APPENDIX

K

Borrow pit rehabilitation strategy

NARROMINE TO NARRABRI ENVIRONMENTAL IMPACT STATEMENT

INLAND RAIL

ARTC

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

ARTC Inland Rail

Narromine to Narrabri Project

Borrow Pit Rehabilitation Strategy

Appendix K

2-0001-250-ELE-00-RP-0003

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Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

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Glossary and abbreviations

Acronym/term	Definition
ANZMEC	Australian and New Zealand Minerals and Energy Council
ARTC	Australian Rail Track Corporation
Borrow pit	An area which has been excavated to extract materials for use in another location for the purposes of construction.
CEMP	Construction environmental management plan
DMP	Department of Mines and Petroleum
DPIE	Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
GIS	Geographic Information Systems
landscape	All aspects of a tract of land, including landform, vegetation, buildings, villages, towns, cities and infrastructure.
LEP	Local environmental plan
LGA	Local Government Area
MCA	Minerals Council of Australia
NSW	New South Wales
OEH	(former) Office of Environment and Heritage
PCT	Plant community type
the proposal	Defined as the construction and operation of the Narromine to Narrabri section of Inland Rail.
the proposal site	Defined as the area that would be directly affected by construction of the proposal (also known as the construction footprint). It includes the location of proposal infrastructure, the area that would be directly disturbed by the movement of construction plant and machinery, and the location of the compounds and laydown areas that would be used during construction.
rail corridor	The corridor within which the rail tracks and associated infrastructure would be located.
Rehabilitation	Rehabilitation is the process of making a former construction site safe, stable, self-sustaining, non-polluting, and free-draining.
Revegetation	The process of assisting the re-establishment and development of vegetation on cleared land and areas disturbed during construction. Revegetation seeks to reinstate and restore vegetation cover to highly modified areas. The vegetation can also assist in soil stabilisation.
SEARs	Secretary Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SSI	State Significant Infrastructure
TfNSW	Transport for New South Wales

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1. Introduction

1.1 Overview

1.1.1 Inland Rail and the proposal

The Australian Government has committed to delivering a significant piece of national transport infrastructure by constructing a high performance and direct interstate freight rail corridor between Melbourne and Brisbane, via central-west New South Wales (NSW) and Toowoomba in Queensland. Inland Rail is a major national program that will enhance Australia's existing national rail network and serve the interstate freight market.

The Inland Rail route, which is about 1,700 kilometres long, involves:

- using the existing interstate rail line through Victoria and southern NSW
- upgrading about 400 kilometres of existing track, mainly in western NSW
- providing about 600 kilometres of new track in NSW and south-east Queensland.

The Inland Rail program has been divided into 13 sections, seven of which are located in NSW. Each of these projects can be delivered and operated independently with tie-in points on the existing railway.

Australian Rail Track Corporation Ltd (ARTC) ('the proponent') is seeking approval to construct and operate the Narromine to Narrabri section of Inland Rail ('the proposal').

1.1.2 Approval and assessment requirements

The proposal is State significant infrastructure and is subject to approval by the NSW Minister for Planning and Public Spaces under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The proposal is also determined to be a controlled action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and requires approval from the Australian Minister for the Environment.

This report has been prepared by the JacobsGHD Joint Venture as part of the environmental impact statement (EIS) for the proposal. The EIS has been prepared to support the application for approval of the proposal, and address the environmental assessment requirements of the Secretary of the NSW Department of Planning, Industry and Environment (the SEARs), dated 9 September 2020.

1.2 The proposal

The proposal consists of about 306 kilometres of new single-track standard gauge railway with crossing loops. The proposal also includes changes to some roads to facilitate construction and operation of the new section of railway, and ancillary infrastructure to support the proposal.

The proposal would be constructed to accommodate double-stacked freight trains up to 1,800 metres long and 6.5 metres high. It would include infrastructure to accommodate possible future augmentation and upgrades of the track, including a possible future requirement for 3,600 metre long trains.

The land requirements for the proposal would include a new rail corridor with a minimum width of 40 metres, with some variation to accommodate particular infrastructure and to cater for local topography. The corridor would be of sufficient width to accommodate the infrastructure currently proposed for construction, as well as possible future expansion of crossing loops for 3,600 metre long trains. Clearing of the proposal site would occur to allow for construction and to maintain the safe operation of the railway.

1.2.1 Location

The proposal would be located between the towns of Narromine and Narrabri in NSW. The proposal would link the Parkes to Narromine section of Inland Rail located in central western NSW, with the Narrabri to North Star section of Inland Rail located in north-west NSW.

The location of the proposal is shown in Figure 1.1

1.2.2 Key features

Key design features of the proposal include:

Rail infrastructure

- a new 306 kilometre long rail corridor between Narromine and Narrabri
- a single-track standard gauge railway and track formation within the new rail corridor
- seven crossing loops, at Burroway, Balladoran, Curban, Black Hollow/Quanda, Baradine, The Pilliga and Bohena Creek
- bridges over rivers and other watercourses (including the Macquarie River, Castlereagh River and the Namoi River/Narrabri Creek system), floodplains and roads
- level crossings
- new rail connections and possible future connections with existing ARTC and Country Regional Network rail lines, including a new 1.2 kilometre long rail junction between the Parkes to Narromine section of Inland Rail and the existing Narromine to Cobar Line (the Narromine West connection)

Road infrastructure

- road realignments at various locations, including realignment of the Pilliga Forest Way for a distance of 6.7 kilometres
- limited road closures.

The key features of the proposal are shown in Figure 1.2.

Ancillary infrastructure to support the proposal would include signalling and communications, drainage, signage and fencing, and services and utilities.

Further information on the proposal is provided in the EIS.

Figure 1.1 **Location of the proposal**

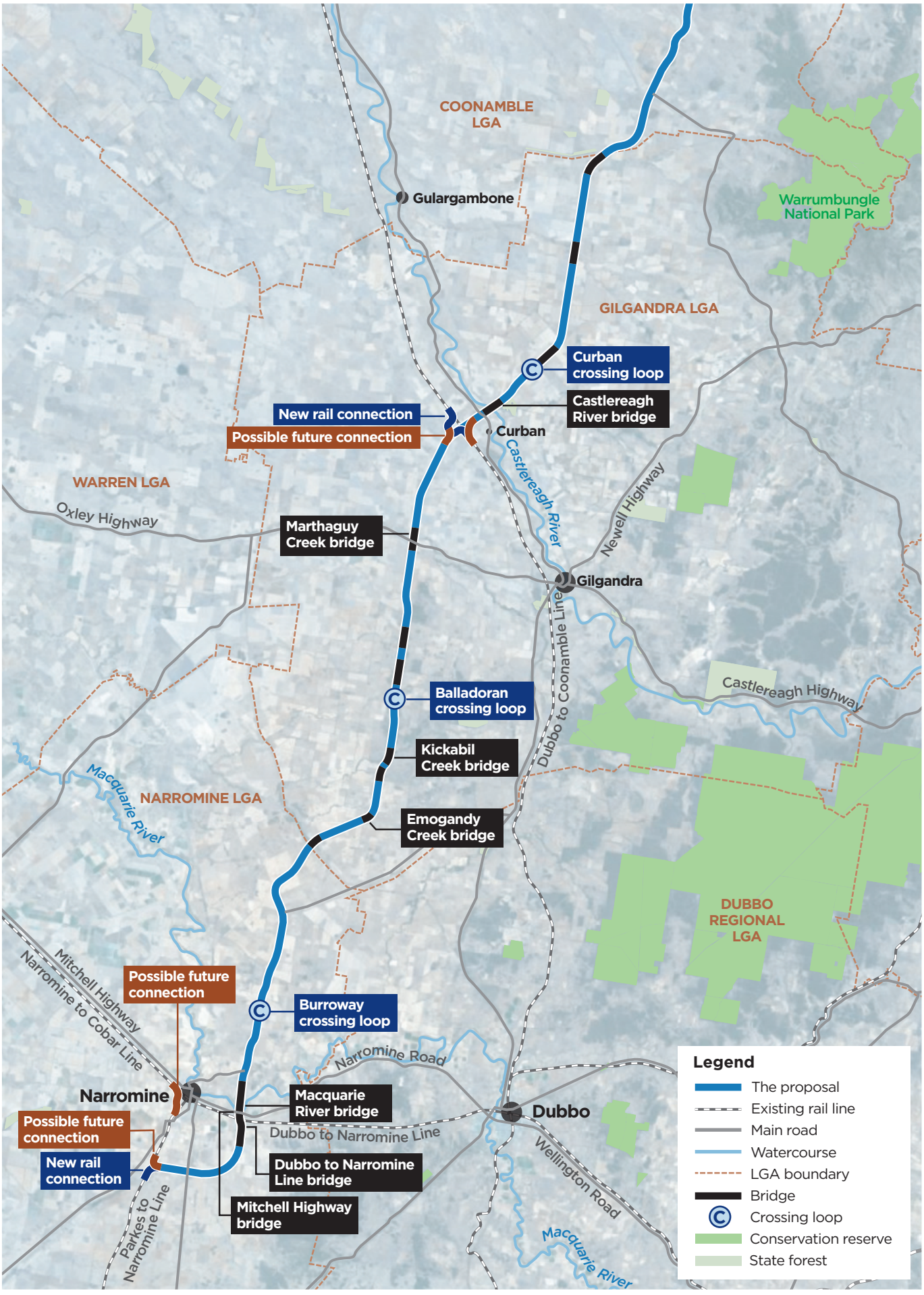

Figure 1.2a **Key features of the proposal**

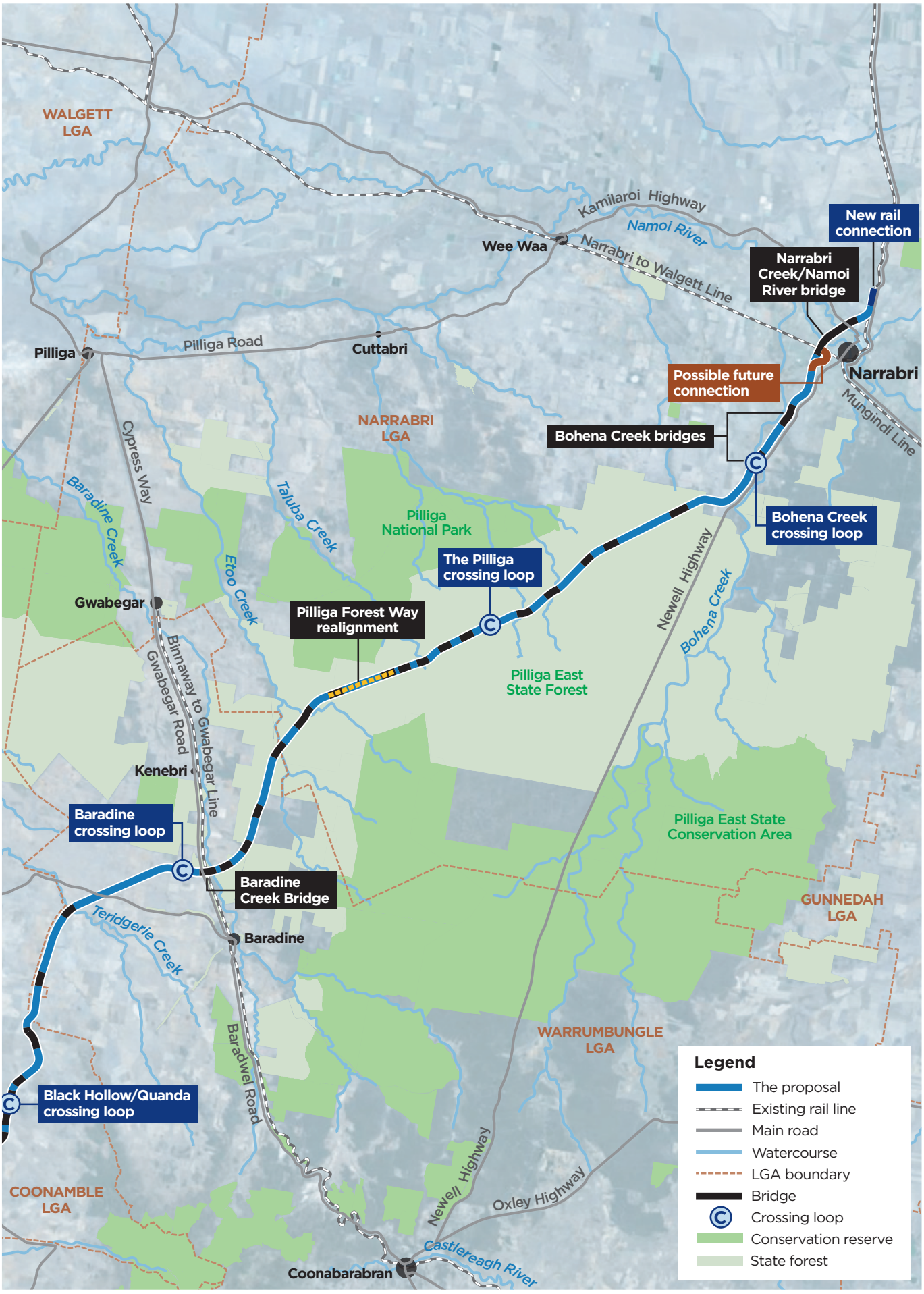

Figure 1.2b **Key features of the proposal**

1.2.3 Construction overview

An indicative construction strategy has been developed based on the current reference design to be used as a basis for the environmental assessment process. Detailed construction planning, including programming, work methodologies, staging and work sequencing would be undertaken once construction contractor(s) have been engaged and during detailed design.

Timing and work phases

Construction of the proposal would involve five main phases of work as outlined in Table 1.1. It is anticipated that the first phase would commence in late 2021, and construction would be completed in 2025.

