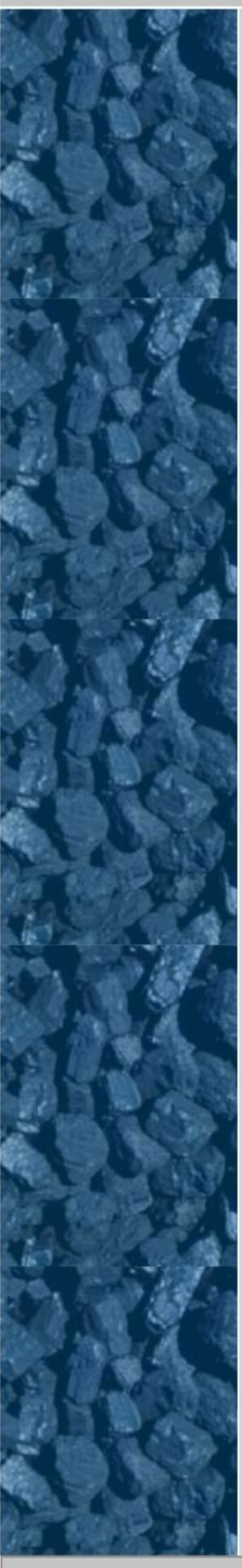
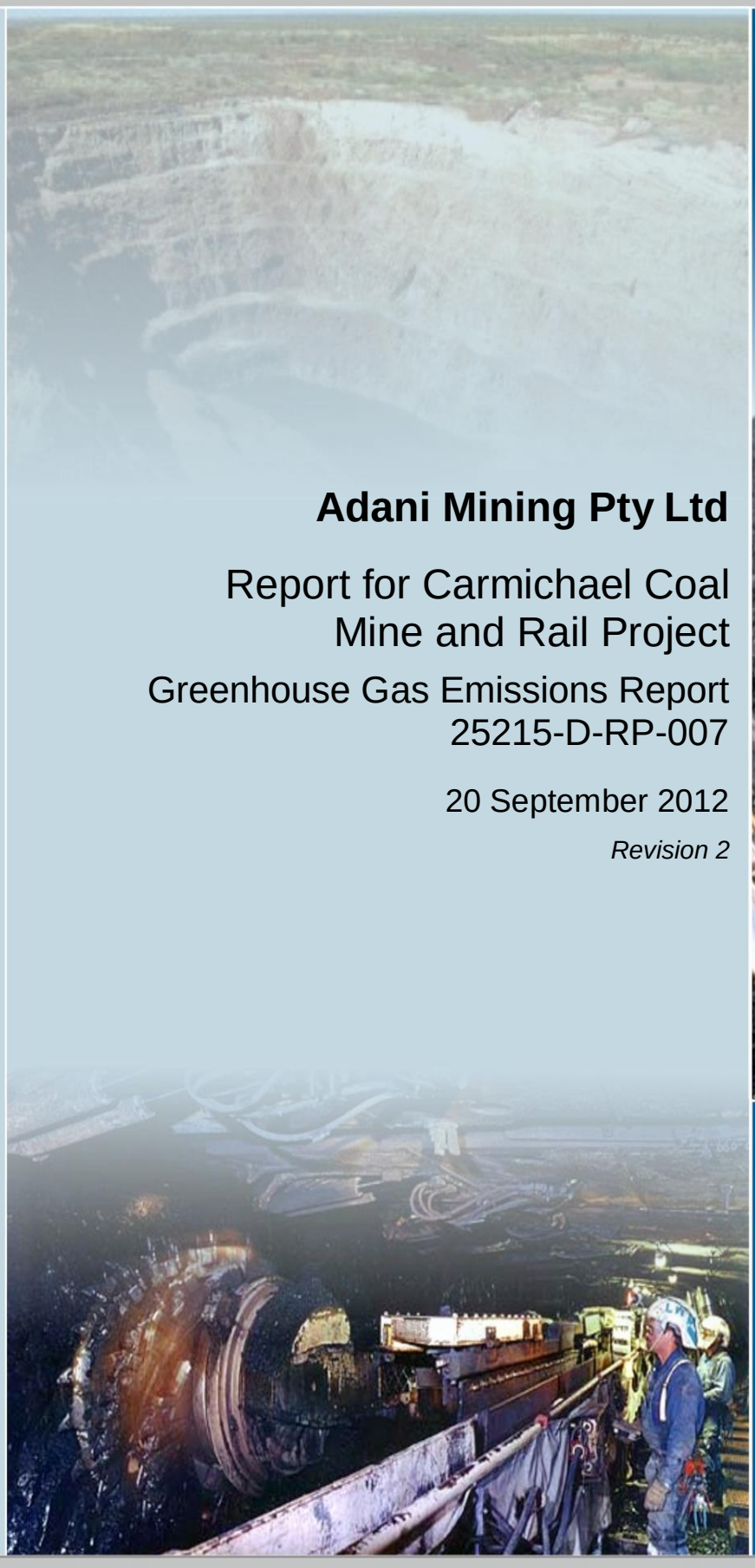
Adani Mining Pty Ltd





Adani Mining Pty Ltd

Report for Carmichael Coal Mine and Rail Project

Greenhouse Gas Emissions Report
25215-D-RP-007

20 September 2012

Revision 2

GHD

This Carmichael Coal Mine and Rail Project: Rail Greenhouse Gas Emissions Report ("the Report") has been prepared by GHD Pty Ltd ("GHD") on behalf of and for Adani Mining Pty Ltd ("Adani") in accordance with an agreement between GHD and Adani.

The Report may only be used and relied on by Adani for the purpose of informing environmental assessments and planning approvals for the proposed Carmichael Coal Mine and Rail Project (Purpose)and may not be used by, or relied on by any person other than Adani.

The services undertaken by GHD in connection with preparing the Report were limited to those specifically detailed in Section 1 of the Report.

The Report is based on conditions encountered and information reviewed, including assumptions made by GHD, at the time of preparing the Report. Assumptions made by GHD are listed within Section 1.5.7 of the Report and contained through the Report.

To the maximum extent permitted by law GHD expressly disclaims responsibility for or liability arising from:

- *any error in, or omission in connection with assumptions, or*
- *reliance on the Report by a third party, or use of this Report other than for the Purpose.*

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Abbreviations and Glossary

Project Specific Terminology	
Abbreviation	**Term**
the EIS	Carmichael Coal Mine and Rail Project Environmental Impact Statement
the Proponent	Adani Mining Pty Ltd
the Project (Mine)	A greenfield coal mine over EPC1690 and part of EPC1080, which includes both open cut and underground mining, on mine infrastructure and associated mine processing facilities (the Mine) and offsite infrastructure
the Project (Rail)	a greenfield rail line connecting the Mine to the existing Goonyella rail system to provide for export of coal via the Port of Abbot Point and/or the Port of Hay Point (Dudgeon Point expansion).

Generic Terminology	
Abbreviation	**Term**
a	annum
C	carbon
CFI	Carbon Farming Initiative
CH_4	methane
CO_2	carbon dioxide
COD	chemical oxygen demand
CNG	compressed natural gas
DCCEE	The Commonwealth Department of Climate Change and Energy Efficiency
ECP	Electronically Controlled Pneumatic Braking System
EEO Act	*Energy Efficiency Opportunities Act 2006*
EF	Emission Factor
FullCAM	Full Carbon Accounting Model
GHG	greenhouse gas
GIS	geographical information system
GJ	gigajoule
GWP	Global Warming Potential

Project Specific Terminology	
Abbreviation	**Term**
ha	hectare
HFCs	hydrofluorocarbons
kL	kilolitres
LNG	liquefied natural gas
m	metre
N_2O	nitrous oxide
NCAT	National Carbon Accounting Toolbox
NGA	National Greenhouse Accounts
NGERS	National Greenhouse and Energy Reporting System
P	people
PFCs	perfluorocarbons
PJ	Petajoule
RESS	Rechargeable Energy Storage System
SF_6	Sulphur hexafluoride
T	tonne
TJ	Terajoules
TOR	terms of reference
CO_2-e	Carbon dioxide equivalent emissions (emissions of other greenhouse gases are multiplied by their Global Warming Potential so that their effects can be compared to emissions of carbon dioxide)
Emission	The release of material into the environment (such as, dust)
GHG Protocol	The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard
Greenhouse Gases	Gases that accumulate within the earth's atmosphere (eg: primarily carbon dioxide and methane) which contribute to global climatic change/global warming (i.e. the 'greenhouse effect')
Mitigation	Limit the intensity of impacts or prevent impacts

1. Introduction

1.1 Project Overview

Adani Mining Pty Ltd (Adani) is proposing to develop a 60 million tonne (product) per annum (Mtpa) thermal coal mine in the north Galilee Basin approximately 160 kilometres (km) north-west of the town of Clermont, Central Queensland. All coal will be railed via a privately owned rail line connecting to the existing QR National rail infrastructure, and shipped through coal terminal facilities at the Port of Abbot Point and the Port of Hay Point (Dudgeon Point expansion). The Carmichael Coal Mine and Rail Project (the Project) will have an operating life of approximately 90 years.

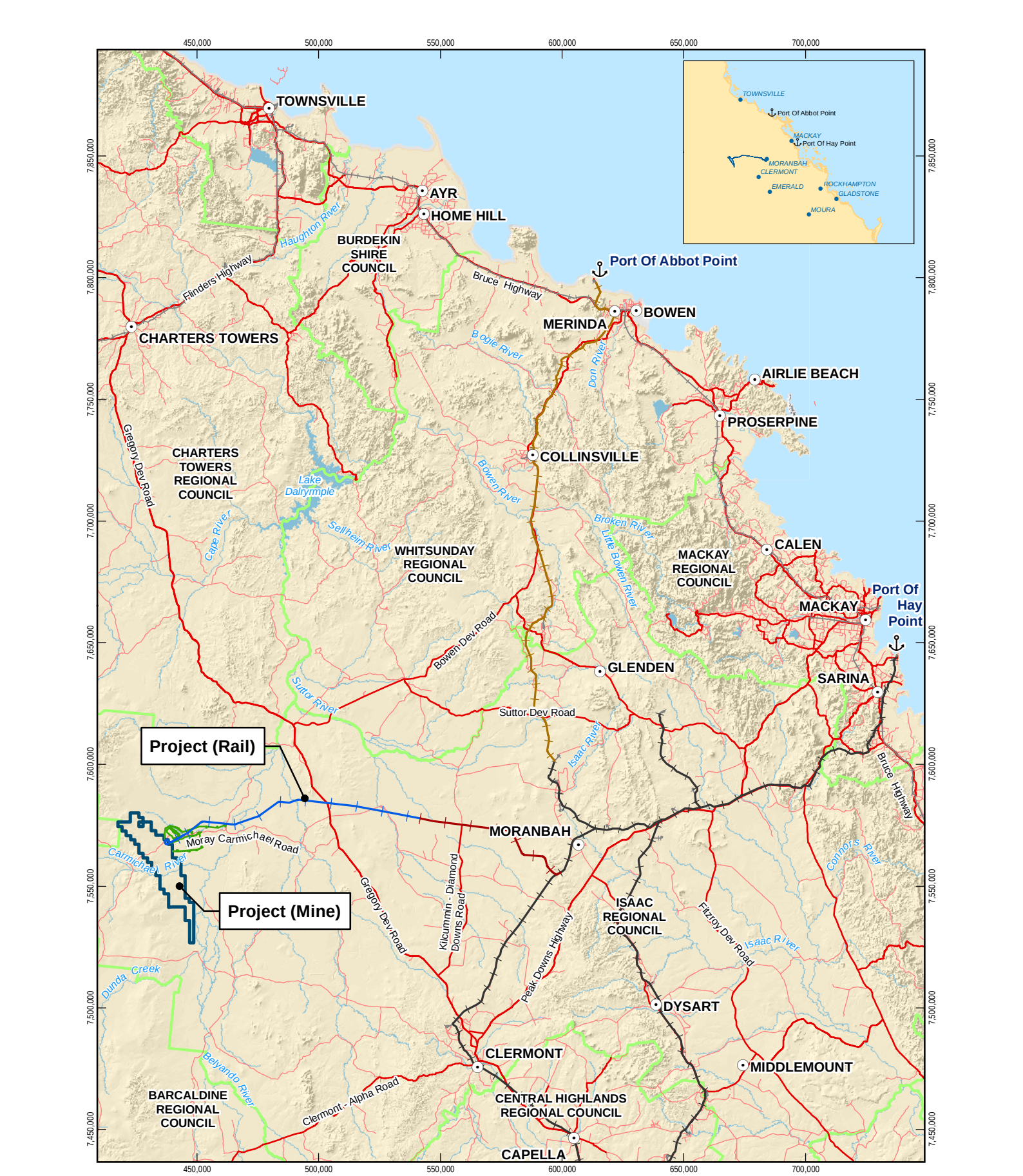
The Project comprises of two major components:

