topography, geology, soils and land contamination.

Service removal and treatment

Initial assessment has determined that no major services will require removal. Where a service is likely to be impacted by the NGBR Project, consultation with the asset owner will be undertaken to determine the appropriate interface for the railway and method of protection during construction.

Haul roads, access roads and laydown construction

Temporary haul roads and access roads will be established along the NGBR Project, while access widening will be undertaken on designated local and State-controlled road.

The roads will provide access for material delivery trucks to drainage and bridge structures. The materials to be delivered include:

- Fill material (sub-base and capping)
- Equipment, fuels and lubricants
- Water supply, sewage and waste removal
- Pre-cast culverts, headwalls and bridge girders
- Rail, sleepers and ballast.

Construction materials will be stockpiled at laydown areas established near the junctures of access roads to the construction road, or alternatively within designated areas within the construction yards (refer Section 2.3.9).

Installation of water supply infrastructure

Water supply infrastructure will be installed, including any water pipelines, boreholes, holding dams, in-stream and off-stream storages, and river harvesting infrastructure.

Fencing (temporary and permanent)

Fencing will be established along the entire NGBR Project final rail corridor. Security fencing will also be established around temporary construction laydown areas.

Communication cable laying

Communication cables will be buried and directional boring will be employed under major waterways. Alternately, cables will pass over major waterways, and transferred to bridge structures as soon as practicable.

2.4.8 Phase 2 – Drainage structures, earthworks and bridges

Drainage structure construction

Installation of culverts will begin prior to cut and fill earthworks. Precast culverts may be procured from an existing supplier and transported to the construction site.

Cast in-situ culverts will require a supply of concrete from one of five concrete batch plants spread across the NGBR Project. The quantity of concrete to be produced at each batch plant for the production of culverts is quantified in Table 2-26.

Longitudinal drains will be cut by dozers or graders. Excavators and dump trucks may be utilised to excavate longitudinal drainage in areas of cut.

Table 2-26 In-situ concrete quantities (culverts)

Component	Range[1]	Quantity (m^3)
Concrete batch plant 1	3.49 km – 35 km	3,347
Concrete batch plant 2	35 km – 95 km	6,241
Concrete batch plant 3	95 – 150	1,389
Concrete batch plant 4	150 – 205	4,042
Concrete batch plant 5	205 – 310	3,079

[1] The section of the alignment that will be serviced by the concrete batch plant

Cut and fill earthworks

The volume of cut and fill along the NGBR Project is depicted in Figure 2-3. Fill will be delivered to the NGBR Project via trucks or scrapers, depending on final source locations (refer Section 2.3.8). Fill will be laid out by grader, dozers or compactors prior to compaction.

Cut activities will be dependent on the content of the material to be cut (refer Section 2.3.3). Rippable material that does not contain oversized rocks will be removed and transported by dozers and scrapers, whereas rocky material will be removed by excavator and transported by dump truck. Excavators and dump trucks will also be required where it is necessary to transport any material greater than five kilometres. Unsuitable material will be relocated to an approved location.

Blasting may be required for large excavations, however this will be determined with further geotechnical investigations. Blasting activities would make use of ammonium nitrate fuel oil (ANFO) explosives.

Cut off drains and levees will be constructed to direct water away from earthworks. Catch drains will also be installed at the top of cuttings. Batter slope protection measures, such as grass mats or shotcrete, may be applied where batter slope material is unsuitable for exposure.

Direct buried signalling cable will be installed after bulk earthworks, prior to capping layer application, to minimise any trenching through capping during signalling and communications installation (refer Section 2.4.10).

Capping layer application

The capping layer will be applied progressively, following construction of drainage structures and cut and fill earthworks for a given section of formation. Capping layer material will be taken from quarries and borrow areas in the region of the NGBR Project (refer Section 2.3.8).

The bottom capping layer will be applied as soon as possible to protect the formation from weather and vehicle damage. Capping materials may be treated to strengthen the capping layer, however this will be confirmed with further geotechnical investigations.

Bridge construction

Bridge construction will include the construction of bridges themselves and associated retaining walls and abutments. Precast bridge girders will be procured from an existing supplier and transported to the construction site.