Table 1.1 Main construction phases and indicative activities

Phase	Indicative construction activities
Pre-construction	• Establishment of areas to receive early material deliveries • Delivery of certain materials that need to be bought to site before the main construction work
Site establishment	• Establishment of key construction infrastructure, work areas and other construction facilities • Installing environmental controls, fencing and site services • Preliminary activities including clearing/trimming of vegetation
Main construction works	• Construction of the proposed rail and road infrastructure, including earthworks, track, bridge and road works
Testing and commissioning	• Testing and commissioning of the rail line and communications and signalling systems
Finishing and rehabilitation	• Demobilisation and decommissioning of construction compounds and other construction infrastructure • Restoration and rehabilitation of disturbed areas

Key construction infrastructure

The following key infrastructure is proposed to support construction of the proposal:

- borrow pits:
  - borrow pit A – Tantitha Road, Narromine
  - borrow pit B – Tomingley Road, Narromine
  - borrow pit C – Euromedah Road, Narromine
  - borrow pit D – Perimeter Road, Narrabri
- three main compounds, which would include a range of facilities to support construction ('multi-function compounds'), located at:
  - Narromine South
  - Curban
  - Narrabri West
- temporary workforce accommodation for the construction workforce:
  - within the Narromine South multi-function compound
  - Narromine North
  - Gilgandra
  - Baradine
  - within the Narrabri West multi-function compound.

The key construction infrastructure are shown in Figure 1.3.

Other construction infrastructure would include a number of smaller compounds of various sizes located along the proposal site, concrete batching plants, laydown areas, welding yards, a concrete pre-cast facility and groundwater bores for construction water supply.

1.2.4 Operation

The proposal would form part of the rail network managed and maintained by ARTC. Train services would be provided by a variety of operators. Inland Rail as a whole would be operational once all 13 sections are complete, which is estimated to be in 2025.

It is estimated that Inland Rail would be trafficked by an average of 10 trains per day (both directions) in 2025, increasing to about 14 trains per day (both directions) in 2040. This rail traffic would be in addition to the existing rail traffic using other lines that the proposal interacts with.

The trains would be a mix of grain, bulk freight, and other general transport trains. Total annual freight tonnages would be about 10 million tonnes in 2025, increasing to about 17.5 million tonnes in 2040.

Train speeds would vary according to axle loads, and range from 80 to 115 kilometres per hour.

1.3 Purpose and scope of this report

The purpose of this report is to assess the potential borrow pit impacts from constructing and operating the proposal. The report:

- addresses the relevant SEARs listed in Table 1.2
- describes the existing environment with respect to borrow pits
- assesses the impacts of constructing and operating the proposal on borrow pits
- recommends measures to mitigate and manage the impacts identified.

The methodology for the assessment is described in section 3.

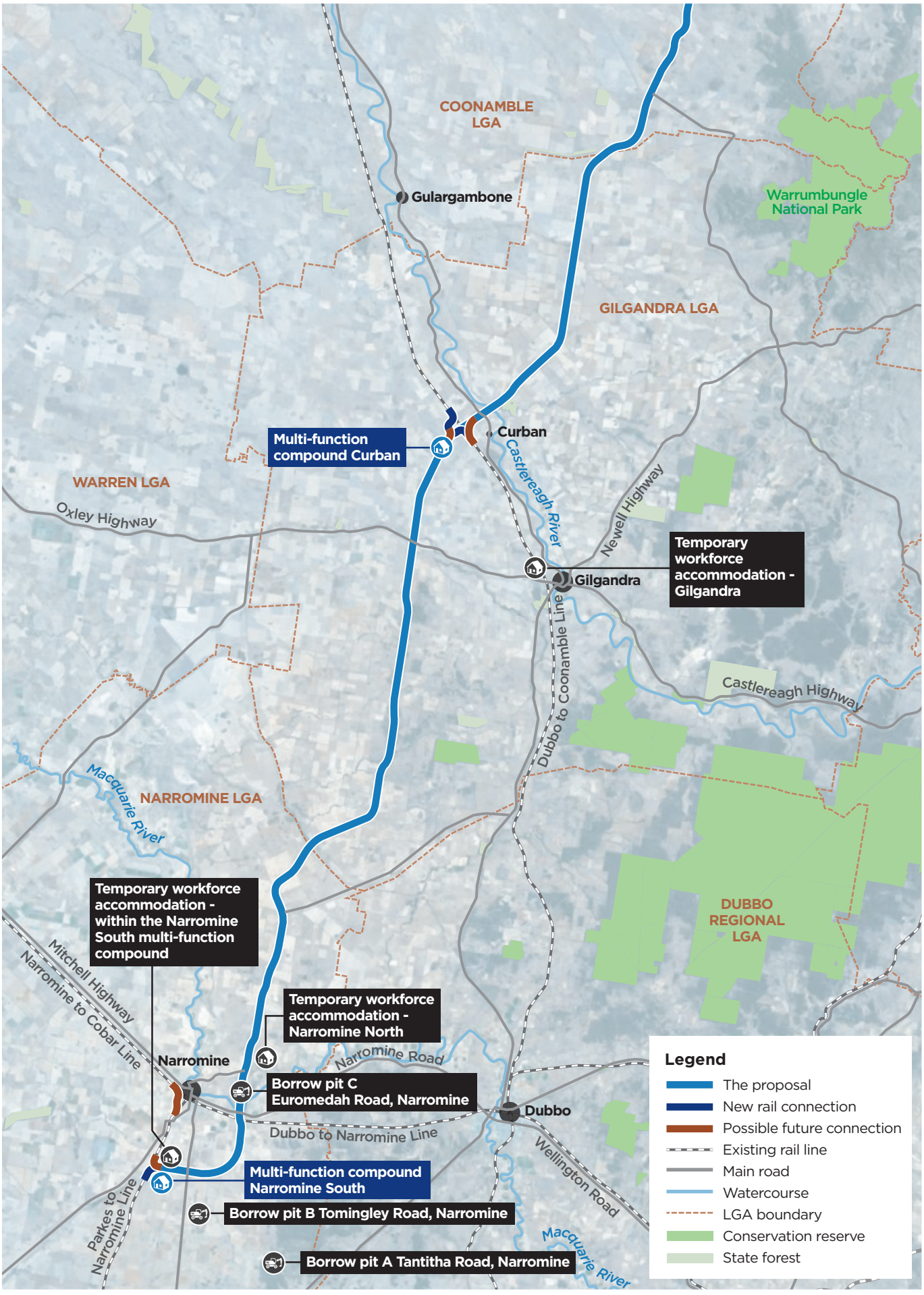

Figure 1.3a **Key construction infrastructure**

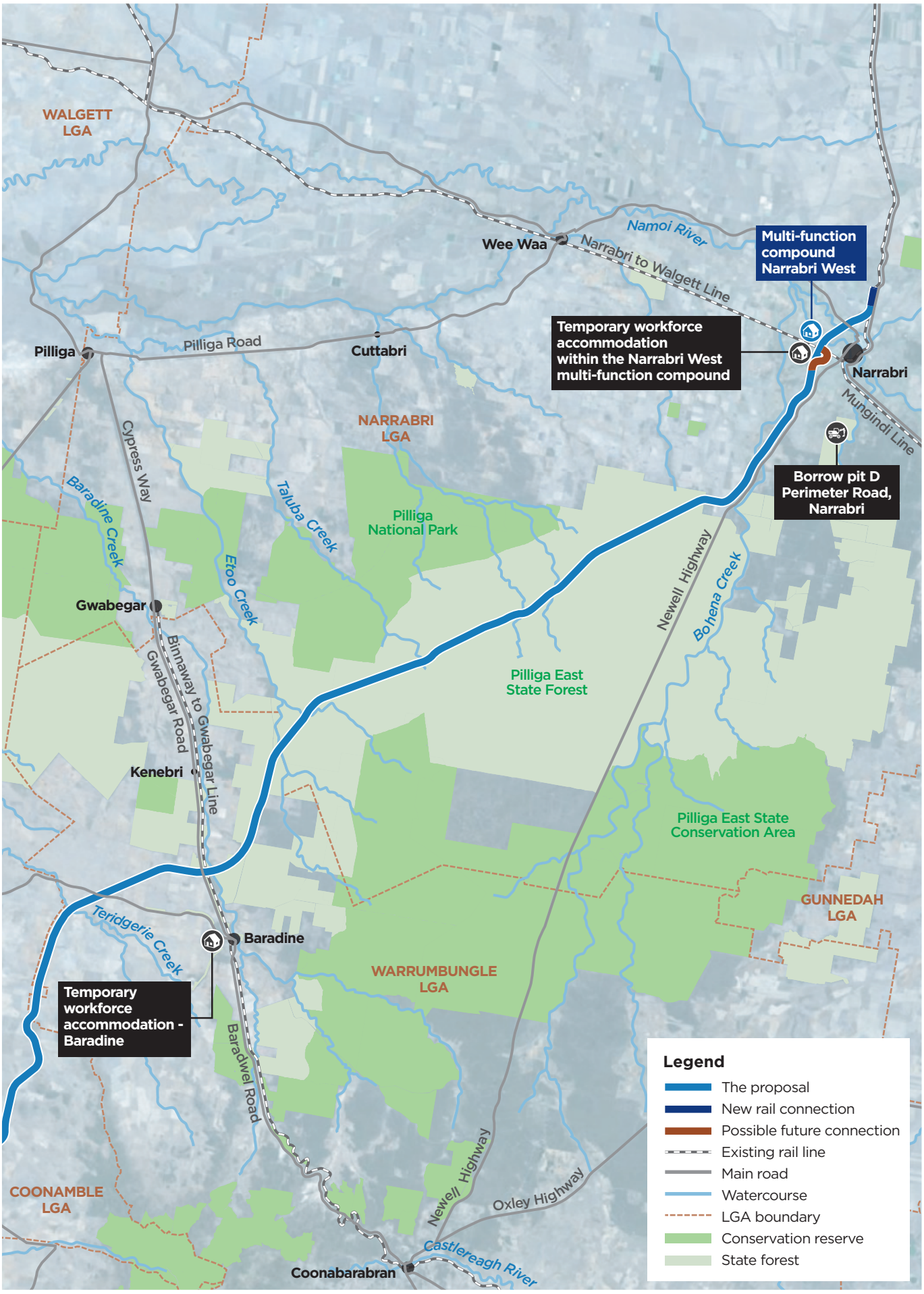

Figure 1.3b **Key construction infrastructure**

Table 1.2 Applicable SEARs

SEAR number	Requirements	Where addressed in this report
17.1	The Proponent must provide a rehabilitation strategy for the borrow sites having regard to: (a) Rehabilitation objectives, methodology, monitoring programs, performance standards and proposed completion criteria;	The rehabilitation objectives are listed in section 4.3. Section 3.4 sets out the methodology used to gather and assess site information in order to inform site specific approaches to the rehabilitation strategy. Recommendations for a monitoring program are detailed in section 5.3. Environmental performance standards and indicators in relation to the rehabilitation objectives are outlined in section 5.2, in Table 5.1, in which the indicative completion criteria are also addressed.
	(a) Nominated final land use and landform having regard to any relevant strategic land use planning or resource management plans or policies; and	A rehabilitation overview has been laid out in Section 4, in which the nominated final land use and landform are addressed in section 4.1. This report and its recommendations have been written in accordance with the local planning policy framework covered in section 2.2, as well as relevant guidelines that have been used to inform the structure and content of the report, as referred to in section 2.3.
17.2	The potential for integrating this strategy with other rehabilitation and / or offset strategies in the region.	Section 6.2 outlines the opportunities for integration of this strategy with other rehabilitation and / or offset strategies in the region during the detailed design stage.

1.4 Structure of this report

The structure of the report is outlined below.

- Section 1 – Introduction. Provides an introduction to the report, including a description of the proposal and scope of this report.
- Section 2 – Legislation and guidelines. Outlines a range of legislation, guidelines and frameworks relevant to this report.
- Section 3 – Context. Describes the context of the sites and proposed works.
- Section 4 – Rehabilitation overview. Gives an overview of the nominated final land use and rehabilitation objectives.
- Section 5 – Environmental performance standards. Outlines the rehabilitation management strategy, monitoring, and completion criteria.
- Section 6 – Implementation. Summarises the key points of the report and recommendations for the future.
- Section 7 – References.
- Appendix A – Borrow Pit Context Landscape Plans and Indicative Planting Plans. Contains context plans showing borrow pits and access roads in relation to nearby public roads, and indicative planting plans showing the indicative placement of specified revegetation mixes.
- Appendix B – Indicative Planting Schedules. Contains schedules of the suggested plant mixes for revegetation of each borrow pit site and access road.

2. Legislation and guidelines

2.1 Legislation

2.1.1 Environmental Planning and Assessment Act 1979

The proposal is State Significant Infrastructure (SSI) by operation of Division 5.2 of the EP&A Act. As State significant infrastructure, the proposal needs approval from the NSW Minister for Planning and Public Spaces, and the application for approval must be supported by an EIS. The EIS should be prepared having regard to the SEARs, which have been issued for that purpose by the Secretary of Department of Planning, Industry and Environment (DPIE).

Local environmental plans (LEPs) do not apply to SSI. However, in order to consider local planning approaches to rehabilitation, below is an outline of the relevant LEPs insofar as they may be relevant post-rehabilitation.

2.2 Local planning policy framework

The proposed borrow pit sites fall within two local government areas (LGAs), borrow pits A, B, and C being within the Shire of Narromine, and borrow pit D being within the Shire of Narrabri.

All four borrow pits are located on land zoned as RU1 – Primary Production.

2.2.1 *Narromine Local Environmental Plan 2011*

The aims of the Narromine LEP relevant to landscape rehabilitation include the following:

- to protect and conserve the natural environment including surface and ground water, soil, air and native vegetation by encouraging sustainable development.

