Carmichael Coal Mine and Rail Project
Supplementary Environmental Impact Statement

Volume 4, Appendix C3h – Watercourse Determination Review

Containing

- Watercourse Determination and Riverine Protection Review

environmental management

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Carmichael Coal Project (Rail)
Separable Portion 1

Water Act 2000
Watercourse Determination & Riverine Protection Permit Review

6396
22 March 2013
Adani Mining Pty Ltd

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Document Control

Title	**Carmichael Coal Project (Rail) SP-1** **Watercourse Determination and Riverine Protection Permit Review**
Job Number	**6396**
Client	Adani Mining Pty Ltd

Document Issue

Issue	Date	Prepared By	Checked By
Draft	20.03.2013	Angela Little	Ross Marshall
Final	21.03.2013	Ross Marshall	Dr Andrew Davies

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Reports and/or Plans by Others

Reports and/or plans by others may be included within this Environmental Management report to support the document.

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Plans

I. Introduction

The purpose of this report is to review the applicability of the *Water Act 2000* (specifically works triggering Riverine Protection Permits) in relation to activities associated with the construction of the proposed Carmichael Coal Project (Rail) Separable Portion 1 (SP-1) alignment. Two outcomes are proposed:

1. Seek 'watercourse' determination for waterway features along the SP-1 alignment; and

2. Provide information to the **Department of Environment and Heritage Protection** (DEHP) regarding Adani's intent to undertake works associated with SP-1 construction in accordance with *'Activities in a watercourse, lake or spring associated with a resource activity or mining operations'* 2012 (refer to **Appendix A**).

This report provides a detailed site assessment for 21 locations along the SP-1 alignment. Information is provided to support 'watercourse' determinations and provide a record of environmental features present within and adjoining 'watercourses', drainage lines and flood plain areas.

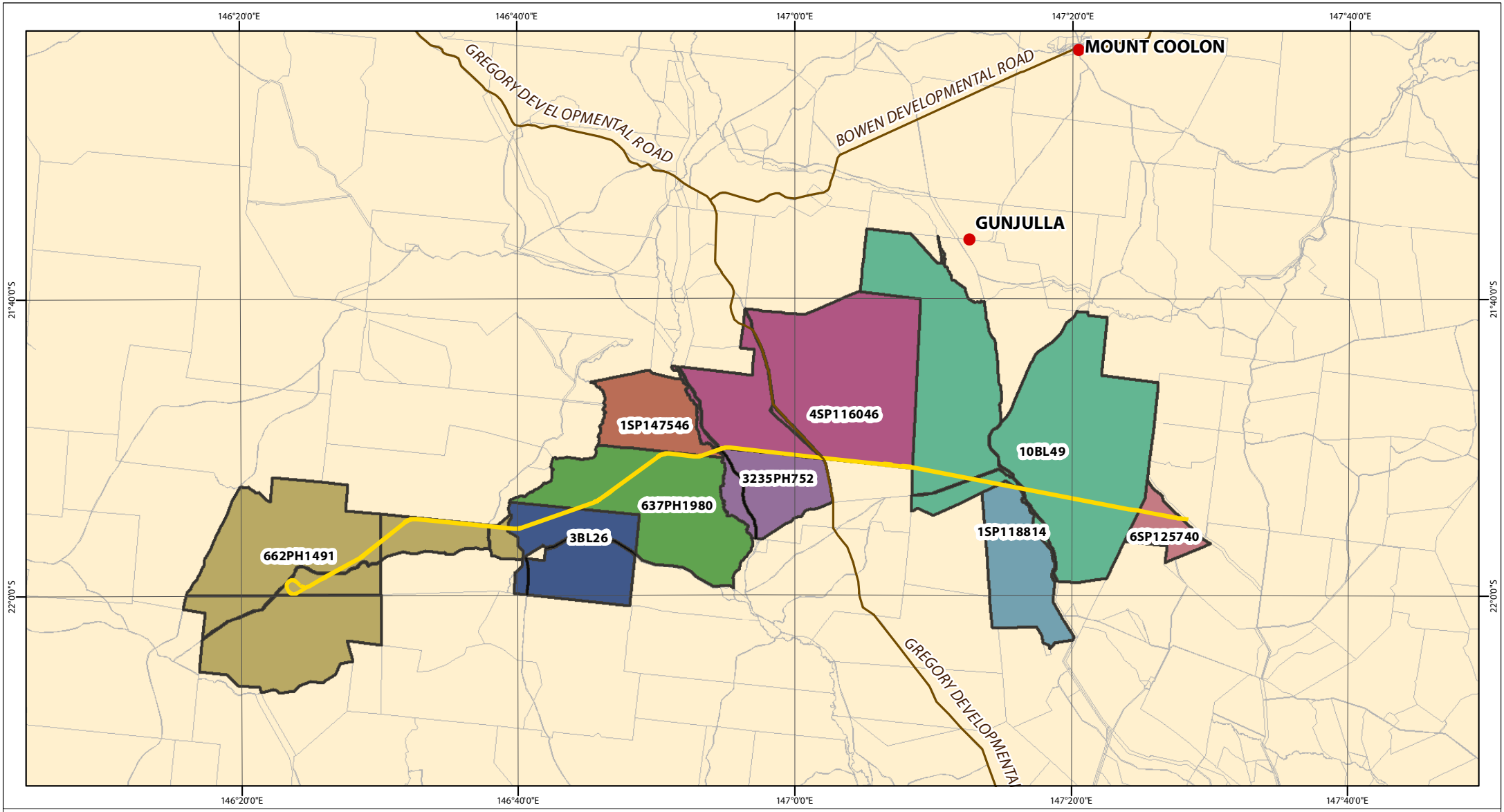
I.I. Carmichael Coal Project (Rail) Summary