In areas of perennial water, temporary work platforms consisting of loose rock over geofabric will be established to provide access to any intermediate piers. It is expected that no more than one intermediate pier per crossing would fall within an area of perennial water in most instances (a notable exception may be Bowen River).

Temporary low flow pipes may be required to maintain drainage flow paths and fish movements. Coffer dams may also be required around any intermediate piers to support substructure works.

In waterways where perennial water flows are likely, a crane lift may be required to undertake the erection of the span over the relevant waterway. Following construction, any temporary work platforms within the waterway will be removed and the waterway reinstated and rehabilitated by the construction contractor in accordance with conditions of the works approval permits.

Cast in-situ bridge structures will require a supply of concrete from one of five concrete batch plants spread across the NGBR Project. The quantity of concrete to be produced at each batch plant for the production of bridges is quantified in Table 2-28.

Table 2-27 In-situ concrete quantities (bridges)

Component	Chainage range[1]	Quantity (m^3)
Concrete batch plant 1	3.49 km – 35 km	7,193
Concrete batch plant 2	35 km – 95 km	5,318
Concrete batch plant 3	95 – 150	10,661
Concrete batch plant 4	150 – 205	2,960
Concrete batch plant 5	205 – 310	10,143

[1] The section of the alignment that will be serviced by the concrete batch plant

2.4.9 Phase 3 – Track laying

Welding

Short rails of 25 m length will be welded into 300 m long welded rails at the flash butt welding yard, utilising an automated flash butt welder (refer Section 2.4.5 for indicative make). Welding activities will continue for approximately 12 - 14 months.

Track and sleeper laying

Track and sleepers will be delivered to the NGBR Project by B-double trailer. The majority of the NGBR Project rail and sleepers (368.24 km) will be laid by a mechanised track laying machine (refer Section 2.4.3 for indicative make; see Figure 2-8). A train loaded with long welded rail lengths and sleepers will be connected to the mechanised track laying machine. This approach is more efficient and enables greater daily production than other track construction approaches and eliminates significant numbers of heavy truck movements over the road network, thereby improving both worker and public safety. It is expected that this work will be completed over a period of approximately eight months.

Short track components and sleepers (approximately 10 km) at the construction depots, bad order sidings, turnouts and so forth, will be laid by an excavator with octopus attachment (refer Figure 2-9). Turnouts will be constructed in this manner in advance of the arrival of the

mechanised track laying machine, to enable construction of passing loops. Track and sleeper laying at the rolling stock maintenance depot will also be constructed in this way.

Figure 2-8 Mechanised track laying machine

Figure 2-9 Excavator with octopus attachment

The main track and sleeper laying operations will require a daily supply of track construction materials and tamping (refer Table 2-28).

Table 2-28 Daily track and sleeper laying logistics

Material	Quantity	Unit
Sleeper	2,770	no.
Long welded rail lengths (300m)	12	no.
Ballast	5,994	tonnes
Tamping	8 – 10	km

Ballasting and tamping

Ballasting will be undertaken utilising a ballast train, to be loaded at ballast sidings using frontend loaders. Ballast unloading will be undertaken over three passes, while the track will be lifted in four passes by a tamper.

2.4.10 Phase 4 – Signalling and communications installation

Signalling and communications installation for the NGBR Project prior to commencement of operations will include the following activities:

- Establishment of direct buried cable route via cable ploughing
- Establishment of solar arrays to power motorised points at passing loops
- Establishment of optic fibre running to main signalling control
- Establishment of preassembled equipment buildings and cases
- Installation of axle counters for train detection.

2.5 Operation phase

2.5.1 Overview

The operation of the NGBR Project is expected commence in 2016 and reach peak capacity of 100 mtpa by 2026. The ramp up to peak capacity is shown in Table 2-29. Rail and rolling stock maintenance activities will be required throughout operation (refer Section 2.5.4).

Table 2-29 Capacity ramp up

Year	Capacity (mtpa)
2016	4
2017	20
2018	30
2019	40
2020	50
2021	60

Year	Capacity (mtpa)
2022	70
2023	80
2024	90
2025	95
2026	100

2.5.2 Rolling stock

The utilisation of the capacity of the NGBR Project will reflect the production of coal from the Carmichael Project (Mine) and utilisation by third-party users. The number of full consists and train paths per day in the ramp-up to full production was estimated by static modelling of the NGBR Project rail system (Aarvee Associates 2013), the output of which is shown in Table 2-30.