Narromine LEP zones and objectives relevant to the borrow pit sites and access roads are outlined in Table 2.1.

Table 2.1 Land use zones within Narromine LEP relevant to borrow pit sites A, B and C

Zone	Objectives
RU1 – Primary Production	• To encourage sustainable primary industry production by maintaining and enhancing the natural resource base. • To encourage diversity in primary industry enterprises and systems appropriate for the area. • To minimise the fragmentation and alienation of resource lands. • To minimise conflict between land uses within this zone and land uses within adjoining zones.

2.2.2 *Narrabri Local Environmental Plan 2012*

Relevant aims of the Narrabri LEP include the following:

- to encourage the orderly management, development and conservation of resources by protecting, enhancing and conserving:
  - timber, minerals, soil, water and other natural resources, and
  - areas of high scenic or recreational value, and
  - native plants and animals including threatened species, populations and ecological communities, and their habitats, and
  - places and buildings of heritage significance.

Narrabri LEP objectives relevant to the borrow pit site and access road are outlined in Table 2.2.

Table 2.2 Land use zones within Narrabri LEP relevant to borrow pit site D

Zone	Objectives
RU1 – Primary Production	• To minimise conflict between land uses within this zone and land uses within adjoining zones. • To encourage diversity in primary industry enterprises and systems appropriate for the area. • To minimise the fragmentation and alienation of resource lands. • To minimise conflict between land uses within this zone and land uses within adjoining zones. • To allow for non-agricultural land uses that will not restrict the use of other land for agricultural purposes.

2.3 Guidelines

The *Strategic Framework for Mine Closure* (ANZMEC and MCA, 2000) evolved as a cooperative development between the Australian and New Zealand Minerals and Energy Council (ANZMEC) and the Australian Minerals Industry (represented by the Minerals Council of Australia (MCA)). It is designed to provide a broadly consistent framework for mine closure across the various Australian jurisdictions. It has since evolved into the *Enduring Value Framework 2015* (MCA, 2015). From this a series of handbooks have been developed as part of the Leading Practice Sustainable Development Program for the Mining Industry. The handbooks relevant to the proposal, and that have been used to inform the structure and content of this strategy, are discussed below.

Additionally, guidelines for the operation, management and rehabilitation of the borrow pits as quarries have been considered as the borrow pits may also be classified as quarries.

2.3.1 *Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry*

The *Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry* (Department of Industry, Innovation and Science, 2016a) handbook outlines the principles and leading practices of mine rehabilitation, with emphasis on land form design and revegetation.

The sections that have informed the structure and content of this report include:

- Section 2 – The importance of mine rehabilitation
- Section 3 – Rehabilitation success
- Section 4 – Rehabilitation planning
  - Section 4.2.2 – Topsoils
  - Section 4.3 – Landform design
- Section 5 – Rehabilitation implementation
- Section 6 – Monitoring performance.

2.3.2 *Mine Closure – Leading Practice Sustainable Development Program for the Mining Industry*

The *Mine Closure - Leading Practice Sustainable Development Program for the Mining Industry* (Department of Industry, Innovation and Science, 2016b) handbook outlines the principles and leading practices of mine closure and completion, a broader issue that includes rehabilitation. The document's main emphasis is on appropriate planning for closure and completion.

The sections relevant to, and that have been used to structure and inform the content of, this report include:

- Section 2 – Sustainable development
  - Section 2.1 – Sustainable development issues for closure
  - Section 2.2 – Closure objectives, strategy and context
  - Section 2.3 – Managing closure risk
- Section 3 Whole of life mine phases
  - Section 3.4 – Construction/commissioning
  - Section 3.5 – Operations
  - Section 3.6 – Decommissioning and closure
- Section 4 Planning during operational phase: a more detailed look
  - Section 4.1 – Operations commissioning stage
  - Section 4.2 – Mature operations stage
- Section 5 – Mine completion and relinquishment
  - Section 5.2 – Post-closure management requirements.

This handbook also addresses financial provisioning for successful mine closure and completion, which is relevant to this strategy and should be referred to in the development of the detailed rehabilitation management plan post-approval.

2.3.3 *Guidelines for Preparing Mine Closure Plans*

The aim of the *Guidelines for Preparing Mine Closure Plans* (Department of Mines and Petroleum (DMP) and the Environmental Protection Authority of Western Australia, 2015) is to ensure that a planning process is in place for every mine in Western Australia, so that the mine can be closed, decommissioned, and rehabilitated to meet DMP and the Environmental Protection Authority of Western Australia's objectives for rehabilitation and closure. While the proposal is not situated in WA, it is acknowledged that these guidelines represent leading practice in Australia for mine closure and rehabilitation, and as such are relevant to this strategy and have been used to inform the structure, recommendations and content of this report.

2.3.4 *Extractive Industries Quarries EIS Guideline*

This guideline identifies some important factors to be considered when preparing an EIS, relating to quarries and other extractive industries proposals. It presents the information requirements for an EIS for quarries or other excavation proposals.

The borrow pits are excavations for fill materials which are classified as extractive materials. As such, while mining guidelines are relevant to the operation and rehabilitation of the borrow pits, they should also be considered as quarries. Hence, regulations and guidelines for quarries in NSW are important to this document. *Extractive Industries Quarries EIS Guideline* (Department of Urban Affairs and Planning, 1996) outlines the required areas of consideration in assembling this strategy as well as the EIS as a whole, and as such it has been used to inform the content and structure of this report.

2.3.5 *Managing Urban Stormwater: Soils and Construction Volume 1*

Commonly known as “The Blue Book”, *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004) aims to provide “guidelines that will help mitigate the impacts of land disturbance activities on soils, landforms and receiving waters by focussing on erosion and sediment control.”

The sections and guidelines that are relevant to this report include:

- Section 1:
  - Section 1.6 – General Principles of Soil and Water Management
- Section 2:
  - Section 2.2 – Erosion and Sediment Control Plans (ESCPs)
- Section 4:
  - Section 4.3 – Handling soils
  - Section 4.4 – Special Considerations for SWMPs
- Section 6 – Sediment and Waste Control:
  - Section 6.1.2 – Pollutants
  - Section 6.1.3 – General Recommendations
  - Section 6.2 – Waste Control
  - Section 6.3 – Sediment Control
- Section 7 – Site Stabilisation:
  - Section 7.2 – Revegetation: Lands Subjected to Sheet Flow
- Section 8 – Maintenance:

  These sections of The Blue Book have been used to inform the content of this report, and its recommendations for erosion and sediment control as noted in ensuing sections of the report. It should also be referred to and inform the development of the detailed rehabilitation management plan post-approval.

2.3.6 *Managing Urban Stormwater: Soils and Construction Volume 2C Unsealed Roads*

The purpose of *Managing Urban Stormwater: Soils and Construction Volume 2C Unsealed Roads* (Department of Environment and Climate Change NSW, 2008a) is to provide guidelines, principles and recommended design standards for good management practice in erosion and sediment control for unsealed roads. Sections that have been used in developing the recommendations of this report include:

- Section 5.10 – Borrow areas for fill material.

2.3.7 *Managing Urban Stormwater: Soils and Construction Volume 2E Mines and Quarries*

The purpose of *Managing Urban Stormwater: Soils and Construction Volume 2E Mines and Quarries* (Department of Environment and Climate Change NSW, 2008b) is to provide guidelines, principles and recommended minimum design standards for erosion and sediment control at mines and quarries. This handbook is intended to be read and used in conjunction with The Blue Book (Landcom, 2004), and consequently has been used in conjunction with The Blue Book to inform the recommended erosion and sediment controls in this report as noted in ensuing sections.

2.3.8 *Exploration Code of Practice: Rehabilitation*

Exploration licences and assessment leases for all resources are granted with the objective of encouraging ecologically sustainable development, social responsibility and building economic wealth for the people of NSW. The *Exploration Code of Practice: Rehabilitation* (NSW Department of Planning and Environment, 2017) sets out mandatory requirements and provides title holders with related guidance regarding the expected performance to ensure that exploration is undertaken in a manner that manages and minimises risk and achieves sustainable rehabilitation outcomes.

NOTE: at the time of writing, the NSW Resources Regulator (Division of Resources and Geoscience, Department of Planning, Industry and Environment) is implementing policy and operational reforms into mine rehabilitation planning and implementation governance.

The overall objective of the reforms is to set clearer, more focused rehabilitation requirements throughout the mine life to ensure progressive rehabilitation occurs and sustainable post-mining land use outcomes are achieved. The mining lease conditions relating to environmental management and rehabilitation have been reviewed to improve clarity and enforceability in relation to the following requirements:

- progressive rehabilitation
- rehabilitation risk assessment and risk management
- annual reporting and scheduling of rehabilitation in the form of an Annual Rehabilitation Report and Forward Program
- a Rehabilitation Management Plan which includes rehabilitation objectives and completion criteria and a final landform and rehabilitation plan
- rehabilitation records.

Reform guidance documents that may be applicable to the proposal include:

- *Code of Practice: Rehabilitation Management Plan for Small Mines* (Consultation draft July 2018). (NSW Department of Planning and Environment, 2018).
- *Code of Practice: Annual Rehabilitation Report and Forward Program for Small Mines* (Consultation draft July 2018). (NSW Department of Planning and Environment, 2018a).

The former document will replace the Mining Operations Plan (MOP), while the latter document will replace the Annual Environmental Management Plan. Five supporting guidelines have also been developed to assist leaseholders' transition through the reforms.

The above would be considered for guidance when developing the detailed rehabilitation management plan post-approval.

2.3.9 *Central West Regional Strategic Weed Management Plan 2017-2022*

Relevant aims of the *Central West Regional Strategic Weed Management Plan 2017-2022* (NSW Local Land Services, 2017), that have been referred to in the development of this report and its recommendations include the following:

- managing weeds that impact:
  - animal and plant industries, including agriculture, horticulture, forestry, aquaculture and recreational and commercial fishing in freshwater systems
  - ecological communities and biodiversity, including natural urban and peri-urban environments
  - human health, livelihood, lifestyle, cultural values, recreation and landscape amenity"

- preventing new weeds from entering the region
- eradicating or containing the spread of weeds that do establish.

2.3.10 *Narrabri Shire Growth Management Strategy 2009*

It is noted in the *Narrabri Shire Growth Management Strategy 2009* (Edge Land Planning, 2009) that as well as contributing to scenic and landscape values, *"rural lands have a range of social, economic and environmental values including agriculture, extractive resources, water resources, environmental services (such as water quality management), tourism, housing, conservation, landscape values and sustaining rural communities."*

2.3.11 *Transport for NSW Sustainable Design Guidelines Version 4.0*

The *Transport for NSW* (TfNSW) *Sustainable Design Guidelines* (the guidelines) *Version 4.0* (TfNSW, 2017) seek to deliver sustainable development practices by embedding sustainability initiatives into the planning, design, construction, operations and maintenance of transport infrastructure projects.

Requirements that have been used to inform the structure and content of this strategy, and are relevant to landscape rehabilitation are as follows:

- Vegetation Offsets:
  - All projects with non-significant biodiversity impacts to comply with the Infrastructure and Services Vegetation Offset Guide as applicable.
- Urban Design:
  - All projects to address the urban design principles in the TfNSW Interim Urban Design Best Practice Guidelines within their urban design and landscaping plan (UDLP) or equivalent:
    - *Principle 1 – Draw on a comprehensive site and context analysis to inform the design direction.*
    - *Principle 4 – Integrate the project with the surrounding area.*
    - *Principle 7 – Maximise positive view opportunities.*

2.3.12 *Inland Rail Landscape and Rehabilitation Framework*

The *Inland Rail Landscape and Rehabilitation Framework* (ARTC, 2019b) supports the *Inland Rail Landscape and Rehabilitation Strategy* (ARTC, 2019c) and establishes governing landscape objectives and principles and describes the overarching approach to meeting landscape obligations and commitments for the proposal. The performance outcomes outlined in the document are to inform subsequent project specific completion criteria which will be further detailed in subsequent management plans.

2.3.13 *Inland Rail Landscape and Rehabilitation Strategy*

Inland Rail has a legal, social and environmental responsibility to ensure that the design, construction and operation of the proposal minimises adverse impacts to the environment. The *Inland Rail Landscape and Rehabilitation Strategy* (ARTC, 2019c) documents Inland Rail's approach to meeting these obligations and establishes governing landscape objectives and principles. This strategy also outlines landscape and rehabilitation treatment solutions for the various phases of the program. The solutions outlined for borrow pits are relevant to this report, and have been used to guide the content, structure and recommendations of this report.

2.3.14 *Inland Rail Contamination, Spoil and Waste Strategy*

Inland Rail has a legal, social and environmental responsibility to ensure that the design, construction and operation of the proposal minimises adverse impacts to the environment. The *Inland Rail Contamination, Spoil and Waste Strategy* (ARTC, 2019a) documents Inland Rail's approach to meeting these obligations and establishes governing contamination, spoil and waste objectives and principles. This strategy also outlines landscape and rehabilitation treatment solutions for the various phases of the program. The solutions outlined for borrow pits have been used to guide the content and recommendations of this report.

2.4 Hierarchy of documents

The hierarchy of documents informing and informed by this document is shown in Figure 2.1.