Adani Mining Pty Ltd has proposed the development of a Galilee Basin coal mine with projected output capacity of 60 million tonnes per annum. The project is declared a 'significant project' under the *State Development and Public Works Organisation Act 1971* (SDPWO Act) and requires an Environmental Impact Statement (EIS). The Project is also a 'controlled action' and requires assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Rail transport of output coal is proposed via an alignment connecting the mine site with the existing Goonyella and Newlands rail systems to facilitate export via the Port of Hay Point / Abbot Point. This report pertains to Separable Portion 1 (SP-1), or the 'west rail', which traverses approximately 120 km eastward from the Mine to Moranbah (Refer to **Plan 1** – Rail project overview).

Table 1: Project Summary

Location	95 metre wide corridor from the terminal facilities within the Mine site to the termination of the SP-1 alignment ('west rail')	
RPD	• Lot 662 on PH1491 • Lot 3 on BL26 • Lot 637 on PH1980 • Lot 1 on SP147546 • Lot 4 on SP116046	• Lot 3235 on PH752 • Lot 10 on BL49 • Lot 1 on SP118814 • Lot 6 on SP125740
Local Government	Isaac Regional Council	



Legend

- Place Name
- Major Roads
- Rail Alignment Corridor (SP-1)
- QLD DCBD

Plan 1 *Rail Project Overview (SP-1)*

File ref. *6396 E 01 Rail Project Overview A*
Date *20/03/2013*
Project *Carmichael Coal Rail Project*

0 2 4 6 8 10 20 *km*

Scale (A4): 1:650,000 [GDA 1994 MGA Z55]

N

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Layer Sources SP-1 Corridor, Crossing Locations (Adani Mining Pty Ltd 2012), DCDB, Major Roads, Towns (DNRM 2012), WWBW Waterways (DEHP 2013)

2. Legislation

2.1. Water Act 2000

The *Water Act 2000* seeks to advance sustainable management and efficient use of water and other resources by establishing a system for water planning, allocation and use. The Act provides for:

- Rights to, and measurement and management of, water;
- The construction, control and management of works for water conservation and protection;
- Irrigation and water supply; drainage; flood control and prevention; improvement of the flow in, or changes to the courses of, watercourses, lakes and springs; and
- Protection and improvement of the physical integrity of watercourses, lakes and springs.

2.2. Watercourses

A 'watercourse' is defined under the *Water Act 2000* as *'…a river, creek or other stream, including a stream in the form of an anabranch or a tributary, in which water flows permanently or intermittently, regardless of the frequency of flow events, in a natural channel, whether artificially modified or not; or in an artificial channel that has changed the course of the stream.'*

A 'watercourse' does not include a 'drainage feature', which is defined as a *'Natural landscape feature, including a gully, drain, drainage depression or other erosion feature that –*

a. *Is formed by the concentration of, or operates to confine or concentrate, overland flow water during and immediately after rainfall events; and*
b. *Flows for only a short duration after a rainfall event, regardless of the frequency of flow events; and*
c. *Commonly, does not have enough continuing flow to create a riverine environment.**

** Example for paragraph (c) – there is commonly an absence of water favouring riparian vegetation.*

2.3. Riverine Protection Permits

Part 8 (Chapter 1) of the *Water Act 2000* deals with granting riverine protection permits for destroying vegetation, excavating or placing fill in a watercourse, lake or spring. A Riverine Protection Permit is not required if the activity is:

- Listed as an exemption under Section 814(2) of the *Water Act 2000*; or
- Permitted under Section 49-51 of the *Water Regulation 2002*; or
- Undertaken in accordance with an applicable '*guidelines for activities in a watercourse, lake or spring*'.