Each train path in Table 2-30 comprises one loaded movement and one unloaded movement (i.e. one return trip). Therefore, at full capacity (100 mtpa) the following will occur daily:

- 9 loaded train movements
- 9 unloaded trains movements
- 5 loaded train movements
- 5 unloaded train movements.

Unloaded trains will travel at up to 100 km per hour and loaded trains will travel at up to 80 km per hour. Within passing loops and maintenance sidings, trains will slow to 50 km per hour and 25 km per hour respective to each location.

Table 2-30 Rolling stock requirement

Capacity (mtpa)	Full consists	Train paths per day
12.5	2	1.77
25	4	3.55
30	5	4.26
50	8	7.09
60	10	8.51
100	16	14.18

2.5.3 Operational workforce

An estimate of the yearly peak workforce numbers (full-time equivalent) for each year of construction is provided in Table 2-31. This workforce would be accommodated alternately at Bowen and the Carmichael Project (Mine) camp while off-shift and on-shift respectively.

The size of the operational workforce required at any time will vary depending on the number of trains in operation. It is expected that 10 train crew members per train will be required. Up to 15 crew members per train may be necessary where trains are few in the early phase of operation.

Origin and means of transport

It is anticipated that the majority of the operational workforce will be based out of Bowen, with overnight accommodation provided at the Carmichael Project (Mine) camp for changes in shift. A small number of drivers may be based at the yards and provisioning facilities.

Shift pattern

Cycle times show that crews working the loaded trains would work a 12 hour shift, with change-overs occurring at the mine-end and port-end respectively.

Table 2-31 Operational workforce requirements

Occupation	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Management and administration	17	17	17	17	17	17	22	22	22	22	22
Rolling Stock Maintenance Crew	8	8	16	16	20	20	35	35	35	35	35
Track Maintenance Crew	10	10	20	20	40	40	40	40	40	40	40
S&C Maintenance Crew	4	4	4	8	8	12	12	12	12	12	12
Train Crew Trainers	2	2	3	4	5	5	6	6	6	6	6
Compliance and Safety Officers	2	2	3	3	3	3	6	6	6	6	6
Train Control Controllers	6	6	8	12	12	12	18	18	18	18	18
Operations Planner	2	2	3	3	3	3	6	6	6	6	6
Train Crew Superintendent	1	1	2	2	2	2	4	4	4	4	4
Train Crew	14	51	65	88	99	140	166	178	201	212	220
Total	**66**	**103**	**141**	**173**	**209**	**254**	**315**	**327**	**350**	**361**	**369**

2.5.4 Maintenance

Maintenance activities throughout operation include the following:

- Rolling stock maintenance, including:
  - Unit train maintenance
  - Block maintenance
- Track maintenance, including:
  - Routine maintenance
  - Major periodic maintenance
  - Emergency response.

Hazardous substances to be delivered to site during operation are discussed in Volume 1 Chapter 18 Hazard, risk, health and safety.

Maintenance infrastructure

There are several anticipated construction legacies that will be utilised for maintenance activities, including:

- Haul and access roads – for repurpose as maintenance access roads, as necessary, and storage of maintenance materials
- Track work at construction depots and bad order sidings and rail loops – for stabling of track maintenance plant
- Ballast siding at construction depots and construction yard – for reduction and use for storage of maintenance materials, as well as stabling of track maintenance plant
- Passing loop locations – for storage of turnout components by prefabricating panel or complete system on site
- Buildings – for administrative requirements of maintenance teams.

Rolling stock maintenance

Train unit maintenance will be conducted on-track or at the rolling stock maintenance depot, on-track and generally over 12 hours, subject to the number of repairs identified. Locomotives can be maintained in situ or replaced by a maintenance spare for more extensive services. Wagons requiring wheel repairs will be hydro-lifted in situ to maximize asset utilization. Locomotives and wagons that cannot be maintained during unit train maintenance will be shunted-off for shed servicing.