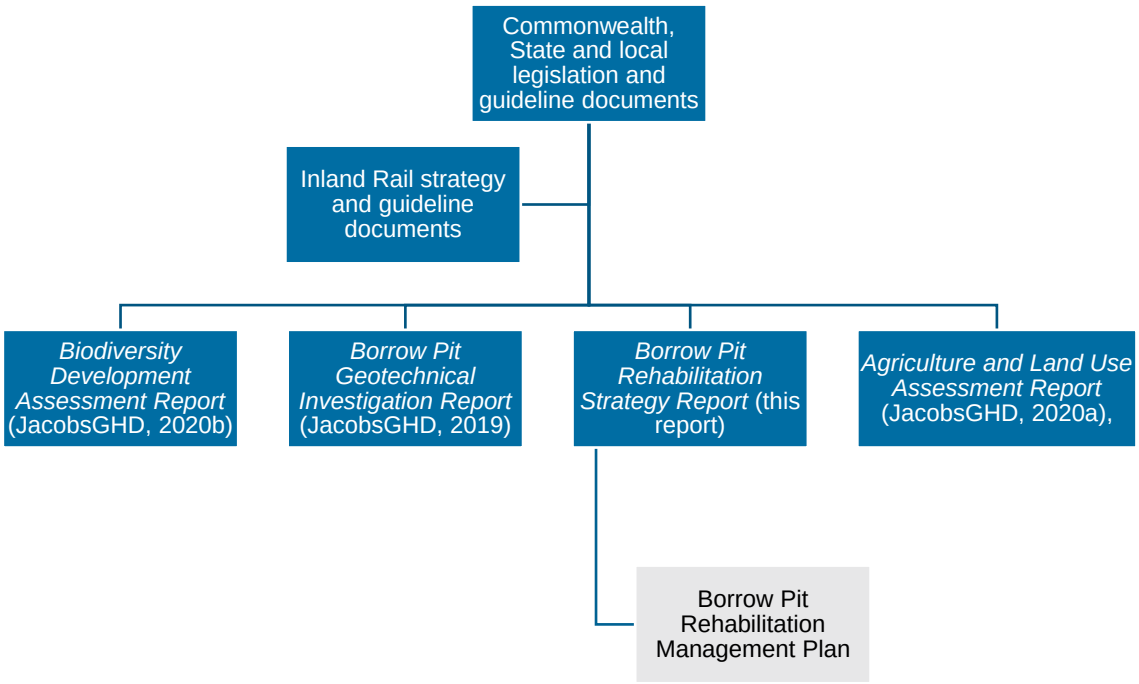

Figure 2.1 Hierarchy of documents

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3. Context

3.1 Land ownership and land use

Each of the four borrow pit sites exist in highly cleared agricultural landscapes, used for primary production including stock grazing and cropping (Land zoning RU1), though scattered patches of remnant vegetation exist on and adjacent to the sites. Borrow pit B has been used as a borrow pit in the recent past. Location and ownership information is summarised in Table 3.1. Following the proposed works to obtain the required fill, all four sites shall be returned to their original condition as far as is reasonably practicable. The state of the final handover to the property owner, the rehabilitated state, is still to be negotiated.

The borrow pits have been selected based on preliminary geotechnical investigations, consultation with the landowner and fill requirements for the proposal. The rationale for each of the borrow pits is as follows:

- Borrow pits A and B – a large volume of fill is required south of the Macquarie River where there are no cuts along the alignment to supply this material. If the borrow pits were not established a significant number of truck movements would be required through Narromine from the north side of the Macquarie River, resulting in unacceptable traffic impacts.
- Borrow pit C – a large volume of fill is required in the area north of the Macquarie River where there are a limited number of cuts along the alignment to supply this material. Further, preliminary geotechnical investigations have identified a substantial shortage of structural fill in this area, which can be obtained from this borrow pit. Haulage from other parts of the alignment to the north is economically unfeasible and would result in a significant number of truck movements on the public road network, with unacceptable traffic impacts.
- Borrow pit D – a large volume of fill is required in the northern parts of Pilliga East State Forest where there are a limited number of cuts along the alignment to supply this material. Haulage from other parts of the alignment to the south is economically unfeasible, and would result in a significant number of truck movements on the public road network, with unacceptable impacts.

Table 3.1 Borrow pit site location and ownership

Site	Location	Occupancy	Title
Borrow pit A	Tantitha Road, Narromine	Owner occupied	Private Freehold
Borrow pit B	Tomingley Road, Narromine	Owner occupied	Private Freehold
Borrow pit C	Euromedah Road, Narromine	Owner occupied	Private Freehold
Borrow pit D	Perimeter Road, Narrabri	Owner occupied	Private Freehold

3.2 Proposed activities during operation of borrow pits

Indicative fill volumes to be excavated from the borrow pits are summarised in Table 3.2, noting they represent the maximum potential size for each borrow pit. Final volumes subject to further geotechnical investigations during detailed design.

Access to the proposal site from borrow pits would be via new temporary access roads connecting the borrow pit to the nearest public road, then via the public road network to the proposal site as shown on the context plans in Appendix A.

Typical facilities and activities at the borrow pits are:

- self-contained amenities such as offices, lunch facilities, and restroom facilities
- diversion drains (for up-slope surface flow diversion) and sedimentation basins
- crushing plant (for oversized excavated material)
- screening plant
- large scale excavation and loading of fill material
- blasting (borrow pit C and borrow pit D only) if hard rock is encountered at depth
- stockpiling of topsoil
- progressive rehabilitation and revegetation works.

Table 3.2 Borrow pits – indicative sizes

Location	Impact area (m2)	Indicative depth (m)	Total general fill (m^3)	Total structural fill (m^3)	Other fill (m^3)	Total (m^3)
Borrow pit A - Tantitha Road, Narromine	109,181	2	85,000	200,000	25,000	**310,000**
Borrow pit B - Tomingley Road, Narromine	153,884	4.5	115,000	290,000	65,000	**470,000**
Borrow pit C - Euromedah Road, Narromine	95,534	13	45,000	340,000	280,000	**665,000**
Borrow pit D – Perimeter Road, Narrabri	200,768	10	135,000	600,000	220,000	**955,000**

Refer to Appendix A for context plans showing the proposal site, as well as the borrow pit construction footprints.

3.3 Timing of rehabilitation

It is anticipated that overall construction would take about 48 months, subject to seasonal weather conditions. An indicative construction program is shown in Table 3.3.

Bulk earthworks and construction of the larger structures at the Macquarie River, Castlereagh River and the Narrabri Creek / Namoi River crossings are significant construction activities which are expected to take up to 36 months. At the larger structures a specialised workforce would be required along with barges (Macquarie River only), piling rigs and large cranes.

Table 3.3 Indicative construction program

Construction Activity	Indicative duration (months)	2021	2022	2023	2024	2025
Site establishment and preliminary activities	6					
Main construction works (rail and road infrastructure)	39					
Testing and commissioning and finishing and rehabilitation	6					

Indicative planting plans (refer Appendix A) have been developed which outline the proposed landform and planting areas of the borrow pits. Rehabilitation of the borrow pits would be undertaken progressively, consistent with the rehabilitation strategy and individual property agreements (where relevant). This would allow rehabilitation and borrow pit excavation to proceed concurrently. This strip mining approach is commonplace in sand and bauxite mining operations, and therefore, a known, low-risk strategy. Progressively, as sections of excavation are complete within the borrow pits, sub-grade ripping and rehabilitation preparatory works would take place to allow for backfilling. Following extraction of all required material from the borrow pits, all facilities would be removed and the remaining disturbed areas of the pits would be stabilised and rehabilitated.

Due to the remoteness of the proposal site and based on waste hierarchy principles of re-use being preferable to off-site disposal, it is proposed to backfill the borrow pits with excess spoil material (that does not meet design specifications or cannot be feasibly used within the rail formation) from the main construction works. Excess spoil not able to be used during construction would be used to reshape and rehabilitate the borrow pits. As the proposed borrow pits are located on private land and would be subject to lease agreements with the landowner, the extent to which this option could be used would be confirmed during detailed design and construction planning in consultation with the landowner. Where the use of excess spoil is insufficient in quantity or volume, inert and/or clean fill would be used, with embankments cut to grade suitable for drainage and revegetation. Pre-strip, site-won stockpiled topsoil would then be emplaced as the growth media prior to being revegetated.

3.4 Environmental baseline

A site visit to borrow pits A, B, and C was undertaken in December 2019 to collect the following baseline information:

- land use
- vegetation type
- estimated percentage cover of vegetation
- landscape qualities.

The indicative size of each of the borrow pits is shown in Table 3.2.

Further information on the borrow pits and access roads regarding each of the following areas of study can be found in:

- Geology:
  - *ARTC Inland Rail Narromine to Narrabri Borrow Pit Geotechnical Investigation* (JacobsGHD, 2019).
- Biodiversity:
  - *ARTC Inland Rail Narromine to Narrabri Biodiversity Development Assessment Report* (JacobsGHD,2020b)
- Agriculture and Land Use:
  - *ARTC Inland Rail Narromine to Narrabri Agriculture and Land Use Assessment* (JacobsGHD, 2020a).

3.4.1 Limitations to baseline assessment

The site visits carried out from 9 to 11 December 2019 included visual data collection at borrow pits A, B and C. However due to forecast extreme fire danger, the decision was made to omit borrow pit D in the interests of safety. This presents a minimal limitation however, as a desktop analysis of the landscape of, and surrounding, borrow pit D was carried out, which supplements the accounts, data collected, and observations of ecologists who were able to visit the site. As such, sufficient information on the site has been collected from specialist investigations to inform this assessment.

3.4.2 Summary of plant species selected for revegetation

Baseline biodiversity data has been collected and analysed for all four borrow pits, and is detailed in the *ARTC Inland Rail Narromine to Narrabri Biodiversity Development Assessment Report* (JacobsGHD, 2020b). The specific plant community types (PCTs) that have been recorded for each site are listed below. These PCTs have informed the development of the indicative revegetation planting plans and schedules for each proposed site with borrow pit and access road (refer Appendix A and Appendix B).

The PCTs recorded at each site are as follows:

- Borrow pit A:
  - PCT 185: Dwyer's Red Gum - White Cypress Pine - Currawang shrubby woodland mainly in the NSW South Western Slopes Bioregion.
  - PCT 619: Derived Wire Grass grassland of the NSW Brigalow Belt South Bioregion and Nandewar Bioregion.
- Borrow pit B:
  - PCT 255: Mugga Ironbark - Buloke - Pilliga Box - White Cypress Pine shrubby woodland on sandstone in the Dubbo region, south-western Brigalow Belt South Bioregion.
- Borrow pit C:
  - PCT 88: Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion.
  - PCT 255: Mugga Ironbark - Buloke - Pilliga Box - White Cypress Pine shrubby woodland on sandstone in the Dubbo region, south-western Brigalow Belt South Bioregion.

- Borrow pit D:
  - PCT 398: Narrow-leaved Ironbark - White Cypress Pine - Buloke tall open forest on lower slopes and flats in the Pilliga Scrub and surrounding forests in the central north Brigalow Belt South Bioregion.
  - PCT 746: Brown Bloodwood - cypress - ironbark heathy woodland in the Pilliga region of the Brigalow Belt South Bioregion.

3.4.3 Borrow pit A – Tantitha Road, Narromine

Borrow pit A is located in largely agricultural land south of Narromine (Photo 3.1). There was evidence of feral animals (rabbits) during the December 2019 site visit (Photo 3.2).

This site is vegetated predominantly with PCT 619 (Derived Wire Grass grassland) with a small area of PCT 185 (Dwyer's Red Gum - White Cypress Pine - Currawang shrubby woodland) in the south-west corner (approximately 10-15 per cent of the proposed borrow pit footprint) (Photo 3.3). The surrounding landscape consisted of gently sloping land. Refer Appendix A for context plans and indicative planting plans showing the proposed revegetation of the borrow pit and access road.

Photo 3.1 Site Landscape

Photo 3.2 Evidence of feral animals (rabbits)

Photo 3.3 Existing stand of native vegetation

3.4.4 Borrow pit B – Tomingley Road, Narromine

Borrow pit B is located in largely cleared agricultural land south of Narromine. The land use at borrow pit B is an historic borrow pit in part (Photo 3.4 and Photo 3.5), with evidence of opportunistic dryland cropping also observed (Photo 3.6). Approximately 15 per cent of the proposed borrow pit footprint was vegetated with PCT 255 (Mugga Ironbark - Buloke - Pilliga Box - White Cypress Pine shrubby woodland) located adjacent to the existing quarry (Photo 3.7 and Photo 3.8). Approximately 40 per cent of the footprint was covered with low tussock grasses likely to be remnants of the observed opportunistic dryland cropping, with the remaining 45 per cent of the footprint bare, due to the existing borrow pit having removed the upper soil horizons. The surrounding landscape consisted of flat to very gently sloping land. Refer Appendix A for context plans for the revegetation of the borrow pit and access road.

Photo 3.4 Existing borrow pit

Photo 3.5 Existing borrow pit

Photo 3.6 Previously cropped land

Photo 3.7 Grass and shrub understorey of areas vegetated with PCT 255

Photo 3.8 Existing established native vegetation

3.4.5 Borrow pit C – Euromedah Road, Narromine

Borrow pit C is located north of Narromine. The land use at borrow pit C was observed to be cattle grazing. Approximately 25 per cent of the proposed borrow pit area had herbaceous ground cover in poor condition (Photo 3.9 and Photo 3.10), with the remaining 75 per cent comprising of native vegetation of PCT 88 and PCT 255. The site itself is situated on a local low-rise ridgeline, and is therefore visible from surrounding roads. The eastern edge of the proposed borrow pit area abuts an operational quarry on adjoining land (Photo 3.11). Refer Appendix A for context plans for the revegetation of the borrow pit and access road.

Photo 3.9 Grazing land in foreground and forested area comprising native vegetation in background

Photo 3.10 Understorey of shrubs in area comprised of native vegetation

Photo 3.11 Adjacent quarry

3.4.6 Borrow pit D – Perimeter Road, Narrabri

As noted in Section 3.4.1, a desktop study of the proposed site of borrow pit D was undertaken due to the fire safety risk during December 2019 that resulted in the site visit to borrow pit D being cancelled. Information gained from this desktop study has been used to supplement the accounts and observations of ecologists, who were able to visit the site to undertake the biodiversity site survey earlier in 2019.