- The Project (Mine): a greenfield coal mine over EPC1690 and the eastern portion of EPC1080, which includes both open cut and underground mining, on mine infrastructure and associated mine processing facilities (the Mine) and the Mine (offsite) infrastructure including:
  - A workers accommodation village and associated facilities
  - A permanent airport site
  - Water supply infrastructure
- The Project (Rail): a greenfield rail line connecting the Mine to the existing Goonyella and Newlands rail systems to provide for the export of coal via the Port of Hay Point (Dudgeon Point expansion) and the Port of Abbot Point, respectively; including:
  - Rail (west): a 120 km dual gauge portion from the Mine site running west to east to Diamond Creek
  - Rail (east): a 69 km narrow gauge portion running east from Diamond Creek connecting to the Goonyella rail system south of Moranbah

The Project has been declared a 'significant project' under the *State Development and Public Works Organisation Act 1971* (SDPWO Act) and as such, an Environmental Impact Statement (EIS) is required for the Project. The Project is also a 'controlled action' and requires assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The Project EIS has been developed with the objective of avoiding or mitigating all potential adverse impacts to environmental, social and economic values and enhancing positive impacts. Detailed descriptions of the Project are provided in Volume 2 Section 2 Project Description (Mine) and Volume 3 Section 2 Project Description (Rail).

Figure 1-1 shows the Project location.



LEGEND

- Town
- Major Port
- Other Rail Network
- Goonyella System
- Newlands System
- State Road
- Local Road
- Watercourse
- Local Government Area
- Project (Rail)
- Rail (West)
- Rail (East)
- Project (Mine)
- Mine (Offsite)

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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

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Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project

Job Number 41-25215
Revision L
Date 28-08-2012

Project Location

Figure: 1-1

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Level 4, 201 Charlotte 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); DERM: LGA, (2011), Hillshade (2009); DMR: State Roads (2008); Gassman/Hyder: Mine (Offsite) (2012); DME: EPC1690 (2010), EPC1080 (2011); Adani: Alignment Opt9 Rev3 (2012). Created by: BW, JVC

1.2 Background

In 2007, the Intergovernmental Panel on Climate Change (IPCC) released its fourth assessment report which stated that warming of the climate system is now unequivocal and is very likely due to the observed increase in greenhouse gas (GHG) concentrations in the atmosphere as a result of human activities (IPCC, 2007).

Greenhouse gases are those gases in the earth's atmosphere that trap heat, allowing the temperature of the earth to be kept at a level that is necessary to maintain life. An increase in the levels of these gases in the atmosphere results in an increase in the amount of heat being trapped, leading to warming of the earth's surface. This is commonly referred to as the enhanced greenhouse effect. The three main greenhouse gases are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The emissions of these greenhouse gases are then multiplied by the global warming potential (GWP)[1] so that their effects in the atmosphere can be compared to emissions of carbon dioxide. These are represented in carbon dioxide equivalent (CO_2-e).

At an international level, the Australian government is a signatory to the Kyoto Protocol and as such, has greenhouse gas stabilisation and reporting commitments. Australia has committed to limit national emissions to 108 per cent of 1990 emissions, during the period 2008 - 2012. International negotiations will determine what new commitment Australia signs up to after 2012.

At a National level, the government has made a commitment to Australians, separate to any commitment under the Protocol, to reduce Australia's emissions by 5 per cent below 2000 levels by 2020 and 80 per cent by 2050.

1.3 Relevant Legislation

Key legislation relevant to the Project (Rail) construction and operations and their potential implications include the following:

- *Clean Energy Act 2011*. The Clean Energy Future legislation introduced a carbon pricing mechanism that has a broad coverage, encompassing the stationary energy sector, industrial processes, non-legacy waste and fugitive emissions. The carbon pricing mechanism commenced on 1 July 2012, with a fixed price for the first three years, after which the carbon price will transition to a fully flexible price under an emissions trading scheme, with the price determined by the market. Participation will need to be determined based on actual annual greenhouse gas emissions.
- *National Greenhouse and Energy Reporting Act 2007*. In the 2011-2012 reporting year, National Greenhouse and Energy Reporting Scheme (NGERS) applies to facilities that emit over 25,000 t CO_2-e per year or consume more than 100 TJ of energy or corporations that emit over 50,000 t CO_2-e per year or consume more than 200 TJ of energy. These thresholds relate to Scope 1 and Scope 2 emissions. Based on the estimated average annual energy use during operations the Project (Rail) is likely to trigger the facility and corporation thresholds. Participation will need to be determined based on actual annual greenhouse gas emissions and energy consumption.
- *Energy Efficiency Opportunities Act 2006*. The Energy Efficiency Opportunities (EEO) program requires businesses to identify, evaluate and publicly report cost effective energy saving opportunities. Participation in EEO is mandatory for corporations that use more than 0.5 PJ of energy

[1] The Global Warming Potential (GWP) is a relative measure of how much heat a greenhouse gas absorbs in the atmosphere compared with carbon dioxide.

per year. As the Project (Rail) will use more 0.5 PJ of energy per year, it will be mandatory to report this under the EEO program. Participation will need to be assessed based on actual energy consumption to determine the first year in which the threshold is exceeded.

- *Carbon Credits (Carbon Farming Initiative) Act 2011.* The Carbon Farming Initiative (CFI) has been developed to give farmers, forest growers and landholders the ability to generate accredited domestic offsets for access to domestic voluntary and international carbon markets. Any claims relating to 'carbon neutrality' for the Project (Rail) (or part thereof) should give consideration to the purchase of offsets generated under the CFI.
- Sequestration of greenhouse gases from the Project (Rail). The reference to the *Greenhouse Gas Storage Act (2009)* (GGS Act) in the Project ToR is not applicable in this assessment. The GGS Act applies to the sequestration of greenhouse gases by injection into storage areas and to the storage lease. As there is no greenhouse gas storage or injection associated with the Project (Rail), the GGS Act is not applicable and has not been assessed in this study.

1.4 Level of Assessment

The level of assessment required, as stated in the terms of reference (ToR) includes:

- Scope 1 greenhouse gas emissions
- Scope 2 greenhouse gas emissions

Scope 3 greenhouse gas emissions were not required for this assessment.

Compliance with the ToR is provided in Appendix A and summarised in Table 1-1.

Table 1-1 Terms of Reference Cross Reference

Terms of Reference Requirement/Section Number	Is this included in this report?	Section of this report
Section 3 Legislative Framework with reference to *Greenhouse Gas Storage Act 2009*	No	GHD note the ToR relates only to conditions for any proposed greenhouse gas injection and storage lease. As there is no greenhouse gas storage or injection associated with the Project (Rail), this is not applicable and is therefore not a requirement for this assessment.
Section 3.6.1 Description of environmental situation	Yes	Section 2
Section 3.6.2 Description of proposed mitigation measures	Yes	Sections 3.2 and 3.3 Volume 3 Section 13 Draft EMP
Section 3.6.2 Assessment of how the measures achieve energy efficiency	Yes	Section 3.3.3
Section 3.6.2 How the measures achieve best practice environment management	Yes	Section 3.3.4

Terms of Reference Requirement/Section Number	Is this included in this report?	Section of this report
Section 3.6.2 Description of off-setting opportunities	Yes	Section 3.2.4
Section 3.6.2 Description of the environmental management plan	Yes	Section 3.2
Section 3.6.2 Commitments to monitor, audit and report on emissions	Yes	Section 3.2.4

1.5 Approach and Methodology

1.5.1 Overview

The greenhouse gas assessment was prepared in accordance with the general principles of:

- *The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard* developed by the World Resource Institute and the World Business Council for Sustainable Development (GHG Protocol).
- The Commonwealth Department of Climate Change and Energy Efficiency (DCCEE) *National Greenhouse Accounts* (NGA) Factors, July 2012 (DCCEE, 2011a)
- Australia's National Carbon Accounting System (DCCEE, 2005)

These are considered to represent current good practice in Australian greenhouse gas accounting.

1.5.2 Boundary of the Assessment

This assessment is limited to the Project (Rail) and includes emissions from the following activities:

- Fuel combustion from construction and during operation of the rail only
- Vegetation removal during construction (95 m Project (Rail) footprint, ie rail line and access/maintenance road and ancillary infrastructure)
- Wastewater treatment during construction of the rail line only

1.5.3 Greenhouse Gases Considered

The greenhouse gases considered in this assessment are listed in Table 1-2. The global warming potential (GWP) for each greenhouse gas has also been provided, which provides a relative measure of how much heat a greenhouse gas traps in the atmosphere.

Table 1-2 Greenhouse Gases and 100 Year Global Warming Potential

Greenhouse Gas	Global Warming Potential (t/CO_2-e)
Carbon dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous oxide (N_2O)	310
Hydrofluorocarbons (HFCs)	140 – 11,700
Perfluorocarbons (PFCs)	6,500 – 9,200
Sulfur hexafluoride (SF_6)	23,900

Source: NGA Factors, July 2012

1.5.4 Emission Scopes

Emissions have been separated into Scopes 1 and 2 in accordance with the GHG Protocol. These scopes are defined as follows:

- Scope 1 emissions are greenhouse gas emissions that are released into the atmosphere as a direct result of an activity or series of activities
- Scope 2 emissions in relation to an activity or series of activities, are greenhouse gas emissions that are released into the atmosphere as a direct result of the generation of electricity, heating, cooling or steam that is consumed during the course of carrying out the activity or series of activities.

1.5.5 Data Collection and Calculation Procedures

The data for the greenhouse gas assessment was derived from the 'Adani Carmichael Rail Line - Concept Design Stage A, Report Volume 1 of 2', dated 17 November 2011 (Aarvee Associates, 2011). Where required due to the unavailability of data, assumptions and approximations have been made in order to obtain a reasonable estimate of activity levels. All assumptions are provided in Section 1.5.7.