Disturbance activities associated with the proposed alignment qualify for an exemption (therefore a Riverine Protection Permit will not be required), as activities can be undertaken in accordance with *'Activities in a watercourse, lake or spring associated with a resource activity or mining operations'* (2012, refer to **Appendix A**), hereafter, the *Guideline*.

2.4. *Guideline* – Activities in a watercourse, lake or spring associated with a resource activity or mining operations

The purpose of this *Guideline* is to allow activities in a 'watercourse', lake or spring associated with a resource activity or mining operation without the need for a riverine protection permit. As outlined within the *Guideline*, it can be used by the holder of an environmental authority (for a resource activity) under the *Environmental Protection Act 1994*, and may be used on land subject to a resource authority, or by holders of an environmental authority (for a resource activity) on land not subject to a resource authority. Under these latter circumstances, this *Guideline* may only be used for investigation, construction and maintenance of infrastructure necessary for operations associated with the resource activity.

It is proposed that **Adani Mining Pty Ltd**, in holding an ***Environmental Authority (exploration and mineral development, Permit no. MIN102643011)***, qualify to use the *Guideline* for proposed works pertaining to 'watercourses' along the SP-1 alignment.

Compliance with the *Guideline* will be achieved through actively self-assessing activities and maintaining records of all activities as required. A table of requirements, providing outcomes and acceptable solutions, is detailed within the *Guideline* (refer to **Appendix A**), which will form the basis for ensuring the activities minimise impacts on water quality and flow, vegetation, and the physical integrity of any 'watercourses' identified.