Borrow Pit D is located south-east of Narrabri. Despite its appearance in aerial imagery, much of this site was observed by ecologists during field surveys in 2019 to have been cleared by the landholder (Photo 3.12). A narrow strip of PCT 746 remains on the western edge of the proposed footprint of the borrow pit (Photo 3.13 and Photo 3.14). PCT 398 was also observed on the site, which would be impacted by the proposed access road. The surrounding landscape is very gently sloping and the site is well screened from surrounding roads and other viewpoints.

Photo 3.12 Cleared area of the proposed borrow pit footprint

Photo 3.13 Remnant vegetation in proposed borrow pit footprint in the foreground with Jacks Creek state forest in the background

Photo 3.14 Juvenile Cypress-pine in the foreground with remnant vegetation of the site seen in the background

3.4.7 Access roads

The proposed access roads to each of the proposed borrow pits also will require rehabilitation following the completion of works. The location of each access road can be seen in the context plans provided in Appendix A. The access roads would be ripped, the soil ameliorated as required following suitable analysis, and seeded with local native species as shown in the indicative planting schedules in Appendix B, unless otherwise agreed with the respective landholder.

4. Rehabilitation overview

4.1 Nominated final use and landform

The agreed final land use for the borrow pits and associated access roads is that they will be returned to their original condition as far as is reasonably practicable or otherwise as agreed with the landholder. In addition to this, the final landform shall be safe, stable, self-sustaining, non-polluting, and free-draining.

4.2 Rehabilitation hierarchy

In developing the rehabilitation objectives, indicators and completion criteria for the borrow pits and access roads, the following hierarchy has been used to prevent or minimise environmental harm:

- avoid disturbance that will require rehabilitation
- reinstate land to pre-disturbance condition as closely as reasonable and feasible, to facilitate pre-disturbance land use, or otherwise as agreed with the landholder
- propose lower value land use as required and as agreed with the landholder.

4.3 Rehabilitation objectives

The objectives of this rehabilitation strategy are to:

- ensure a final landform is produced that is safe, stable and non-polluting, as well as free draining and compatible with the post construction phase land use
- ensure topsoil and subsoil are managed to conserve the seedbank, nutrients, and to encourage the establishment of proposed revegetation
- ensure that disturbed areas are to be rehabilitated as close as reasonably practicable to their pre-disturbance condition or otherwise as agreed with the landholder
- ensure that rehabilitation works comply with and are undertaken as per relevant regulatory requirements
- establish a set of indicators and a rehabilitation monitoring program to ensure successful rehabilitation
- establish agreed criteria where rehabilitation is deemed successful by relevant authorities and key stakeholders.

4.3.1 Typical landscapes

The *Inland Rail Landscape and Rehabilitation Framework* (ARTC, 2019b) identifies four typical landscape scenarios. Those that are relevant to this report are:

- rural landscapes
- temporary treatments (ie borrow pits).

A project specific rehabilitation management plan will be developed post approval that will address relevant performance outcomes as detailed in the above framework for the borrow pit and access road sites.

4.3.2 Erosion and sediment measures

Erosion and sediment measures will be implemented at all work sites in accordance with the principles and requirements in *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom, 2004), *Managing Urban Stormwater: Soils and Construction Volume 2C Unsealed roads* (Department of Environment and Climate Change NSW, 2008a), and *Managing Urban Stormwater: Soils and Construction Volume 2E Mines and Quarries* (Department of Environment and Climate Change NSW, 2008b).

4.4 Key issues

There remains the risk that the following environmental risks may arise during operation of the borrow pits that will require appropriate management prior to the return of the leased sites to the landowners:

- surface water management, including erosion and sediment control
- airborne dust
- creation of voids and unstable/steep landforms that may be unsafe for livestock or wildlife
- soil structural decline
- changes to groundwater levels where borrow pits intersect the water table
- clearing of vegetation and subsequent establishment of weed species
- challenges to revegetation establishment including post-rehabilitation livestock, fauna and feral animal access
- alteration of landscape character through fill removal activities.

The detailed rehabilitation management plan to be prepared post approval will contain rehabilitation measures that will be developed in accordance with this strategy, including the above outlined hierarchy and objectives, to manage these issues. The implementation of these measures is intended to achieve the nominated final use and landform for each site, such that they shall be safe, stable, self-sustaining, non-polluting, and free-draining.

5. Environmental performance standards

5.1 General

A detailed rehabilitation management plan will be developed post approval, in accordance with relevant guidelines and legislation as set out in this strategy. Construction and operation of the borrow pits will also comply with relevant guidelines and legislation and project approvals. The following areas will be addressed by the detailed rehabilitation management plan:

- topsoil - stripping and handling; sampling and testing; topsoil requirements; soil treatment; placement of topsoil
- subsoil - sampling and testing; ground preparation
- fertiliser
- mulch
- weed management
- herbicides and pesticides
- bonded fibre matrix, hydromulch, hydroseed and binders
- seed mix
- livestock, fauna and feral animal exclusion fencing.

5.2 Objectives, performance indicators and indicative completion criteria

Table 5.1 identifies the rehabilitation objectives, performance indicators, and indicative completion criteria for the borrow pit sites and access roads.

Table 5.1 Objectives, performance indicators and indicative completion criteria

Objective	Performance indicator	Indicative completion criteria
Phase – Decommissioning		
Ensure that disturbed areas are to be rehabilitated as close as reasonably practicable to their pre-disturbance condition or otherwise as agreed with the landholder.	Fixed and mobile infrastructure such as offices, lunch facilities, crushing plants, etc. shall be decommissioned and removed.	Complete removal of fixed and mobile infrastructure.
	Resultant contamination shall be remediated and the footprints of the removed facilities shall be appropriately rehabilitated.	Contamination remediated to relevant standards as far as reasonable and feasible. Mitigation measures to be developed and implemented as part of a soil and water management plan, and a contamination and hazardous materials plan, both as part of the construction environmental management plan (CEMP).
	All signage shall be removed.	Complete removal of signage.

Objective	Performance indicator	Indicative completion criteria
Phase – Landform Establishment		
Ensure a final landform is produced that is safe, stable and non-polluting, as well as free draining and compatible with the post construction phase land use	Maximum slope of final landform	Batters and slopes around the perimeters of the borrow pits should be a maximum of 1V:4H gradient. Where reasonable and feasible, reshaping of the borrow pits should create an effect that is in keeping with the surrounding landscape character.
	Drainage capabilities of borrow pits	The borrow pits have been designed to be free draining with a purpose designed and built detention basin to allow sedimentation of borrow pit run-off to occur in rainfall events. Detention basins shall be designed to allow for the relevant clean water guidelines for NSW.
	Changes to groundwater levels minimised	The borrow pits shall be rehabilitated to have final ground levels above the water table.
	Appropriate Approval Authority to carry out rehabilitation works	Approval Authority to have licences appropriate to works being carried out, and carry out works only to such levels as documented in project approvals.
Phase – Growth Medium Development		
Ensure topsoil and subsoil are managed to conserve the seedbank, nutrients, and to encourage the establishment of proposed revegetation	Top soil stockpiling	Top soil stockpiled to a maximum height of 1.5 m and 3 m width. The stockpiles shall be free draining and outside tree drip lines, and revegetated to protect from erosion and maintain active populations of beneficial soil microbes. Stockpiles shall be managed to avoid erosion in accordance with The Blue Book (Landcom, 2004).
Phase – Ecosystem and Land Use Establishment		
Ensure that rehabilitation works comply with and are undertaken as per relevant regulatory requirements	Revegetation, erosion and surface water management, weed, pest and disease control, and soil management compliance with appropriate guidelines	Revegetation managed as per *Inland Rail Landscape and Rehabilitation Framework* (ARTC, 2019b) and *Inland Rail Landscape and Rehabilitation Strategy* (ARTC, 2019c). Erosion and surface water managed in accordance with the Blue Book (Landcom, 2004). Water quality and runoff managed in accordance with *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018). Weed, pest, disease and soil compliance managed in accordance with recommendations of the *ARTC Inland Rail Narromine to Narrabri Agriculture and Land Use Assessment* (JacobsGHD, 2020a), and *Biosecurity Act 2015*.

Objective	Performance indicator	Indicative completion criteria
		Weed densities are no greater than the pre-disturbance condition and no new weed species are introduced.
	Revegetation species shall be suitable for their location	Seed for revegetation tube stock shall be collected from the area such that they are of local provenance where feasible. Seed collection from sites shall be commenced in advance as soon as possible to accommodate this.
	Appropriate fencing to support final land use	Fencing colour to suit the landscape character of the area. Ensure it is not too brightly coloured or reflective.
Phase – Ecosystem and Land Use Sustainability		
Establish a set of indicators and a rehabilitation monitoring program to ensure successful rehabilitation	Erosion and sedimentation rates	Land stability and erosion rates are the same as or less than pre-disturbance conditions.
	Weed, pest and disease densities	Weed densities are no greater than the pre-disturbance condition. Pests, disease, or nutrient deficiencies or toxicities are not evident. Weed, pest, disease and soil compliance managed in accordance with recommendations of the *ARTC Inland Rail Narromine to Narrabri Agriculture and Land Use Assessment* (JacobsGHD, 2020a), and *Biosecurity Act 2015.*
	Vegetation establishment	Vegetation is established and self-sustaining, and maintains at least 85 per cent ground coverage compared to pre-disturbance site to cell, seeded and/or hydromulched areas. Plants have healthy root systems that have penetrated into the surrounding, undisturbed ground and not able to be lifted out of its planting hole.
	Adequate ground coverage	Ground surfaces are covered with the specified treatment to the specified depths and have been maintained in a weed-free and tidy condition.
	Habitat/ Revegetation	In areas that have been cleared, pre-disturbance surface features (such as fallen trees and logs and boulders), and 15-20 per cent of trees removed, have been retained and reinstated carefully according to the recommendations of an ecologist.
Phase – Land Relinquishment		
Establish agreed criteria where rehabilitation is deemed successful by relevant authorities and key stakeholders	Completion criteria agreed upon	All non-conformance reports and defects notifications have been closed out.

5.3 Monitoring program

In order to achieve the completion criteria, a monitoring program consisting of an initial two-year maintenance and establishment period will be implemented at the conclusion of works. This program will track the progress of the above performance indicators. At the conclusion of the two year maintenance and establishment period, the need for a further monitoring period will be assessed, the duration of which will be determined at that time. If required, this further monitoring period will track the continuing progress of the performance indicators to ensure a positive trend, until the completion criteria are met.

5.4 Administrative considerations

Following project approval, a detailed rehabilitation management plan will be developed, in which administrative considerations that are key to the monitoring of the success criteria will be addressed. These considerations include:

- roles and responsibilities
- training
- specification of success criteria
- reporting and review
- audit
- adaptive management
- financial provisioning.

6. Implementation

This strategy has been developed with reference to the SEARs; national, state and local legislation; as well as other relevant guidelines and frameworks.

6.1 Next steps

This rehabilitation strategy is intended to provide an overarching framework to inform the subsequent develop of detailed rehabilitation management plans in the next phase of the proposal, subject to further assessment and agreement with relevant stakeholders.

6.2 Potential for integration

This borrow pit rehabilitation strategy is intended to inform the works relating to the borrow pits and access roads for the Narromine to Narrabri section of Inland Rail only. As noted in chapter A7 of the EIS, a rehabilitation strategy would be prepared for the entire proposal site during detailed design. There would be opportunities for that proposal-wide strategy to build on the objectives and performance indicators for the borrow pits identified in this strategy. It is also noted that Inland Rail will be conducting similar activities on adjoining packages, and as such during detailed design development, further work should be done to achieve alignment and integration where possible with other rehabilitation strategies in the region.