The following stages and activities were assessed and considered as part of the Scope 1 and 2 emissions for the greenhouse gas assessment.

Table 1-3 Key Project (Rail) Activities Assessed

Project Stage	Project Activity	Emission Source resulting from Activity
Construction	Vegetation stripping	Carbon resulting from vegetation removal
	General construction camp activities	◗ Methane emissions resulting from treatment of wastewater associated with construction camps ◗ Diesel usage for power generation
	Laying of track, operation of machinery	Diesel usage for machinery
Operations	Rail haulage	Diesel usage for rail haulage

Greenhouse gas emissions due to vegetation clearing within the Project (Rail) were quantified using the National Carbon Accounting Toolbox (NCAT). The NCAT provides access to the Full Carbon Accounting Model (FullCAM) and supporting data (refer Appendix B for methodology). FullCAM is the method used to quantify emissions due to land clearing in Australia's land systems for the purposes of international reporting.

Volume 4 Appendix AA Rail Ecology Report defines broad vegetation communities within the Project (Rail) footprint. Together with geographical information system (GIS) analysis the types and areas of vegetation existing along the Project (Rail) alignment have been quantified. Three FullCAM plot files were created to model the broad scale vegetation types along the rail corridor (this was based on the corridor width of 95 m) (refer Appendix B). The following areas of vegetation (based on vegetation species))[2] are being cleared as part of the rail footprint as shown in Figure 1-2:

- *Corymbia citriodora* on duplex – woodland soil (194.6 ha)
- Mixed species environmental planting on clay – brigalow and gidgee soils (30.3 ha)
- Pasture grasslands (1639.2 ha)

Greenhouse gas emissions due to the clearing of this vegetation were estimated by multiplying the results returned by FullCAM by 3.67 (the ratio of the mass of a carbon atom to a carbon dioxide molecule), in order to convert to carbon dioxide equivalent.

All energy consumption and emissions data was converted into quantities of carbon dioxide equivalent. The emission values have been summed to reach an estimate of the total greenhouse gas emissions.

1.5.6 Exclusions

Exclusions from the assessment included:

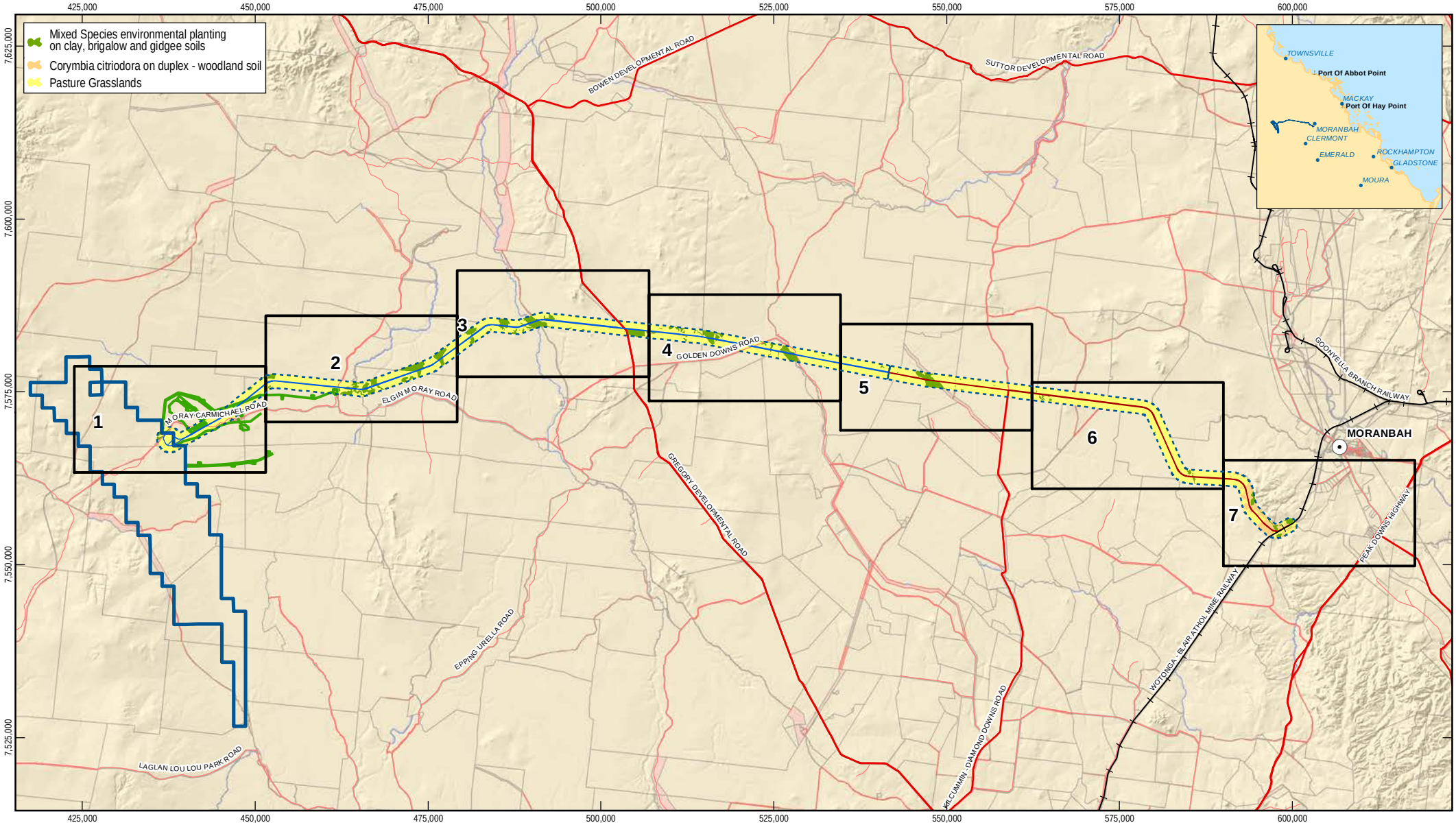
- Leakage of hydrofluorocarbons from air conditioning units and refrigeration. These emissions were considered to be negligible compared with the emissions over the life of the Project (Rail).

[2] Note these areas were calculated and provided as per Volume 4 Appendix AA Rail Ecology Report and based on wooded and grassed areas for the purpose of the vegetation assessment.

- Leakage of sulfur hexafluoride from electrical equipment. These emissions were considered to be negligible compared with the emissions over the life of the Project (Rail).
- Sequestration of carbon dioxide from revegetation of the site. Whilst revegetation of sections of the rail corridor will occur, where appropriate, sequestration calculations were unable to be carried out due to the unavailability of a descriptive revegetation plan. Excluding sequestration also assumes a worst case scenario for greenhouse gas emissions; therefore this scenario is considered the most conservative representation of Project (Rail) emissions.
- Scope 3 greenhouse gas emissions.
- Perfluorocarbons would not be used or stored during construction or operation of the project.

1.5.7 Assumptions

Assumptions used in estimating the activity levels and associated greenhouse gas emissions for the Project (Rail) are listed in Table 1-4. The assessment was based on emission factors available at the time of the assessment and future changes in emission factors were not considered.



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0 5 10 15 20 25

Kilometres

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

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LEGEND

- Town
- State Road
- Local Road
- Other Railway
- Cadastral Parcel
- Road Reserve
- Watercourse Reserve
- Mine (Onsite)
- Mine (Offsite)
- Study Area
- Rail (West)
- Rail (East)

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

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Figure 1-2
Broadscale Vegetation Types (FullCAM) Series Index

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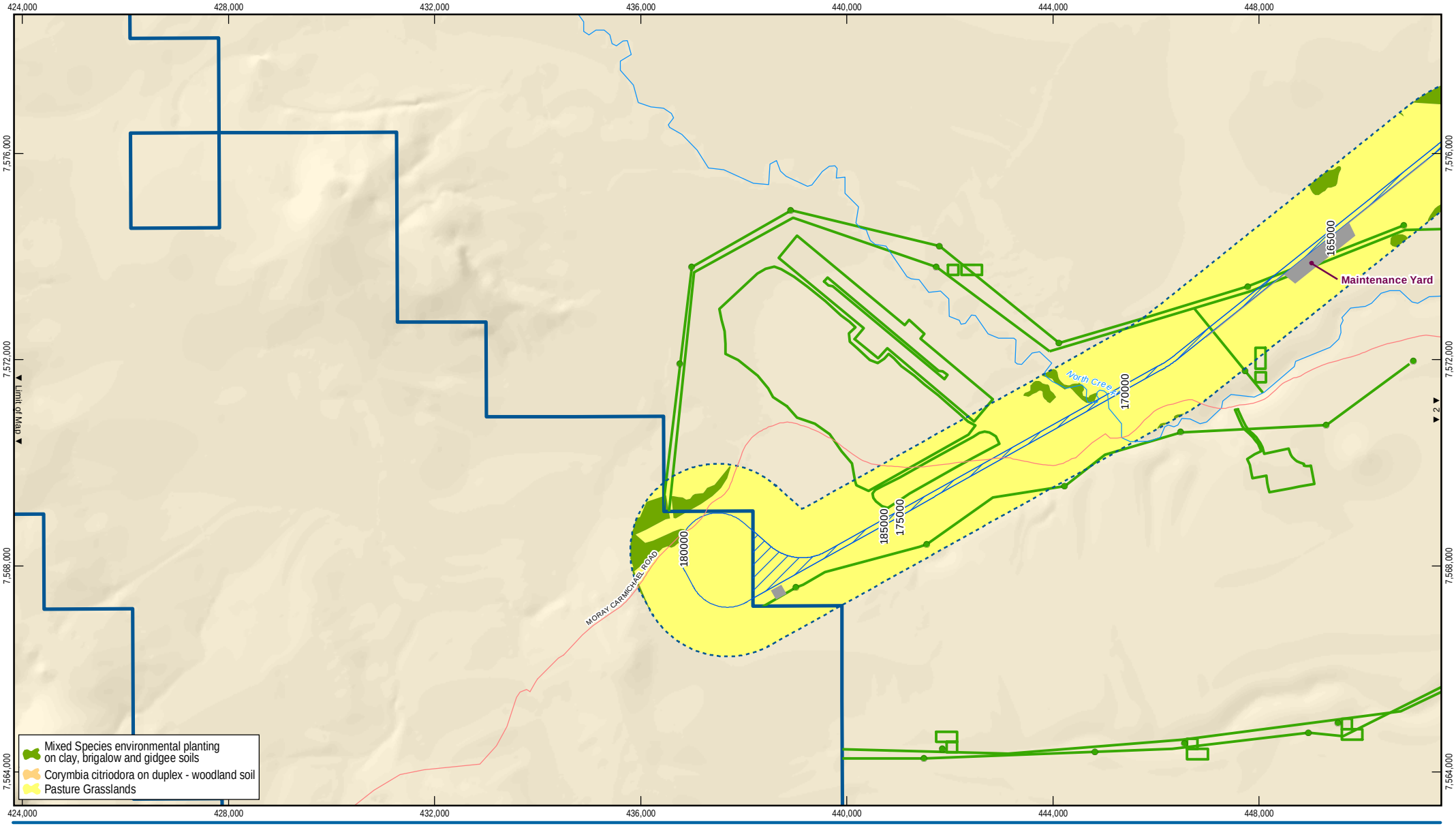
Data source: DERM: DEM (2008), DCDB (2010); DME: EPC1690 (2010)/EPC1080 (2011); © Commonwealth of Australia (Geoscience Australia):Localities, Railways, Roads (2007); Adani: Alignment Opt9 Rev3 (2012); GHD: Broadscale Vegetation Types (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: BW, MS, CA