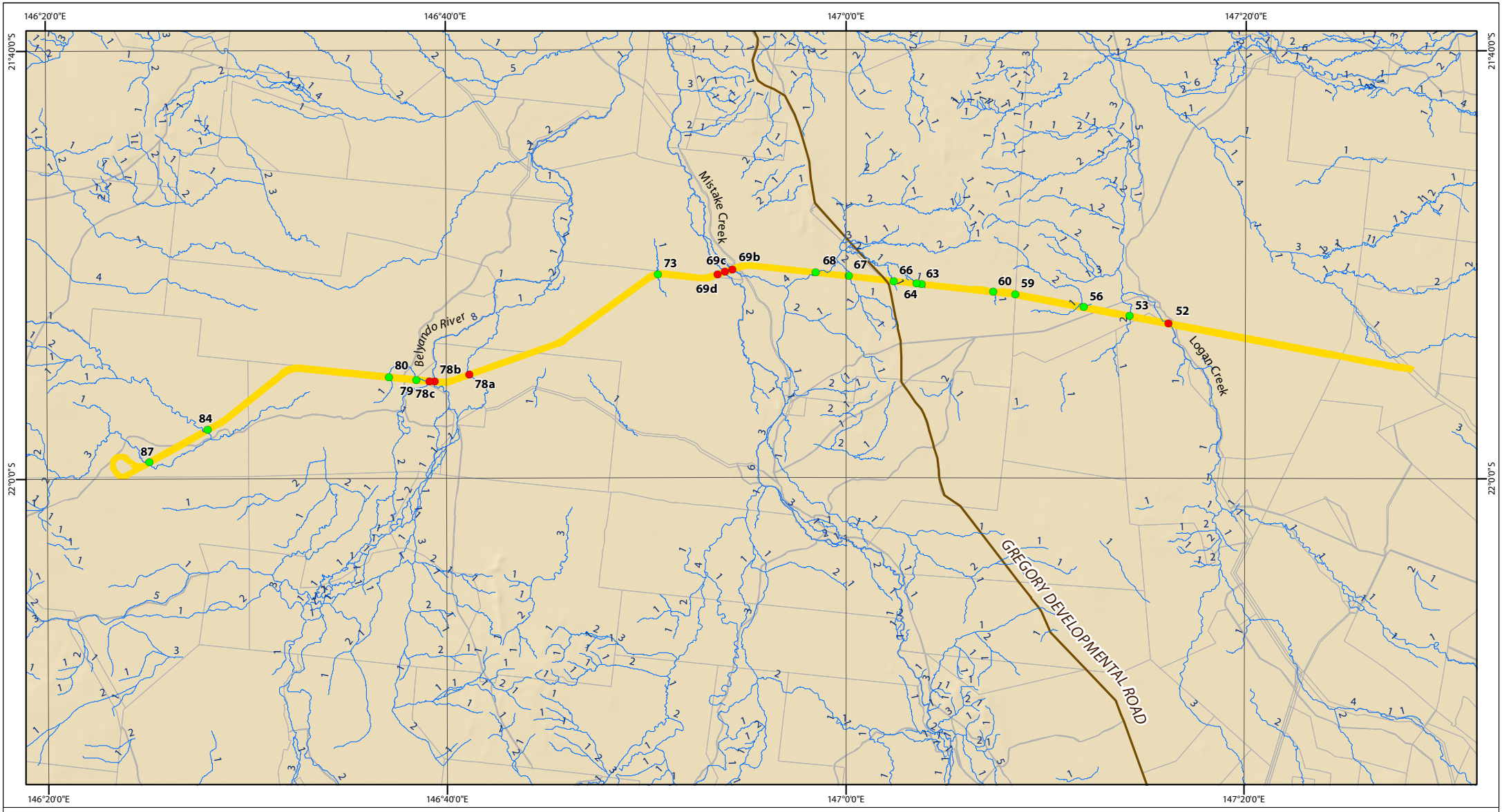
3. Mapped Area Summary

GIS Stream Order mapping and detailed field assessments identified 21 locations where the SP-1 alignment intersects 'watercourses' or 'drainage features'. Each location was assessed in relation to the definition of a 'watercourse' or 'drainage feature' as outlined previously in **Section 2.2**.

Table 2, below, and **Plan 2**, next page, summarise the determination of 'watercourses' and 'drainage features' presented in **Appendix B**. Data presented act as basic records of ecological values and condition at each crossing location. It is requested that DEHP review and provide official 'watercourse' determination for each location described in the **Table 2**.

Table 2: Mapped Area Assessment Summary

Crossing number	Name	Assessment according to definitions within the *Water Act 2000*
87	Eight Mile Creek	Drainage Feature
84	North Creek	Drainage Feature
80	Ogenbeena Creek	Drainage Feature
79	Ogenbeena Creek (lower crossing)	Drainage Feature
78c	Belyando River Tributary	Watercourse
78b	Belyando River	Watercourse
78a	Belyando River (East Tributary)	Watercourse
73	Unnamed Flow Path 1	Drainage Feature
69d	Water body next to Mistake Creek	Watercourse
69c	Mistake Creek	Watercourse
69b	Mistake Creek Anabranch	Watercourse
68	Gowrie Creek	Drainage Feature
67	Gowrie Creek Tributary (67)	Drainage Feature
66	Gowrie Creek Tributary (66)	Drainage Feature
64	Gowrie Creek Tributary (64)	Drainage Feature
63	Gowrie Creek Tributary (63)	Drainage Feature
60	Unnamed Flow Path 2	Drainage Feature
59	Unmapped Flow Path 1	Drainage Feature
56	Unnamed Flow Path 3	Drainage Feature
53	Logan Creek Tributary	Drainage Feature
52	Logan Creek	Watercourse



Legend

- Major Roads
- Mapped Watercourse v2.1
- Rail Alignment Corridor (SP-1)
- QLD DCBD

Waterway / Drainage Feature Crossing Type

- Drainage Feature
- Watercourse

Layer Sources SP-1 Corridor, Crossing Locations (Adani Mining Pty Ltd 2012), DCDB, Major Roads, Towns (DNRM 2012), WWBW Waterways (DEHP 2013)

Plan 2 *Watercourses and Drainage Features*

File ref. *6396 E 02 Watercourses A*
Date *22/03/2013*
Project *Carmichael Coal Rail Project*

0 2 4 6 8 10 20 *km*

N

Scale (A4): 1:450,000 [GDA 1994 MGA Z55]

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4. Appendices

Appendix A

The *Guideline*

Appendix B

Watercourse Determination - Supporting Information

Appendix A

The *Guideline*

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Separable Portion 1

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Appendix A
The *Guideline*

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Department of **Natural Resources and Mines**

Guideline—Activities in a watercourse, lake or spring associated with a resource activity or mining operations

WAM/2008/3435

Queensland Government

Contents

Version history

Version	Date	Comments
1	15/04/2008	Guideline developed for activities in a watercourse, lake or spring associated with mining operations. Approved 15/04/2008
2	9/12/2010	Update departmental name, change references from *Integrated Planning Act 1997* to *Sustainable Planning Act 2009* and definitions updated as per legislation.
3	12/07/2012	New name for guideline to include activities associated with a resource activity. Expanded to allow for activities by holders of environmental authorities on land not subject to a resource authority. Previous title: Guideline - activities in a watercourse, lake or spring associated with mining operations.