Block maintenance will be conducted at the rolling stock maintenance depot. Trains entering the rolling stock maintenance depot for block maintenance will attach to a lead block of 40 wagons and a locomotive at the outgoing departure signal. After attaching at the lead, a rail vehicle placer will haul the blocks of 40 wagons and a locomotive back and place in maintenance arrival lines. Wagons previously placed on the entry side of the wagon repair lines will progress along the line after receiving scheduled attention and repairs. Up to 40 wagons will be held on the wagon repair exit lines after maintenance is complete. After block maintenance, a locomotive and 40 wagons will be placed ready for the next scheduled block change-out attachment.

The rolling stock maintenance depot will require 105,000 L of water per month for train washing, plus 150,000 L of potable water. Water demand at the rolling stock maintenance depot will be met by capturing and treating rainwater. Prior to use, rain water will be treated by removal of

solids, oil separation, disinfection, filtration and chlorine dosing. Runoff from wash-down activities will be captured and treated by the same process.

Track maintenance

The primary on-going maintenance activities include:

- Track inspections and repairs
- Signal compliance and operations checks
- Structures inspections and repairs (both bridge and drainage)
- Turnout maintenance
- Minor faults and defect repair works
- First contact emergency response.

The primary major periodic maintenance activities include:

- Structures cleaning and repairs
- Drainage works
- Rerailing
- Turnout replacement
- Rail grinding
- Resurfacing
- Rail stress management
- Re-ballasting.

Emergency response activities will be governed by an emergency management plan. A preliminary emergency management plan has been developed for the NGBR Project and is included in Volume 2 Appendix P Environmental management plan framework. The emergency management plan imposes the following emergency requirements for emergency preparedness:

- Safety in design, under the *Work Health and Safety Act 2011*
- Fire safety, achieved through a fire management sub-plan
- Contractor emergency sub-plan, to respond to accidents involving contractors
- Emergency specific plans, including
  - Vehicle accident response
  - Spill response
  - Train derailment or collision response
  - Natural hazard response.

The emergency management plan also defines an emergency response team, necessary equipment and training measures, all required to reliably implement the plan.

2.6 Decommissioning and rehabilitation

Material cleared during construction is planned to be chipped, mulched and stockpiled for reuse during progressive rehabilitation. Materials with special habitat value, such as hollow bearing

logs or trees, will be selectively removed for reuse during rehabilitation, or placed in nearby bushland. Topsoil will be stockpiled where practicable, for future use in rehabilitation.

A decommissioning and rehabilitation management plan will be developed for areas temporarily disturbed during construction. These areas include:

- Construction camps
- Borrow areas
- Stockpiles
- Haul roads and access roads
- Turkey nest dams
- Laydown areas
- Turning circles
- Temporary work platforms/hardstands

Temporary construction infrastructure will be decommissioned as soon as they cease to serve their intended purpose. It is noted that some haul roads and access roads will be repurposed as permanent maintenance roads. Turkey nest dams may also be retained, subject to consultation with landholders.

The decommissioning and rehabilitation management plan for temporarily disturbed areas will include landform design and completion criteria. Specific rehabilitation measures include:

- Removal of potentially hazardous stored substances
- Reuse, recycling or disposal option for removed facilities, structures and materials
- Remediation of any contaminated areas
- Regrading of landscape to a state consistent with natural environment
- Ripping of compacted areas
- Application of topsoil and revegetation with native species
- Application of materials with special habitat value, such as hollow bearing logs or trees
- Creation of supplementary habitats, such as nesting boxing, where necessary
- Weed control during reestablishment of vegetation
- Monitoring and other checks will be undertaken to confirm that completion criteria are met. These measures will be detailed in the decommissioning and rehabilitation management plan and will include: Hazardous material and contamination audit
- Monitoring and comparison with analogue site
- Certification by appropriately qualified person

Further decommissioning activities will occur at the end of the 90 year life of the NGBR Project. Rehabilitation will be planned and refined throughout the life of the NGBR Project and incorporated into the decommissioning and rehabilitation plan. This will enable compliance with any legislated requirements closer to the time of intended end-of-life decommissioning.