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Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Representative point for climatic, geophysical and maximum above ground biomass values
- Construction Camp
- State Road
- Local Road
- Watercourse
- Other Railway
- Study Area
- Mine (Onsite)
- Mine (Offsite)
- Mine (Offsite)
- Rail (Infrastructure)
- Rail (West)
- Rail (East)

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Figure 1-2
Broadscale Vegetation Types (FullCAM) Sheet 1 of 7

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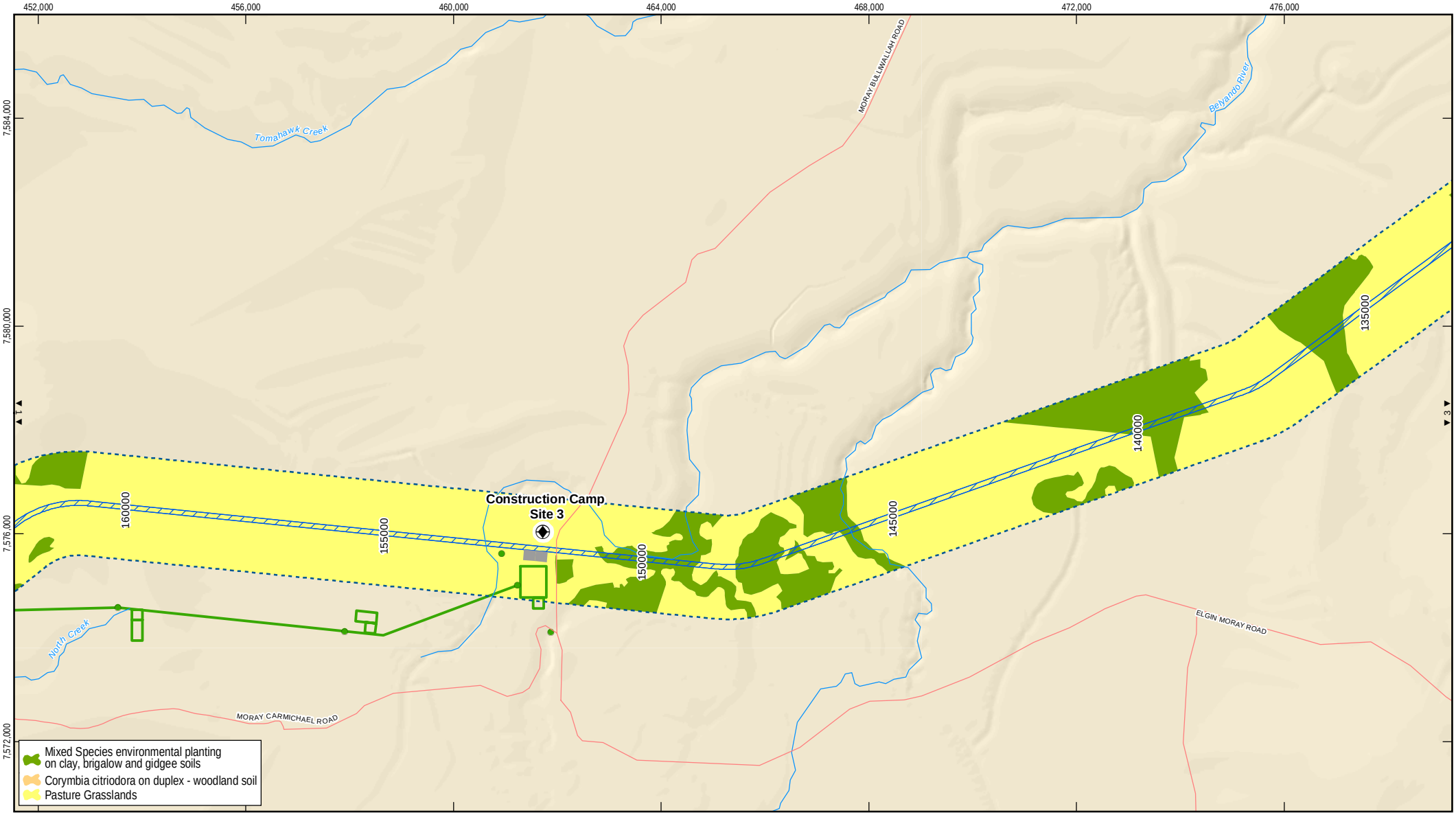

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- Mine (Offsite)
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- Rail (West)
- Rail (East)

Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project

Job Number	41-25215
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Date	05-09-2012

Figure 1-2
Broadscale Vegetation Types (FullCAM) Sheet 2 of 7

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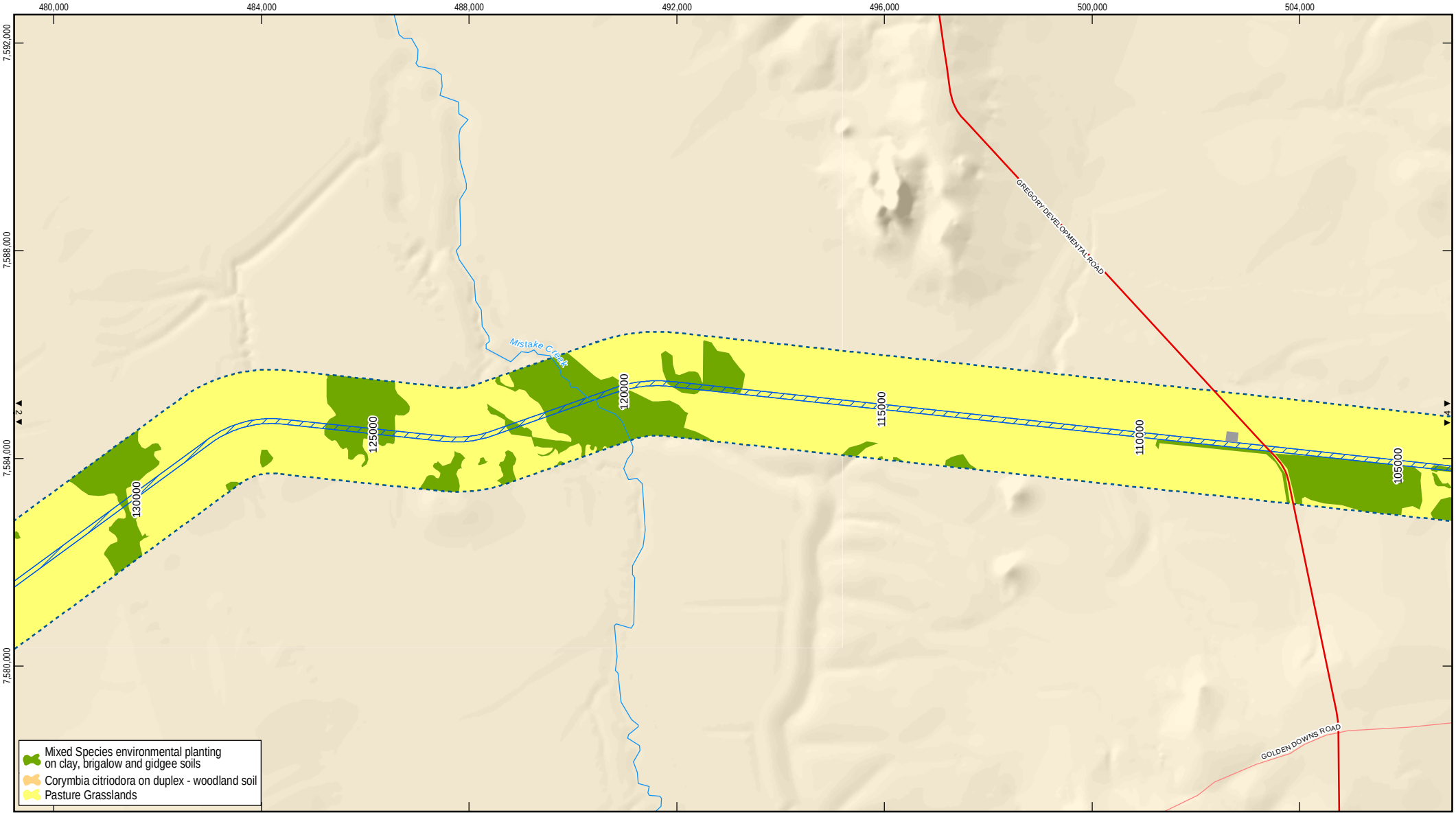
Data source: DERM: DEM (2008) © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Roads, Watercourse (2007); GHD: Broadscale Vegetation Types (2012); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); DME: EPC1690 (2010)/EPC 1080(2011). Created by: BW, MS, CA



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- Rail (East)

Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project

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Figure 1-2
Broadscale Vegetation Types (FullCAM) Sheet 3 of 7

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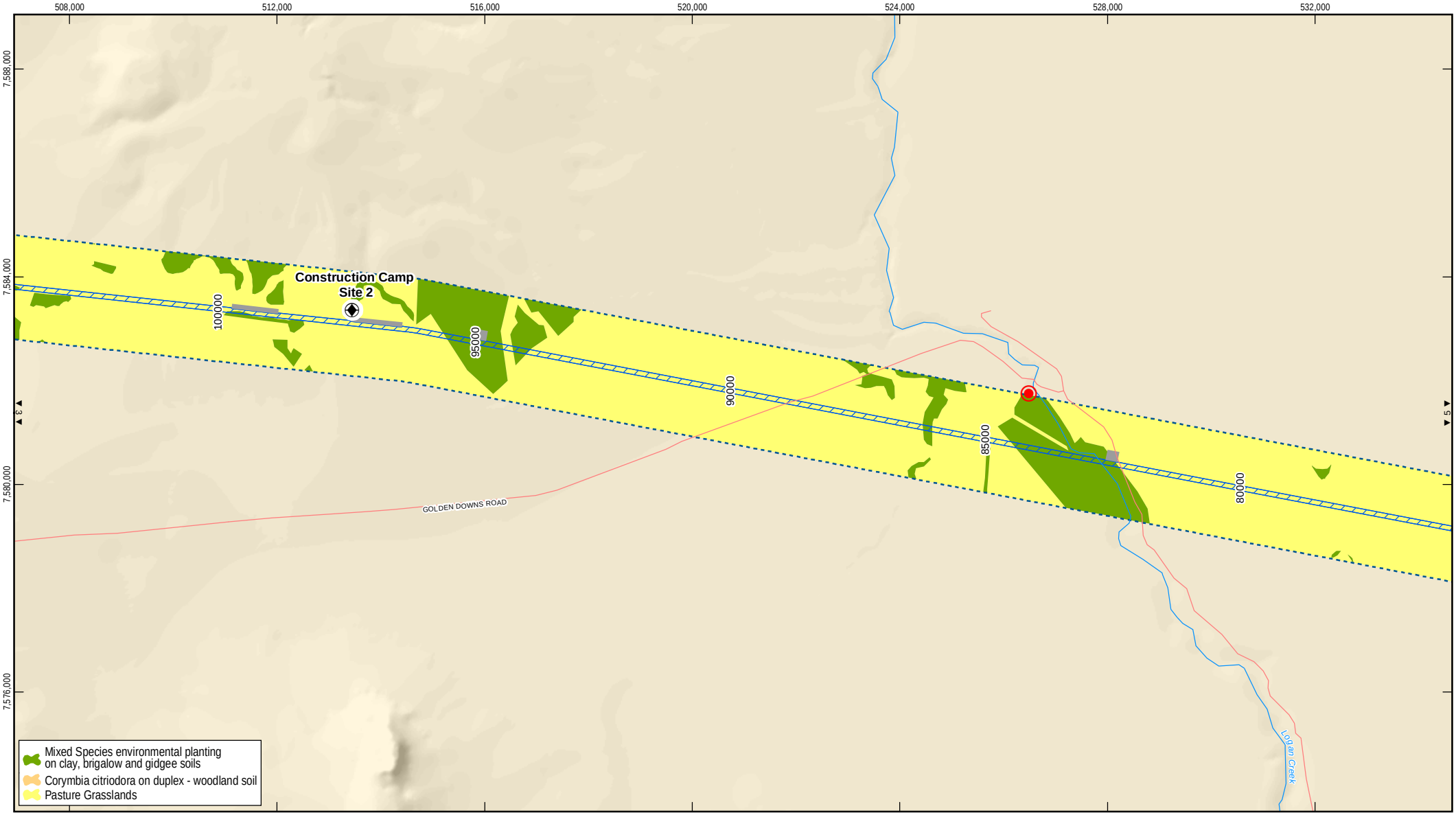