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7. References

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Appendices

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APPENDIX

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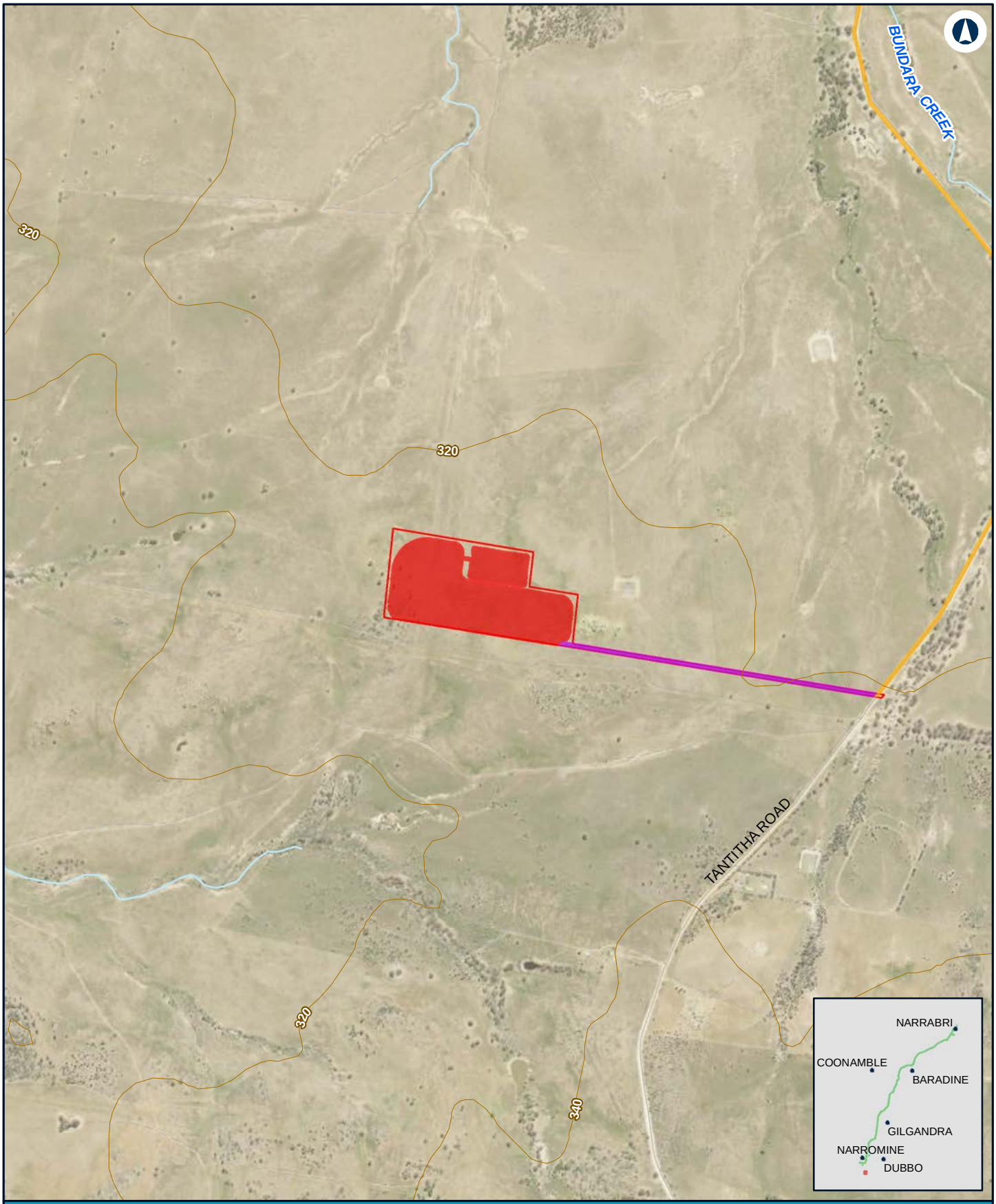
Borrow pit rehabilitation strategy

Appendix A Borrow pit context landscape plans and indicative planting plans

NARROMINE TO NARRABRI ENVIRONMENTAL IMPACT STATEMENT

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



NARROMINE TO NARRABRI Borrow pit A context plan Figure A1.1

0 0.2 0.4 Km

Coordinate System: GDA 1994 MGA Zone 55

Date: 7/04/2020 Paper: A4
Author: JacobsGHD Scale: 1:15,000
Data Sources: Basemap layers: NSWSS; Study area, project elements: GHDJACOBS

LEGEND

- The proposal site
- Borrow pit
- Access road
- Public road
- 20m contours

INLAND RAIL ARTC

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

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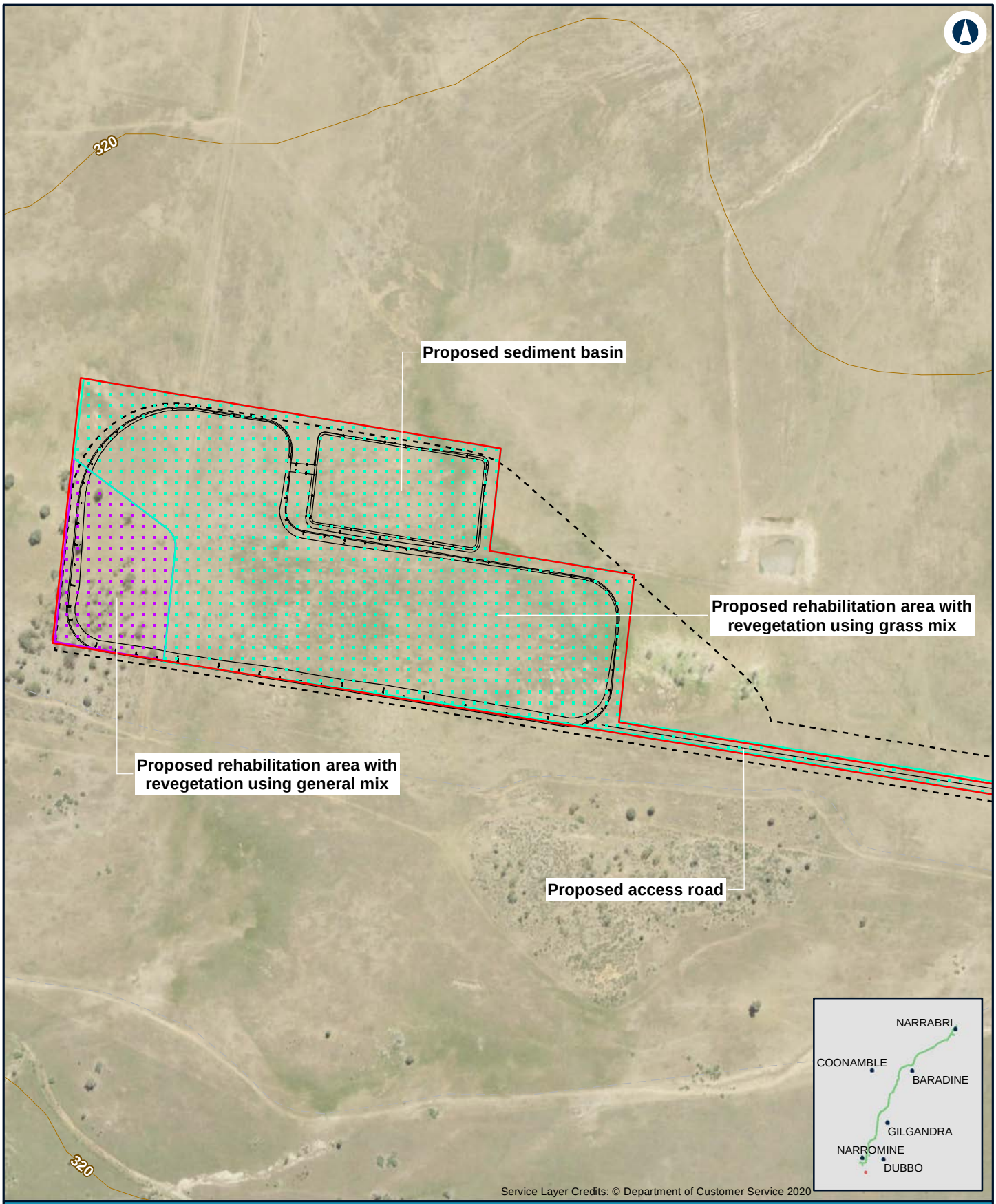

NARROMINE TO NARRABRI Borrow pit A indicative planting plan Figure A1.2

0 0.07 0.14 Km

Coordinate System: GDA 1994 MGA Zone 55

LEGEND

- The proposal site
- Borrow pit layout
- 20m contours
- Rehabiliation area (general mix)
- Rehabiliation area (grass mix)

Date: 20/08/2020 Paper: A4
Author: JacobsGHD Scale: 1:5,000
Data Sources: Basemap layers: NSWSS; Study area, project elements: GHDJACOBS

INLAND RAIL ARTC

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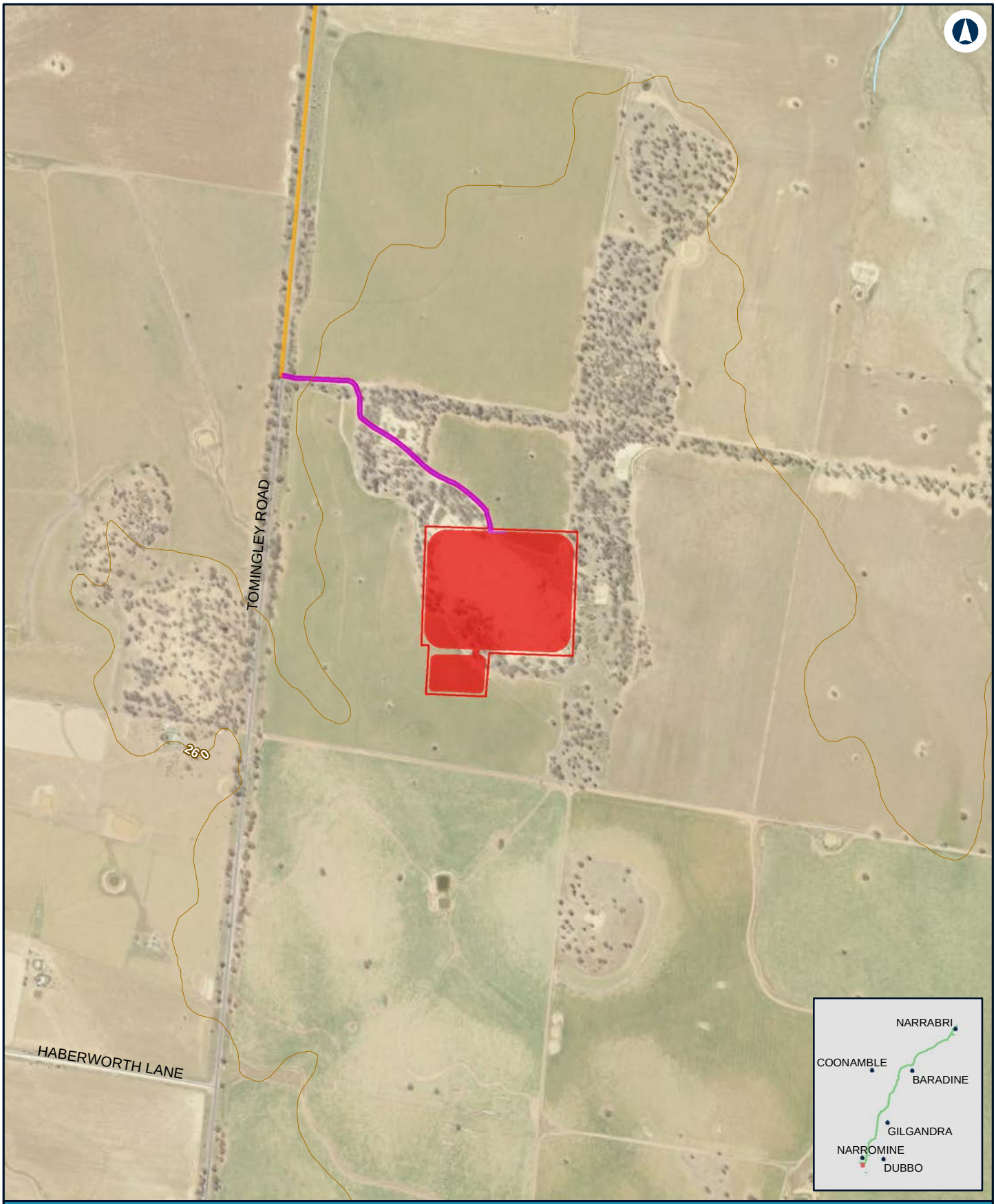

NARROMINE TO NARRABRI Borrow pit B context plan Figure A1.3

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Coordinate System: GDA 1994 MGA Zone 55

LEGEND

- The proposal site
- Borrow pit
- Access road
- Public road
- 20m contours

Date: 7/04/2020 Paper: A4
Author: JacobsGHD Scale: 1:15,000
Data Sources: Basemap layers: NSWSS; Study area, project elements: GHDJACOBS

INLAND RAIL ARTC

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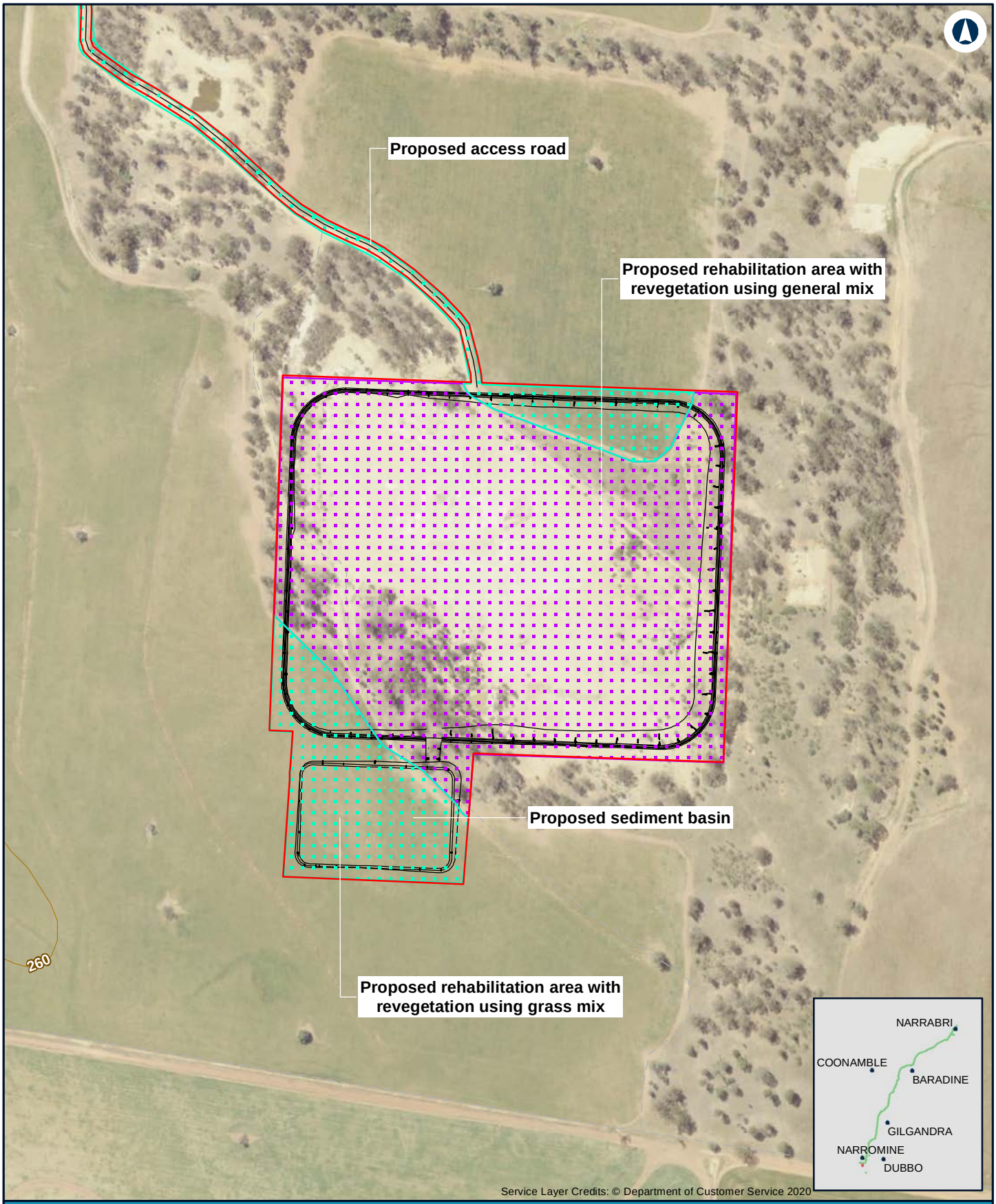