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- Rail (East)

Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project

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Date 05-09-2012

Figure 1-2
Broadscale Vegetation Types (FullCAM) Sheet 4 of 7

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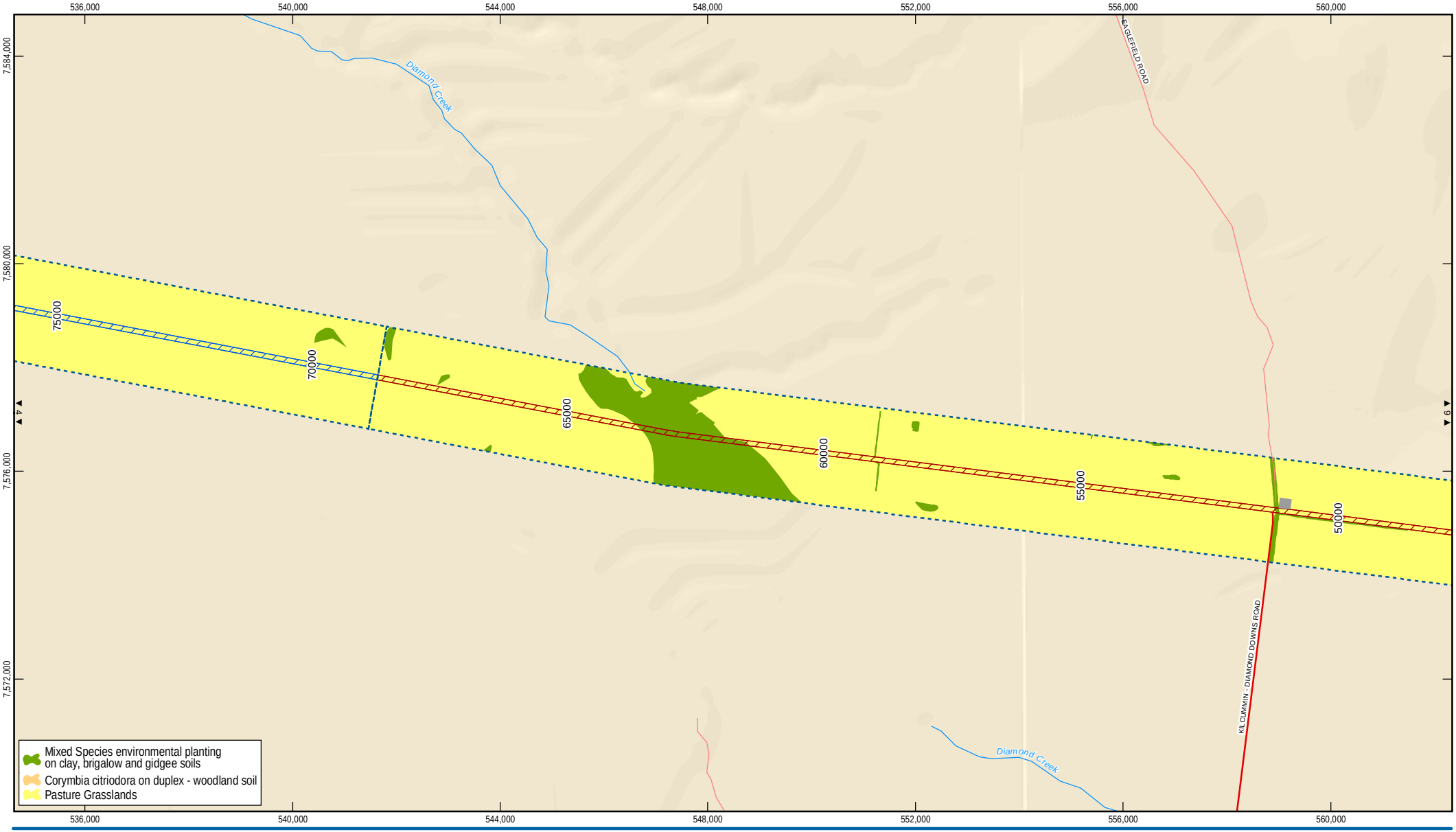
Data source: DERM: DEM (2008) © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Roads, Watercourse (2007); GHD: Broadscale Vegetation Types (2012); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); DME: EPC1690 (2010)/EPC 1080(2011). Created by: BW, MS, CA



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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

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Figure 1-2
Broadscale Vegetation Types (FullCAM) Sheet 5 of 7

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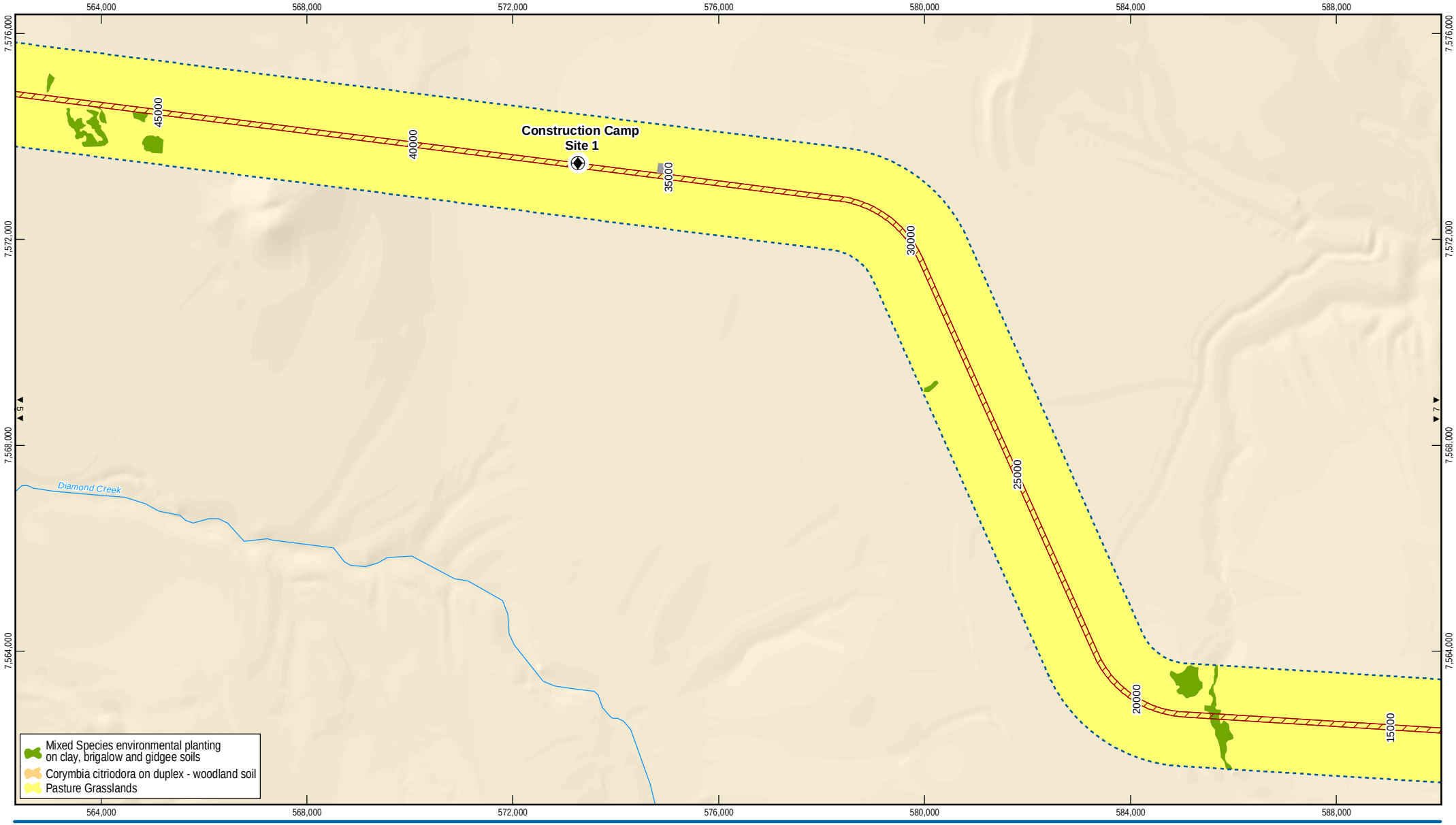
Data source: DERM: DEM (2008) © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Roads, Watercourse (2007); GHD: Broadscale Vegetation Types (2012); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); DME: EPC1690 (2010)/EPC 1080(2011). Created by: BW, MS, CA



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Kilometres

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

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LEGEND

- Representative point for climatic, geophysical and maximum above ground biomass values
- Construction Camp
- State Road
- Local Road
- Watercourse
- Other Railway
- Study Area
- Mine (Onsite)
- Mine (Offsite)
- Mine (Offsite)
- Rail (Infrastructure)
- Rail (West)
- Rail (East)

Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project

Job Number	41-25215
Revision	B
Date	05-09-2012

Figure 1-2

Broadscale Vegetation Types (FullCAM) Sheet 6 of 7

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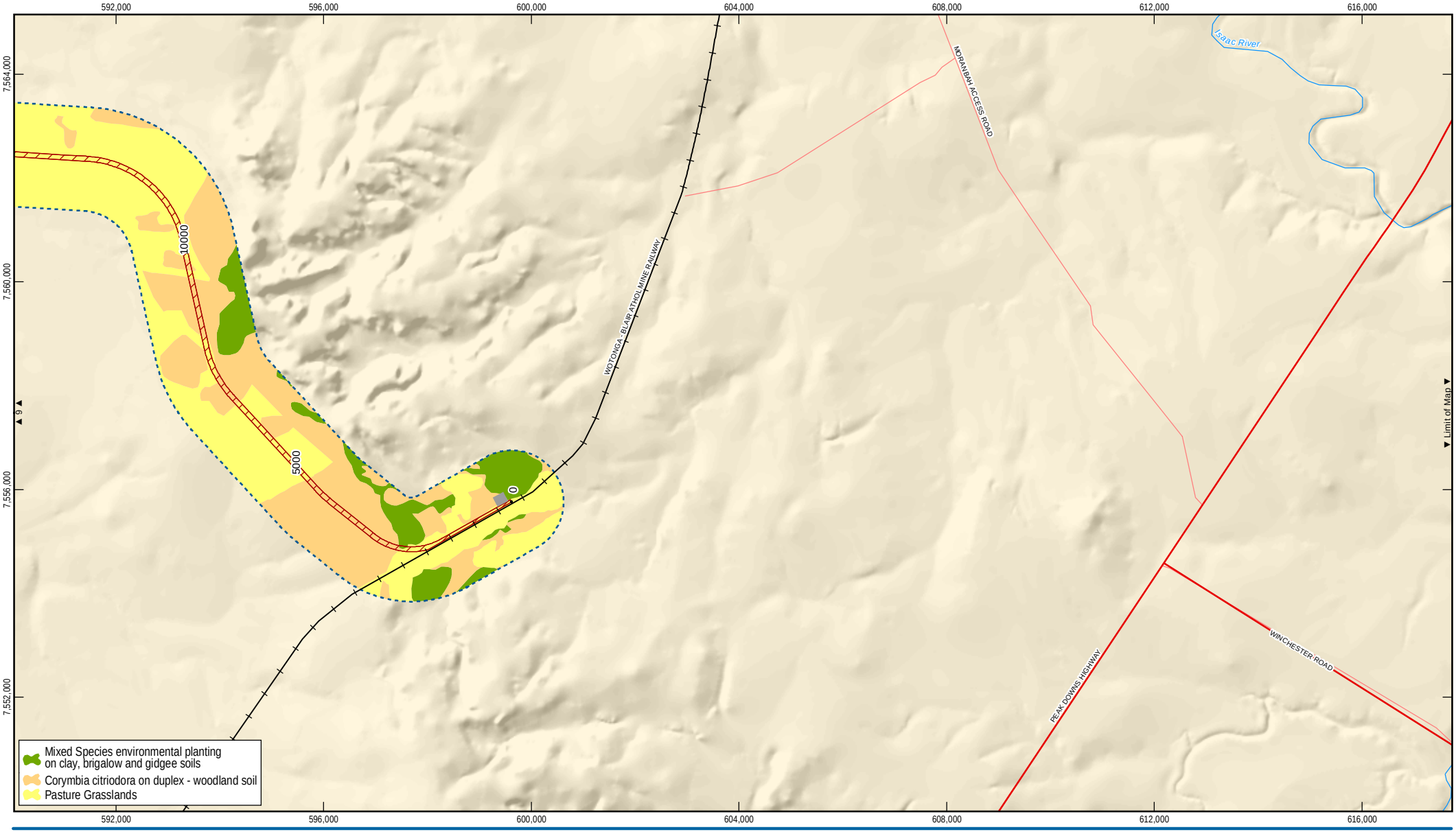

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Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project

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Figure 1-2

Broadscale Vegetation Types (FullCAM) Sheet 7 of 7

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Data source: DERM: DEM (2008) © Commonwealth of Australia (Geoscience Australia): Localities, Railways, Roads, Watercourse (2007); GHD: Broadscale Vegetation Types (2012); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); DME: EPC1690 (2010)/EPC 1080(2011). Created by: BW, MS, CA

Table 1-4 Assumptions

Parameter Measured	Assumption
Diesel – construction	Diesel usage for the Project (Rail) during construction has been based on a figure of 50,000 kL. This quantity is based on an average of the two figures taken from the Surat Basin Rail and Alpha Coal rail projects. This figure equates to 224 kL per km of track laid. Details showing how calculations have been derived to estimate the quantity of diesel usage based on projects of similar nature are provided in Appendix B. As per the methodology described in Section 1.5, Emission Factors (EFs) were sourced from DCCEE NGA Factors July 2012 Table 3. These include components for CO_2, CH_4 and N_20.
Wastewater treatment - construction	Average annual quantity of GHG emission from wastewater treatment was calculated in accordance with the DCCEE NGA Factors 2012. The calculated annual figure was multiplied by the expected length of construction (20 months) to give emissions across the construction period. The emissions were based on a maximum workforce of 2200 people and the following default factors: ◗ Chemical oxygen demand (COD) per capita per year of wastewater – 0.0585 t/person/year ◗ The quantity of COD in wastewater discharged in effluent was assumed to be zero ◗ Fraction of COD removed as sludge – 0.29 ◗ Methane emission factor for wastewater – 5.3 t CO_2-e/t ◗ Methane emission factor for sludge – 5.3 t CO_2-e/t ◗ Fraction of COD anaerobically treated in wastewater and sludge – 0.8 ◗ Fraction of methane recovered from wastewater – 0
Vegetation removal - construction	A representative point along the rail alignment (latitude: -21.867991; longitude: 147.256308) was chosen for which climatic, geophysical and maximum above ground biomass values were downloaded from the DCCEE server. It was assumed that data downloaded at this point was representative of climatic conditions along the alignment. In calculating existing carbon on the site no fires or management (thinning, harvesting or pruning) events in the vegetation's history were simulated. It was assumed that all carbon from the above ground vegetation, roots and soil carbon pools, in the total 95 m corridor and temporary infrastructure areas, would be removed by the Project (Rail) and would not regrow following construction. In the absence of FullCAM categories for each vegetation community

Parameter Measured	Assumption
	identified at the site, it was assumed that the existing FullCAM tree species groups "*Corymbia citriodora*" and "Mixed species environmental planting" represent the types of vegetation existing in the area. Pasture grasslands were modelled as grasslands.
Diesel - Operation	Quantity of diesel for rail haulage was estimated at 21,250,000kL over the life of the Project (Rail) based on the following : ◗ Extractable coal reserves of the mine being 7.8 billion tonnes ◗ Average per coal tonne diesel use being 2.5 L The quantity of diesel includes the haulage of coal from the mine to port and the return trip. EF were sourced from DCCEE NGA Factors July 2012 Table 4. These include components for CO_2, CH_4 and N_20.

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2. Description of Environmental Situation

The greenhouse gas emissions for the Project (Rail) were calculated based on estimated energy usage during construction and operations, wastewater treatment during construction and vegetation removal.

The total Scope 1 emissions during construction were estimated to be approximately 311 kt CO_2-e. Vegetation removal contributed 57 per cent of the Scope 1 emissions during construction, diesel consumption contributed 43 per cent and emissions from wastewater treatment were negligible. Electricity is not proposed to be used during construction and therefore Scope 2 emissions are zero.

The total Scope 1 emissions over the life of the Project (Rail) from coal haulage were estimated to be approximately 57,335 kt CO_2-e based on a 90 year project life. Details with regard to the future proposed electrification of the rail track were not proposed at the time of the assessment and therefore Scope 2 emissions are zero. If electrification of the rail track occurs in the future then the emissions and associated impacts will be assessed at this time.

The total Scope 1 emissions over the life of the Project (Rail) (i.e. construction and operation) were estimated as 57,647 kt CO_2-e. Diesel consumption for coal haulage accounts for 99 per cent of emissions over the life of the Project (Rail), vegetation clearing and diesel consumption during construction less than 1 per cent.

The average annual Scope 1 emissions over the life of the Project (Rail) were estimated to be approximately 641 kt CO_2-e per annum. The average annual Scope 1 emissions from the Project (Rail) are estimated to be approximately 0.5 per cent of Queensland's 2009 greenhouse gas emissions and approximately 0.1 per cent of Australia's 2009 greenhouse gas emissions (DCCEE, 2011b).

As per International Standard and the Greenhouse Gas Protocol, the accumulative impact of greenhouse gases resulting from the Project is expressed in terms of CO2-e. Through this calculation, the greenhouse gas potential of relevant gases (CO_2, CH_4, N_20) has been taken into account.

As per International Standard and the Greenhouse Gas Protocol, the accumulative impact of greenhouse gases resulting from the Project is expressed in terms of CO2-e. Through this calculation, the greenhouse gas potential of relevant gases (CO_2, CH_4, N_20) has been taken into account.

The greenhouse gas inventory is provided in Table 2-1.

Table 2-1 Greenhouse Gas Inventory over 90 Year Project Life

Emissions Source	Quantity	Units	Scope 1 Emission Factor	Scope 2 Emission Factor	Units	Scope 1 Emissions	Scope 2 Emissions	Total Emissions	Proportion of Total Inventory
	Total		t CO_2-e / units	t CO_2-e / units		(t CO_2-e)	(t CO_2-e)	(t CO_2-e)	%
Diesel - construction	50,000	kL	2.683	0.000	kL	134,135	0	134,135	0.2
Vegetation removal - construction	48,037*	t C	3.670	0.000	t C	176,297	0	176,297	0.3
Wastewater treatment - construction	3,667	Person years	0.248	0.000	p	909	0	909	0.0%
Diesel - operation	21,250,000	kL	2.698	0.000	kL	57,335,475	0	57,335,475	99.5
Project Life GHG Emissions						**57,646,817**	**0**	**57,646,817**	**100.0%**

Note:

* The total tonnes of carbon for each vegetation type were estimated as (refer Appendix B):

- *Corymbia citriodora* on duplex – woodland soil (13,698 t C)
- Mixed species environmental planting on clay – brigalow and gidgee soils (2,310 t C)
- Pasture grasslands (32,029 t C).

3. Potential Mitigation Measures

3.1 Overview

According to the Commonwealth Department of Climate Change and Energy Efficiency potential impacts to Queensland's industries, infrastructure, environment and people from greenhouse gas induced climate change includes:

- Reduction in the coastal zone - due to the risk of inundation from a sea level rise
- Reduction in the water supply – due to a decrease in rainfall and an increase in evaporation rates
- Increase in extreme weather events - including severe storms, tropical cyclones, extreme rainfall leading to flooding
- Heatwaves and decrease in human health - increase in heat related deaths and mosquito-borne diseases
- Loss of biodiversity – increase in sea temperature rises leading to coral bleaching of the Great Barrier Reef. Reduction in rainforest area leading to decreased habitat.
- Agriculture - future productivity growth may be affected by climate change in the medium to long term through higher temperatures, reduced rainfall and extreme weather events (DCCEE, 2012)

It is recognised that railway construction and operations will result in the generation of greenhouse gas emissions and therefore may contribute to climate change. Therefore, it is important to managing and mitigating the impacts identified above on industries, infrastructure, environment and people.

The following greenhouse gas abatement measures are proposed to minimise greenhouse gas emissions during the construction and operation of the Project (Rail) that may be implemented on site and at corporate level.

The responsibility of implementing mitigation measures and complying with monitoring and reporting requirements during the operational phase will fall to the operator of the rail line.

3.2 Construction

3.2.1 Potential Greenhouse Gas Impacts

The greenhouse gas emissions from the construction of the Project (Rail) will result from fugitive emissions from construction activities and other direct emission sources, including vegetation removal, wastewater treatment, transport, manufacturing and construction of building materials and energy usage.

These greenhouse gas emissions will be relatively low and produced over a short time period and are therefore unlikely to contribute significantly to Queensland's overall greenhouse gas emissions. However, to reduce the likely greenhouse gas emissions from the construction of the rail management and mitigation measures are outlined further below.