NARROMINE TO NARRABRI Borrow pit B indicative planting plan Figure A1.4

0 0.07 0.14 Km

Coordinate System: GDA 1994 MGA Zone 55

LEGEND

- The proposal site
- Borrow pit layout
- 20m contours
- Rehabiliation area (general mix)
- Rehabiliation area (grass mix)

Date: 20/08/2020 Paper: A4
Author: JacobsGHD Scale: 1:5,000
Data Sources: Basemap layers: NSWSS; Study area, project elements: GHDJACOBS

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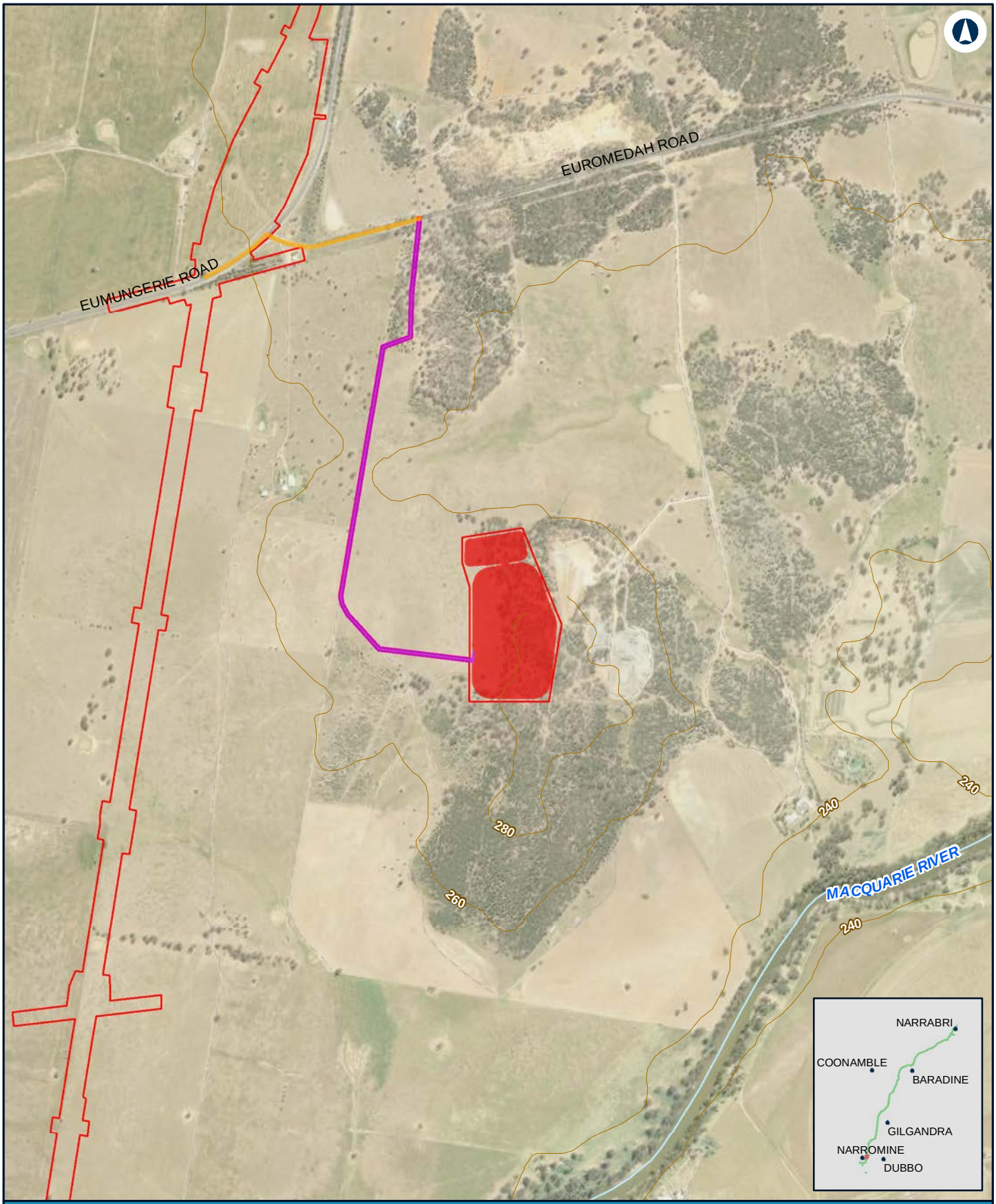

NARROMINE TO NARRABRI Borrow pit C context plan Figure A1.5

0 0.2 0.4 Km

Coordinate System: GDA 1994 MGA Zone 55

LEGEND

- The proposal site
- Borrow pit
- Access road
- Public road
- 20m contours

Date: 7/04/2020 Paper: A4
Author: JacobsGHD Scale: 1:15,000
Data Sources: Basemap layers: NSWSS; Study area, project elements: GHDJACOBS

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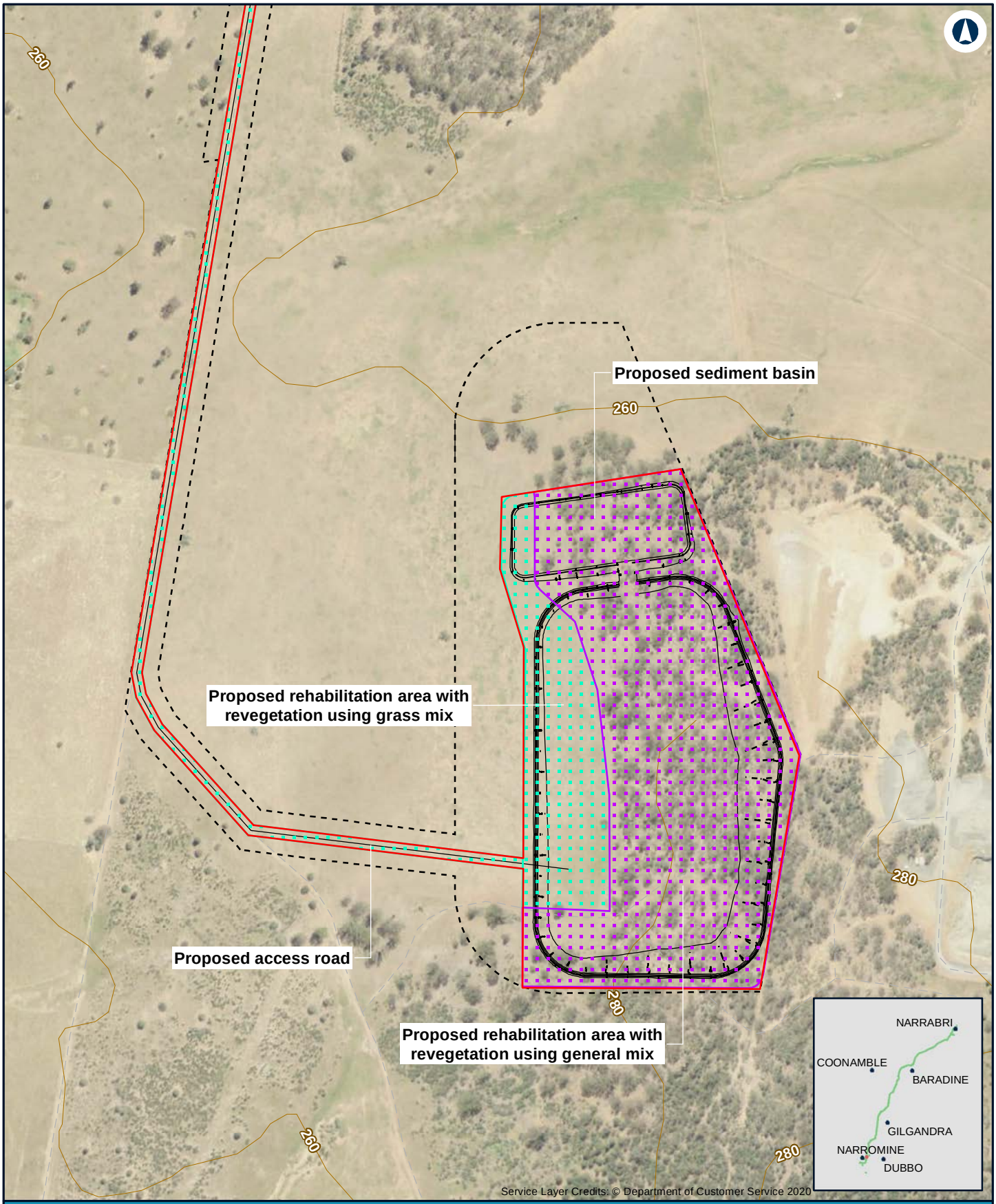

NARROMINE TO NARRABRI Borrow pit C indicative planting plan Figure A1.6

0 0.07 0.14 Km

Coordinate System: GDA 1994 MGA Zone 55

LEGEND

- The proposal site
- Borrow pit layout
- 20m contours
- Rehabiliation area (general mix)
- Rehabiliation area (grass mix)

Date: 20/08/2020 Paper: A4
Author: JacobsGHD Scale: 1:5,000
Data Sources: Basemap layers: NSWSS; Study area, project elements: GHDJACOBS

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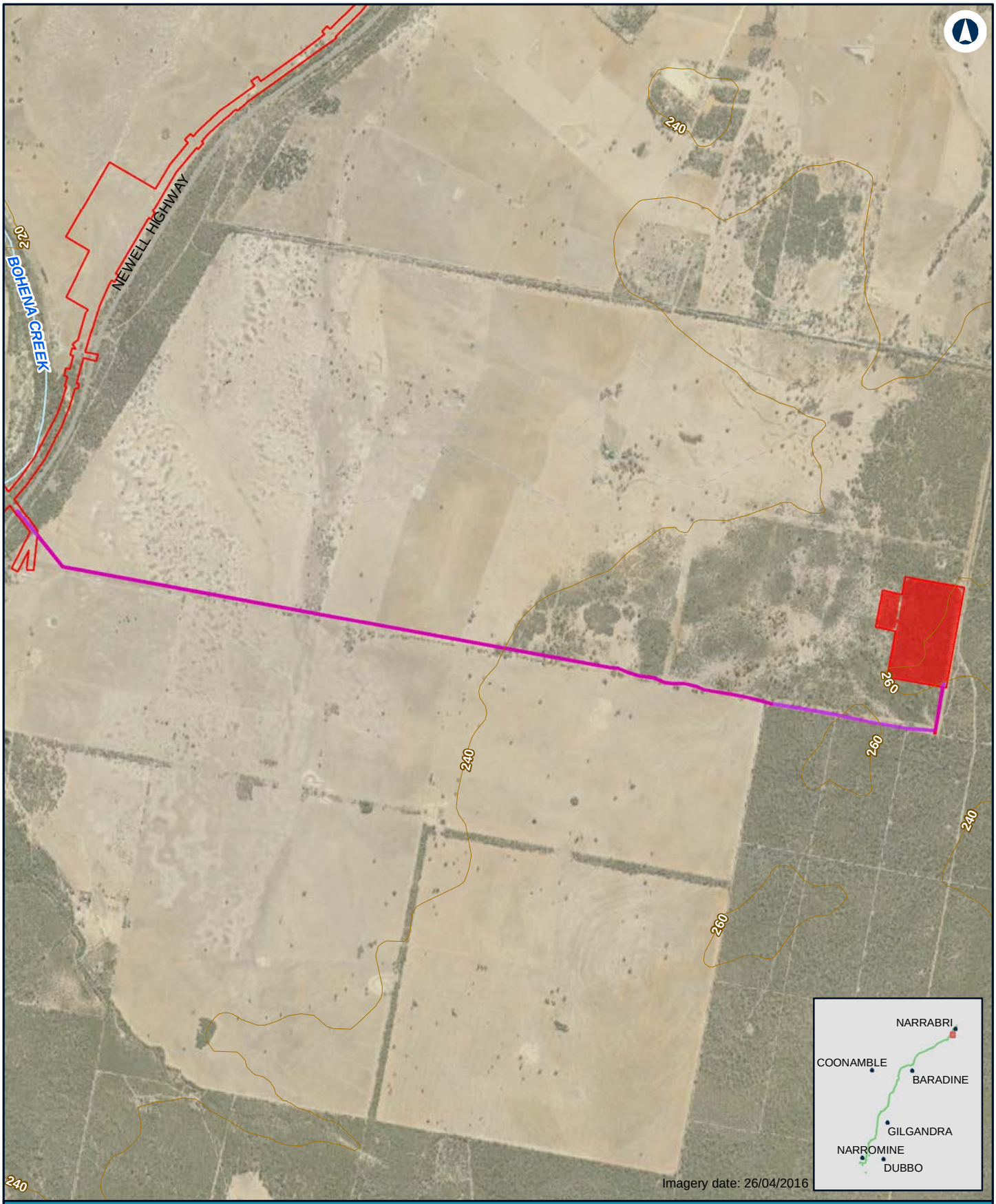