3.2.2 Planning and Avoidance

An Environmental Management Plan (EMP) (refer to Volume 3 Section 13 Draft EMP) has been developed and will be implemented during construction. This Environmental Management Plan includes commitments aimed to avoid and reduce greenhouse gas emissions, energy costs and energy consumption for the construction of the Project (Rail).

These commitments include:

- Greenhouse gas emission and energy use reduction targets will be established
- Reuse of materials onsite will be considered, where possible, to reduce transport distances and heavy vehicle trips to any offsite disposal area
- Vegetation clearing will be been minimised and restricted to the required footprint

The EMP will include GHG Emissions Management Sub Plan that will outline the strategies, objectives and mitigation measures required to measure, report and identify energy efficiency opportunities.

A greenhouse gas emissions inventory has been established and assessed in this report. The next steps would be to set achievable and realistic reduction targets for construction, based on projects of a similar nature and identify and investigate potential reduction opportunities to realise these targets.

3.2.3 Mitigation Measures

The management of adverse impacts arising from the construction of the Project (Rail) has been addressed according to the hierarchy of avoidance; mitigation and offsetting of adverse impacts.

Avoidance of Impacts

Impacts of the Project (Rail) on greenhouse gas emissions have been avoided or minimised where possible through the planning and design process. Activities such as vegetation clearing have been minimised and restricted to the required footprint only to avoid further greenhouse gas emissions through vegetation removal. The design also re-uses excavated spoil material onsite as fill for the train line embankment. Reducing transport distances and heavy vehicle trips to an offsite disposal area also reduces the associated greenhouse gas emissions resulting from combustion of fuels.

The consumption of fuel is a necessary requirement, and currently accounts 98 per cent of greenhouse gas emissions from the Project (Rail). However, a reduction in the quantity of fuel consumed will be achievable through optimisation of operational activities and logistics. Optimisation of these activities will reduce the number of vehicles and/or trips required. This optimisation will be undertaken during the detailed Project (Rail) design and planning stage.

Further mitigation and offset measures are described below.

Mitigation of Impacts

Biodiesel blends (diesel that has a percentage of the fuel replaced with biodiesel) will reduce greenhouse gas emissions due to fuel consumption; however, this is dependent on a number of factors including the origin of the biodiesel feedstock.

When sourced from appropriate feedstocks, the reduction in emissions is approximately equivalent to the percentage of biodiesel in the blend (for example diesel with 20 per cent biodiesel will reduce greenhouse gas emissions by approximately 20 per cent). Calculations to determine the reduction in greenhouse gas emissions when using biodiesel should consider the entire life cycle of the fuel.

There are a number of other factors that require consideration prior to the use of biodiesel for the Project (Rail). There is significant debate over the suitability and/or the percentage of biodiesel that can be used in vehicles and plant. Biodiesel may not be suitable for some vehicles without major modifications. Plant operators are also concerned that vehicle and plant warranties may be void if biodiesel or biodiesel blends are used in vehicles. Opportunities for the use of biodiesel will be further examined and used where possible on the Project (Rail).

Energy Efficiency and Management

Through efficient and appropriate management of the rail construction operations, emissions can effectively be reduced. Recognising opportunities to make significant energy consuming equipment more efficient, including the application of technical efficiencies in plant and equipment as and once available, would provide more efficiency in construction operations.

For the maintenance facilities and construction camps, Adani will investigate the feasibility of utilising, where available, a component of electricity purchased from renewable sources, such as GreenPower, and also use onsite renewables such as photovoltaics or biofuel powered generators.

Through the EMP, appropriate management will be integrated into all construction activities and processes and greenhouse gas emissions will be monitored. Through assessment and review, the Project (Rail) will seek continuous improvement in compliance and emissions reduction.

Commitments to energy management will be developed as part of a detailed energy efficiency assessment. Monitoring and implementation of energy efficient improvements are also required under the EEO Act. Regular energy audits and reviews of railway construction operations will identify possible energy efficiency improvement opportunities which will be implemented to progressively improve construction operations and subsequent efficiency.

Technology Review

The application of technical efficiencies in construction plant and equipment will provide more efficiency in operations. An appropriate business case will identify equipment options to be considered for construction, including any new technologies available, expected benefits, potential risks and costs.

3.2.4 Offset Measures

The feasibility of generating carbon offsets for the construction of the Project (Rail) in accordance with the Carbon Farming Initiative will be investigated during project planning. The feasibility study would need to consider legislative and development approval requirements in assessing whether the potential carbon offset projects comply with the additional requirements of the Carbon Farming Initiative.

The purchase of carbon permits generated in Australia or overseas will be considered when managing the Project (Mine) liability under the carbon pricing mechanism.

3.2.5 Monitoring and Reporting

There are a number of legislative requirements for measuring, monitoring and reporting greenhouse gas emissions and energy consumption that are applicable to the construction of the Project (Rail). The liable entity for this reporting will need to be determined prior to the commencement of the construction phase.

Monitoring and reporting is likely to be a requirement under the NGER and EEO Acts.

The legislative measuring and reporting requirements will be used to assist in the identification of greenhouse gas reduction opportunities and track performance throughout the rail construction period.

The following monitoring and reporting commitments will be implemented during the construction of the Project (Rail):

- Fuel consumption and energy use will be monitored
- Greenhouse gas emissions and energy consumption will be measured and recorded in accordance with current legislative requirements
- Fuel consumption, energy use and greenhouse gas emissions will form part of the reporting requirements to senior management
- Greenhouse gas emissions and energy consumption will be reported to relevant authorities in accordance with current legislative requirements

3.3 Operation

3.3.1 Potential Greenhouse Gas Impacts

The greenhouse gas emissions from the operation of the Project (Rail) will result from fugitive emissions from direct emission sources such as diesel usage. As discussed previously in this chapter the average annual Scope 1 emissions over the life of the Project (Rail) are estimated to be approximately 0.3 per cent of Queensland's 2009 greenhouse gas emissions and approximately 0.07 per cent of Australia's 2009 greenhouse gas emissions. Diesel consumption is the largest emitting source over the life of the Project (Rail).

These greenhouse gas emissions will contribute to Queensland and Australia's overall greenhouse gas emissions over an extended period of time. To reduce the impacts from greenhouse gas emissions the operation of the Project (Rail) management and mitigation measures are outlined further below.

3.3.2 Planning and Avoidance

An EMP (refer to Volume 3 Section 13 Draft EMP) has been developed and will be implemented during operation. The EMP includes commitments aimed to avoid and reduce greenhouse gas emissions, energy costs and energy consumption to assist operational efficiency and business productivity.

These commitments include:

- Greenhouse gas emission and energy use reduction targets will be established
- The use of anti-idling engine management software to balance energy demand and fuel consumption will be considered for the operation of the locomotives. Similar technologies such as automatic engine stop start (AESS) systems, which shuts down the engine if it has been idling for more than 10 minutes have been successfully adopted for freight train transportation in Western Australia.

  The use of biodiesel or other low emissions fuels will be considered and investigated for operating the trains. SBR, a private rail operator in Victoria currently run their AC locomotives on B20 biodiesel, enabling savings of carbon emissions through daily operations. Biodiesel is currently not commonly utilised throughout the Australia train industry, however with successful application in the private sector, this consideration may become more feasible with time

- Alternative drivetrain technologies for rail transport have been researched within the rail industry, with potential to provide energy efficiency opportunities with documented fuel reduction savings. However, this technology currently has limited Australian experience. Further research into the feasibility of this technology would be required prior to consideration for the Project
- The opportunity to include a component of electricity purchased from renewable sources will be investigated. Electricity usage for infrastructure such as signalling boxes has the opportunity to consider photovoltaic power.
- Greenhouse gas emissions and energy use will be reviewed regularly and opportunities to reduce will be investigated. Fortescue Minerals Ltd have undertaken detailed energy analysis of their freight trains, identifying activities and operations which are fuel intensive in order to identify opportunities where fuel efficiency could be improved. An understanding of energy uses and corresponding fuel consumption would help Adani identify further opportunities where reduction in sources is most feasible and effective
- Energy efficiency measures will be continually investigated

A greenhouse gas emissions inventory has been established and assessed in this report. The next steps will be to set achievable and realistic reduction targets for operations, based on projects of similar nature and identify and investigate potential reduction opportunities to realise these targets. A site specific marginal abatement cost curve for identified reduction opportunities will help to prioritise these opportunities and be useful in determining what particular opportunities can be employed to reach a specific carbon reduction goal.

3.3.3 Mitigation Measures

The management of adverse impacts arising from the operation of the Project (Rail) has been addressed according to the hierarchy of avoidance; mitigation and offsetting of adverse impacts.

Avoidance of Impacts

Impacts of the Project (Rail) operations on greenhouse gas emissions have been avoided or minimised where possible through the planning and design process.

The consumption of fuel is a necessary requirement, and currently accounts 98 per cent of greenhouse gas emissions from operations. However, a reduction in the quantity of fuel consumed will be achievable through optimisation of operational activities and logistics. Optimisation of these activities will reduce the number of vehicles and/or trips required. This optimisation will be undertaken during the detailed Project (Rail) design and planning stage.

The Australasian Railway Association (2010) identifies a number of options which will lead to a reduction in fuel consumption of the train sets, including:

- Use of newer locomotives, or old locomotives with new engines to improve operational efficiency
- Fitting electronically controlled pneumatic (ECP) braking to locomotives and wagons. ECP braking enables all wagons to brake simultaneously, reducing fuel consumption. There have been extensive Australia trials on the benefits of this technology to reduce overall fuel consumption, with overall savings of around 4-11% in some trials.
- Improving the aerodynamics of locomotives and wagons

- Use of anti-idling engine management software to balance energy demand and fuel consumption. Australian trials are currently being undertaken, which demonstrate fuel savings in the range of 4-11%.

The use of more recent models and technologies during operation will need to be part of a wider fuel management strategy that incorporates Project (Rail) planning, logistics, driver education and maintenance as any fuel reductions due to more efficient models may be outweighed by poor management in other areas. Where appropriately investigated and feasible, applying technical efficiencies in train operations will provide more efficiency in operations.

Further mitigation and offset measures are described below with the aim to overcome these constraints.

Mitigation of Impacts

Biodiesel blends (diesel that has a percentage of the fuel replaced with biodiesel) may reduce greenhouse gas emissions due to fuel consumption. However, this is dependent on a number of factors including the origin of the biodiesel feedstock.

When sourced from appropriate feedstocks, the reduction in emissions is approximately equivalent to the percentage of biodiesel in the blend (for example diesel with 20 per cent biodiesel will reduce greenhouse gas emissions by approximately 20 per cent). Calculations to determine the reduction in greenhouse gas emissions when using biodiesel should consider the entire life cycle of the fuel.

Opportunities for the use of biodiesel will be further examined and used where possible on the Project (Rail).

For the operation phase, the Australasian Railway Association (2010) identifies a number of longer term options for mitigating the impacts of fuel use associated with rail freight. These options vary in their current level of technical capacity, development and cost and include:

- Utilising liquid natural gas (LNG) or compressed natural gas (CNG) in place of diesel. Natural gas has the advantages of reduced fuel cost and emissions
- The use of hybrid locomotives with rechargeable energy storage systems (RESS). Regenerative braking charges the RESS, which is then used to supplement the diesel engine
- The use of biodiesel blends, which have been tested in Australia with limited success. While biodiesel offers emissions benefits, there is uncertainty over feedstock quality, and the impacts of the product on engine performance, reliability and durability.

Energy Efficiency and Management

It is recognised that operations will result in the generation of the majority of greenhouse gas emissions associated with the Project (Rail). Through efficient and appropriate management of the rail operations, emissions can effectively be reduced. Recognising opportunities to make significant energy consuming equipment more efficient, including the application of technical efficiencies in plant and equipment as and once available, will provide more efficiency in operations.

For the maintenance facilities, Adani will investigate the opportunity to include a component of electricity purchased from renewable sources, such as GreenPower. Queensland Rail is currently working to reduce its impact on the environment by using 100% GreenPower and installing solar power panels to supplement energy supply at a number of city network stations. Such technologies may be adopted for the maintenance facilities where energy requirements are known and relatively constant.

Adani will in the future look to investigate the option of electrification of the rail line. Opportunities for a different energy mix to power the Project (Rail) will be investigated including possible purchase of a mixture of non-renewable and renewable electricity.

Development and implementation of an energy efficiency review which would identify initiatives and available technologies, leading to implementation of processes to ensure energy efficiency opportunities are integrated into operations, will be undertaken. A process such as this will ensure potential energy efficient concepts are recognised and considered through operations. The review will also identify opportunities to improve workforce awareness of energy efficiency through training and education.

A well-defined management plan which outlines control, management and research strategies to ensure environmental conditions are considered during the operational phase of the rail line will ensure targets and goals are achievable and best practice management is realised.

Through the EMP (refer Volume 3 Section 13 Draft EMP), appropriate management will be integrated into all activities and processes and greenhouse gas emissions will be monitored. Through assessment and review, the Project (Rail) will seek continuous improvement in compliance and emissions reduction.

Commitments to energy management will be developed as part of a detailed energy efficiency assessment. Monitoring and implementation of energy efficient improvements are also required under the EEO Act. Regular energy audits and reviews of railway operations will identify possible energy efficiency improvement opportunities which will be implemented to progressively improve operations and subsequent energy efficiency.

The Australasian Railway Association (2010) identifies potential Energy Efficiency Opportunities for the rail freight, including:

- Use of engine management systems to determine the optimal power output for the task
- Use of consist management systems to optimally distribute the load between locomotives in multiple locomotive consists

Technology Review

The application of technical efficiencies in plant and equipment will provide more efficiency in operations. Due to the life of the mining operations (based on 90 years of operation), regular equipment replacement will be subject to an appropriate business case review. An appropriate business case will identify equipment options to be considered, including any new technologies available, expected benefits, potential risks and costs.

In order to fulfil the monitoring and implementation requirements of the EEO Act, regular improvements in transport operations energy efficiency will be reviewed and undertaken.

3.3.4 Offset Measures

The feasibility of generating carbon offsets at the Project (Rail) site in accordance with the Carbon Farming Initiative will be investigated during project planning. The feasibility study will need to consider legislative and development approval requirements in assessing whether the potential carbon offset projects comply with the additionally requirements of the Carbon Farming Initiative.

The Project (Rail) is likely to exceed the threshold for a liable entity under the Clean Energy Act 2011. Therefore, a legislative price on the Scope 1 greenhouse gas emissions from the Project (Rail) is likely to apply. The purchase of carbon offsets generated in Australia or overseas will be considered in managing

potential carbon liability. Preference will be given to sourcing offsets identified as acceptable under the Federal Government's Carbon Farming Initiative, as these offsets are considered to be sourced from reputable offset projects.

3.3.5 Monitoring and Reporting

There are a number of legislative requirements for measuring, monitoring and reporting greenhouse gas emissions and energy consumption that are applicable to the Project (Rail). The liable entity for this reporting will need to be determined prior to the commencement of the construction phase.

Scope 1 and 2 emissions from the rail operations will be required to be measured or estimated as part of NGERS. The technical guidelines for NGERS outline the methods used for measuring and reporting Scope 1 and Scope 2 greenhouse gas emissions.

Measuring and monitoring Scope 1 emissions is required under the Clean Energy Act 2011.

Monitoring and reporting is also mandatory under the EEO Act.

The legislative measuring and reporting requirements will be used to assist in the identification of greenhouse gas reduction opportunities and track performance throughout the rail operations.

The following monitoring and reporting commitments will be implemented during the construction of the Project (Rail):

- Fuel consumption and energy use will be monitored
- Greenhouse gas emissions and energy consumption will be measured and recorded in accordance with current legislative requirements
- Regular energy audits and reviews of railway operations will be conducted to identify possible energy efficiency improvement opportunities
- Fuel consumption, energy use and GHG emissions will form part of the reporting requirements to Adani senior management
- Greenhouse gas emissions and energy consumption will be reported to relevant authorities in accordance with current legislative requirements

4. Conclusion

This greenhouse gas assessment has been undertaken by GHD on behalf of Adani Mining Pty Ltd as part of the EIS for the Carmichael Rail Line.

This report has been prepared to estimate greenhouse gas emissions associated with construction and operation of the rail line, and to develop mitigation measures to minimise impacts.

The assessment was undertaken in accordance with the guidelines relevant to the EIS and in line with the terms of reference. The assessment results identified:

- The total construction emissions were estimated as 311 kt CO_2-e
- The total operation emissions were estimated as 57,335 kt CO_2-e
- Over the 90 year life of the Project (Rail), average annual emissions were estimated as 637 kt CO_2-e per annum

Greenhouse gas emissions associated with diesel use, which contributes over 95% of emissions associated with the Project (Rail), may be avoided or mitigated through a number of mitigation measures including adopting new technologies and implementing strategies to reduce fuel consumption. Consideration would need to be given to the full life cycle of options to determine if a reduction in greenhouse gas emissions would occur.

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5. References

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Appendix A

Terms of Reference Cross-reference

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Terms of Reference Requirements/Section Number	Is this included in this report?	Section of this report
Section 3 Legislative Framework with reference to *Greenhouse Gas Storage Act 2009*	No	GHD note the ToR relates only to conditions for any proposed greenhouse gas injection and storage lease. As there is no greenhouse gas storage or injection associated with the Project (Rail), this is not applicable and is therefore not a requirement for this assessment.
Section 3.6.1 Description of environmental situation		
Provide an inventory of projected annual emissions for each relevant greenhouse gas, with total emissions expressed in 'CO2 equivalent' terms for the following categories:	Yes	Section 2 Table 2-1
◗ Scope one emissions, where 'scope one emissions' means direct emissions of greenhouse gases from sources within the boundary of the facility and as a result of the facility's activities.	Yes	Table 2-1
◗ Scope two emissions, where 'scope two emissions' means emissions of greenhouse gases from the production of electricity, heat or steam that the facility will consume, but that are physically produced by another facility.	Yes	Table 2-1
Briefly describe method(s) by which estimations were made.	Yes	Section 1.5 Appendix B
The Department of Climate Change National Greenhouse Accounts (NGA) Factors can be used as a reference source for emission estimates and supplemented by other sources where practicable and appropriate.	Yes	Section 1.5
Coal mining projects should include estimates of coal seam methane to be released as well as emissions resulting from such activities as transportation of products and consumables and energy use by the project. As a requirement of the National Greenhouse Accounts (NGA) Factors, estimates should include the loss of carbon sink capacity of vegetation due to clearing and impoundment.	No	Volume 4 Appendix T Mine Greenhouse Gas Emissions Report
Section 3.6.2 Description of proposed mitigation measures		
Discuss the potential for greenhouse gas abatement measures, including:	Yes	Section 3.2 and 3.3
◗ A description of the proposed measures (alternatives and preferred) to avoid and/or minimise direct greenhouse gas emissions.	Yes	Section 3.2 and 3.3

Terms of Reference Requirements/Section Number	Is this included in this report?	Section of this report
◗ An assessment of how the preferred measures minimise emissions and achieve energy efficiency.	Yes	Section 3.2 and 3.3
◗ An indication of how the preferred measures for emission controls and energy consumption compare with practice in the relevant sector of industry with a view to achieving best practice environment management.	Yes	Section 3.2 and 3.3
◗ A description of any opportunities for further greenhouse gas emissions through indirect means including sequestration and carbon trading	Yes	Section 3.2 and 3.3
The environmental management plan in the EIS should include a specific module to address greenhouse gas abatement. The module should include: ◗ Commitments to the abatement of greenhouse gas emissions from the project with details of the intended objectives, measures and performance standards to avoid, minimise and control emissions ◗ Commitments to energy management, including undertaking periodic energy audits with a view to progressively improving energy efficiency ◗ A process for regular review of new technologies to identify opportunities to reduce emissions and use energy efficiently, consistent with the best practice environmental management ◗ Any voluntary initiatives such as projects undertaken as a component of the national Greenhouse Challenge Plus program, or research into reducing the lifecycle and embodied energy carbon intensity of the project's processes or products ◗ Opportunities for offsetting greenhouse emissions, including, if appropriate, carbon sequestration and renewable energy uses ◗ Commitments to monitor, audit and report on greenhouse emissions from all relevant activities and the success of offset measures	Yes	Section 3.2 and 3.3 Volume 3 Section 13 Draft EMP

Appendix B

FullCAM Setup Data and Vegetation Clearing Calculations

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Rail Corridor FullCAM Setup

Rail Corridor – Grassland

Config: Multilayer Agricultural System

Simulation Steps: Monthly
Start Simulation: Jan, 1900
End Simulation: Dec, 2011
Output steps: every 12 (i.e. yearly)

Spatial Data
Latitude: -21.867991
Longitude: 147.256308

Regional Soils:
Duplex – woodland

Crop species:
Pasture (Pasture : Introduced grass)

Maximum Aboveground Biomass
50 tdm/ha (default)

Site; Crops; Soil; Initial Conditions: Defaults left

Events: No events

Area: 31284.27

Rail Corridor – Wooded – Corymbia

Config: Multilayer Forest System

Simulation Steps: Monthly
Start Simulation: Jan, 1900
End Simulation: Dec, 2011
Output steps: every 12 (i.e. yearly)

Spatial Data
Latitude: -21.867991
Longitude: 147.256308

Regional Soils:
Duplex – woodland

Tree species group: Corymbia citriodora var varigata (Lemon-scented gum)
Tree-species/Regimes: Qld; InitPlat; Med; 1990-on; BroadBurn; SpotCul; NoPPWC; 2Thin; NoPrune; FertAtEst; 0327

Maximum Aboveground Biomass
80.00 tdm/ha
Site; Crops; Trees; Initial Conditions: Defaults left

Events: No events

Rail Corridor – Wooded – Mixed Species Environmental Planting

Config: Multilayer Forest System

Simulation Steps: Monthly
Start Simulation: Jan, 1900
End Simulation: Dec, 2011
Output steps: every 12 (i.e. yearly)

Spatial Data
Latitude: -21.867991
Longitude: 147.256308

Regional Soils:
Clay – brigalow and gidgee (8)

Tree species group: Mixed species environmental planting
Tree-species/Regimes: All; InitPlant; Low; 1970-on; WindrowBurn; SpotCult; NoPPWC; NoHarvest; NoPrune; NoFert; 2097

Maximum Aboveground Biomass
80.00 tdm/ha

Site; Crops; Trees; Initial Conditions: Defaults left

Events: No events

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