NARROMINE TO NARRABRI

Borrow pit D context plan

Figure A1.7

0 0.4 0.8 Km

Coordinate System: GDA 1994 MGA Zone 55

LEGEND

- The proposal site
- Borrow pit
- Access road
- 20m contours

Date: 7/04/2020 Paper: A4
Author: JacobsGHD Scale: 1:30,000
Data Sources: Basemap layers: NSWSS; Study area, project elements: GHDJACOBS

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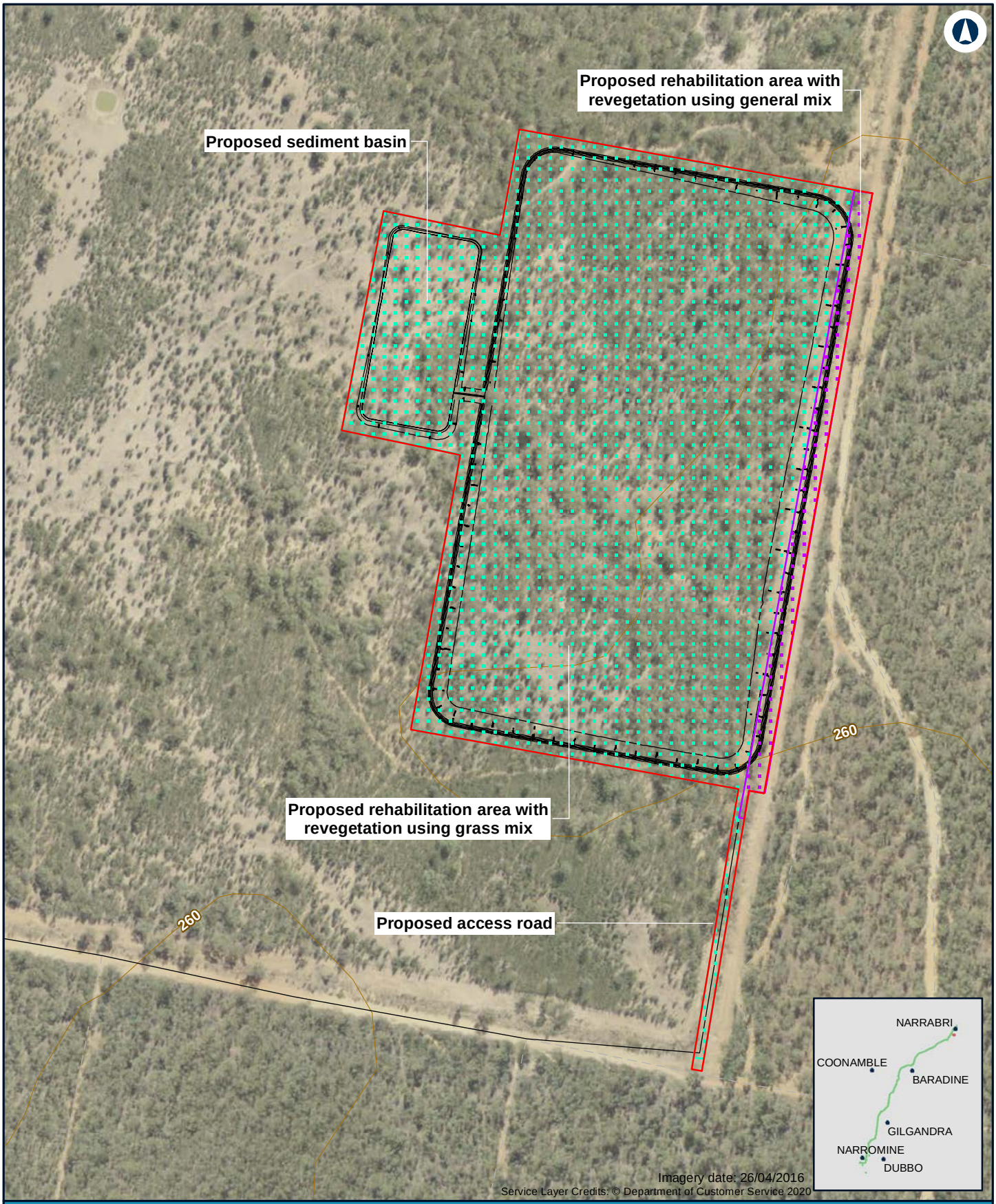

NARROMINE TO NARRABRI Borrow pit D indicative planting plan Figure A1.8

0 0.07 0.14 Km

Coordinate System: GDA 1994 MGA Zone 55

LEGEND

- The proposal site
- Borrow pit layout
- 20m contours
- Rehabiliation area (general mix)
- Rehabiliation area (grass mix)

Date: 20/08/2020 Paper: A4
Author: JacobsGHD Scale: 1:5,000
Data Sources: Basemap layers: NSWSS; Study area, project elements: GHDJACOBS

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APPENDIX K

Borrow pit rehabilitation strategy

Appendix B Indicative planting schedule

NARROMINE TO NARRABRI ENVIRONMENTAL IMPACT STATEMENT

ARTC

Table B1.1 Borrow Pit A Indicative Planting Schedule – General mix

Species	Common Name	Install size	Plants/m^2	Comp %	Mature Size
BORROW PIT A - GENERAL MIX					
Acacia doratoxylon	Currawang	tubestock	0.5	13%	3-12m h
Alectryon oleifolius ssp. canescens	Rosewood	tubestock	0.5	9%	to 9m
Aristida jerichoensis	Jericho wiregrass	tubestock	0.5	7%	0.9m h
Aristida longicollis	Bull Wiregrass	tubestock	0.5	7%	0.65m h
Austrostipa scabra	Speargrass	tubestock	0.5	7%	0.6m h
Bothriochloa biloba	Lobed Bluegrass	tubestock	0.5	7%	1m h
Callitris glaucophylla	White Cypress-pine	tubestock	0.5	13%	up to 20m
Enteropogon acicularis	Curly Windmill Grass	tubestock	0.5	7%	0.4m h
Eucalyptus dwyeri	Dwyer's red gum	tubestock	0.5	13%	6-15m h
Eulalia aurea	Silky Browntop	tubestock	0.5	3%	1m h
Leptospermum divaricatum	Tea tree	tubestock	0.5	4%	1-4m h
Maireana microphylla	Bluebush	tubestock	0.5	3%	1m h
Rytidosperma setaceum	Small-flowered Wallaby Grass	tubestock	0.5	7%	0.7m h
				100%	

Table B1.2 Borrow Pit A Indicative Planting Schedule – Grass mix

Species	Common Name	Install size	Plants/m^2	Comp %	Mature Size
BORROW PIT A - GRASS MIX					
Aristida jerichoensis	Jericho wiregrass	tubestock	0.5	15%	0.9m h
Aristida longicollis	Bull Wiregrass	tubestock	0.5	15%	0.65m h
Austrostipa scabra	Speargrass	tubestock	0.5	14%	0.6m h
Bothriochloa biloba	Lobed Bluegrass	tubestock	0.5	14%	1m h
Enteropogon acicularis	Curly Windmill Grass	tubestock	0.5	14%	0.4m h
Eulalia aurea	Silky Browntop	tubestock	0.5	14%	1m h
Rytidosperma setaceum	Small-flowered Wallaby Grass	tubestock	0.5	14%	0.7m h
				100%	

Table B1.3 Borrow Pit B Indicative Planting Schedule – General mix

Species	Common Name	Install size	Plants/m^2	Comp %	Mature Size
BORROW PIT B - GENERAL MIX					
Acacia deanei	Deane's Wattle	tubestock	0.5	15%	to 7m h
Austrodanthonia setacea	Smallflower Wallaby Grass	tubestock	0.5	6%	0.7m h
Austrostipa scabra var. scabra	Rough Spear Grass	tubestock	0.5	7%	0.6m h
Cassinia laevis	Cough Bush	tubestock	0.5	3%	3m h
Chloris truncata	Windmill Grass	tubestock	0.5	7%	0.5m h
Enteropogon acicularis	Curly Windmill Grass	tubestock	0.5	7%	0.4m h
Eucalyptus microcarpa	Western Grey Box	tubestock	0.5	15%	to 25m h
Eucalyptus pilligaensis	Pilliga Box	tubestock	0.5	15%	to 25m h
Eucalyptus sideroxylon	Mugga Ironbark	tubestock	0.5	15%	to 25m h
Maireana microphylla	Bluebush	tubestock	0.5	3%	1m h
Panicum effusum	Hairy panic	tubestock	0.5	7%	0.7m h
				100%	

Table B1.4 Borrow Pit B Indicative Planting Schedule – Grass mix

Species	Common Name	Install size	Plants/m^2	Comp %	Mature Size
BORROW PIT B - GRASS MIX					
Austrodanthonia setacea	Smallflower Wallaby Grass	tubestock	0.5	20%	0.7m h
Austrostipa scabra var. scabra	Rough Spear Grass	tubestock	0.5	20%	0.6m h
Chloris truncata	Windmill Grass	tubestock	0.5	20%	0.5m h
Enteropogon acicularis	Curly Windmill Grass	tubestock	0.5	20%	0.4m h
Panicum effusum	Hairy panic	tubestock	0.5	20%	0.7m h
				100%	

Table B1.5 Borrow Pit C Indicative Planting Schedule – General mix

Species	Common Name	Install size	Plants/m^2	Comp %	Mature Size (H xW)
BORROW PIT C - GENERAL MIX					
Aristida jerichoensis var. jerichoensis	Jericho Wiregrass	tubestock	0.5	5%	0.9m h
Atriplex semibaccata	Berry Saltbush	tubestock	0.5	3%	to 1.8m w
Austrodanthonia setacea	Smallflower Wallaby Grass	tubestock	0.5	6%	0.7m h
Callitris glaucophylla	White Cypress-pine	tubestock	0.5	15%	up to 20m
Cassinia arcuata	Drooping Cassinia	tubestock	0.5	3%	2m h
Cassinia laevis	Cough Bush	tubestock	0.5	3%	3m h
Chloris truncata	Windmill Grass	tubestock	0.5	5%	0.5m h
Dillwynia sieberi	Sieber's Parrot-pea	tubestock	0.5	5%	0.5 - 2.5m h
Enteropogon acicularis	Curly Windmill Grass	tubestock	0.5	5%	0.4m h
Eucalyptus microcarpa	Western Grey Box	tubestock	0.5	15%	to 25m h
Eucalyptus sideroxylon	Mugga Ironbark	tubestock	0.5	15%	to 25m h
Geijera parviflora	Australian Willow	tubestock	0.5	15%	to 10m h
Panicum effusum	Hairy panic	tubestock	0.5	5%	0.7m h
				100%	

Table B1.6 Borrow Pit C Indicative Planting Schedule – Grass mix

Species	Common Name	Install size	Plants/m^2	Comp %	Mature Size (H xW)
BORROW PIT C - GRASS MIX					
Aristida jerichoensis var. jerichoensis	Jericho Wiregrass	tubestock	0.5	20%	0.9m h
Austrodanthonia setacea	Smallflower Wallaby Grass	tubestock	0.5	20%	0.7m h
Chloris truncata	Windmill Grass	tubestock	0.5	20%	0.5m h
Enteropogon acicularis	Curly Windmill Grass	tubestock	0.5	20%	0.4m h
Panicum effusum	Hairy panic	tubestock	0.5	20%	0.7m h
				100%	

Table B1.7 Borrow Pit D Indicative Planting Schedule – General mix

Species	Common Name	Install size	Plants/m^2	Comp %	Mature Size (H xW)
BORROW PIT D - GENERAL MIX					
Acacia cheelii	Motherumbah	tubestock	0.5	4%	to 10m h
Allocasuarina luehmannii	Buloke	tubestock	0.5	14%	5-15m h
Aristida longicollis	Bull Wiregrass	tubestock	0.5	5%	0.65m h
Aristida ramosa	Purple Wiregrass	tubestock	0.5	5%	1.2m h
Austrostipa setacea	Corkscrew Grass	tubestock	0.5	5%	0.8m h
Callitris glaucophylla	White Cypress-pine	tubestock	0.5	14%	to 20m h
Corymbia trachyphloia	Brown Bloodwood	tubestock	0.5	14%	to 25m h
Cymbopogon refractus	Barbed Wire Grass	tubestock	0.5	5%	1m h
Einadia nutans	Nodding Saltbush	tubestock	0.5	4%	1m h
Eucalyptus crebra	Narrow-leaved Ironbark	tubestock	0.5	14%	to 35m h
Lomandra filiformis	Wattle Mat-rush	tubestock	0.5	4%	0.2m h
Lomandra leucocephala	Wooly-head Mat-Rush	tubestock	0.5	4%	0.4m h
Lomandra multiflora	Many-flowered Mat-rush	tubestock	0.5	4%	0.6m h
Schoenus ericetorum	Heath Bog Rush	tubestock	0.5	4%	0.3m h
				100%	

Table B1.8 Borrow Pit D Indicative Planting Schedule – Grass mix

Species	Common Name	Install size	Plants/m^2	Comp %	Mature Size (H xW)
BORROW PIT D - GRASS MIX					
Aristida longicollis	Bull Wiregrass	tubestock	0.5	25%	0.65m h
Aristida ramosa	Purple Wiregrass	tubestock	0.5	25%	1.2m h
Austrostipa setacea	Corkscrew Grass	tubestock	0.5	25%	0.8m h
Cymbopogon refractus	Barbed Wire Grass	tubestock	0.5	25%	1m h
				100%	

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