1. Purpose

The purpose of this guideline is to allow activities in a watercourse, lake or spring associated with a resource activity or mining operations without the need for a riverine protection permit.

Activities include the destruction of native vegetation, excavation and placement of fill in a watercourse, lake or spring. The Water Regulation 2002 permits these activities provided the activity is in accordance with this guideline.

Clearing vegetation is regulated under the *Sustainable Planning Act 2009* (SPA) and in some cases a development approval for clearing vegetation will also be required.

This guideline outlines the requirements, providing outcomes and acceptable solutions to ensure activities minimise adverse impacts on water quality, water flow, vegetation and the physical integrity of the watercourse, lake or spring.

1.1 This guideline explains:

- who can use this guideline and where the guideline applies
- compliance with this guideline
- recording information
- required outcomes and acceptable solutions.

1.2 This guideline does not apply to:

- taking of or interfering with water that would require a water licence
- excavation for obtaining riverine quarry material from a watercourse or lake
- subsidence of a watercourse, lake or spring through mining operations
- activities in springs where the water is connected to artesian water, or subartesian water connected to artesian water, within the area covered by the Water Resource (Great Artesian Basin) Plan 2006.

2. Who can use this guideline?

This guideline may only be used by the holder of the following authorities (authority holder):

- an environmental authority (for a resource activity) under the *Environmental Protection Act 1994*
- a mineral development licence or mining lease (for mining operations) under the *Mineral Resources Act 1989*.

Contractors, subcontractors and other agents engaged by an authority holder must also use this guideline.

3. Where can an authority holder use this guideline?

This guideline may be used for an activity associated with any resource activity or mining operations on land subject to a resource authority.

Holders of an environmental authority (for a resource activity) may also use this guideline on land not subject to a resource authority. In these circumstances the guideline may only be used for investigation, construction and maintenance of infrastructure necessary for operations associated with the resource activity. Two considerations should be noted for development on land not subject to a resource authority:

1. This guideline does not authorise clearing of vegetation regulated under SPA on land not subject to a resource authority. A development approval for clearing vegetation may be required. For further information contact the local departmental office.
2. This guideline does not authorise access to land.

3.1. Activities in a wild river area

For watercourses, lakes and springs in a wild river high preservation area, wild river special floodplain management area or in a nominated waterway as defined under the *Wild River Act 2005*, the guideline only applies to activities:

- for the control of non-native plants or declared pests in the area
- necessary for specified works in the area
  or
- installing or maintaining works or infrastructure required to support other development for which a development permit is not required.

The spatial coordinates relating to the locations of a wild river area can be obtained by contacting the Department of Environment and Heritage Protection (DEHP) or accessing the Wild Rivers Map on the DEHP website <http://www.ehp.qld.gov.au/>.

4. Compliance with this guideline

The authority holder must comply with all sections of this guideline. The authority holder is responsible for actively self-managing its activities and those of its contractors and subcontractors to ensure compliance with this guideline at all times.

The department may undertake audits to ensure compliance with this guideline. Activities must be carried out in accordance with this guideline or under a riverine protection permit issued under section 269 of the *Water Act 2000* (Water Act). Penalties for non-compliance apply under the relevant legislation.

For further clarification about the requirements, purpose or extent of this guideline the authority holder should seek advice from the local departmental office before commencing activities.

5. Recording activities

The authority holder must maintain records of activities carried out under this guideline. Records are to be retained for a minimum of two years after completion of the activity and must be made available to the department on request.

Information that must be recorded for each activity site includes:

- any documentation relating to the planning of activities
- activity site location and site access details
- commencement and completion dates
- the disposal location(s) and quantity of spoil material removed
- the disposal location(s) and quantity of native vegetation removed from the site
- the plant equipment used e.g. size of excavator, number and type of trucks
- before, during and post activity photographs of the site
- impact management and rehabilitation details
- incidents of unanticipated failure of management methods and subsequent remedial action.

6. Required outcomes

The table below outlines the required outcomes and acceptable solutions that must be achieved when undertaking activities.

Required outcome	Acceptable solutions (proponents can propose an alternative solution to meet the required outcome)
Activity is limited to the extent necessary; or as an unavoidable part of the construction, installation, removal, maintenance or protection of infrastructure; or the protection and enhancement of the stability of a watercourse, lake or spring.	**Acceptable solutions to limit impact of activities:** • Limit the activities to the extent necessary as stated in the record of the activity. • Restrict the area of disturbance to the area necessary as stated in the record of the activity. • Use an existing access track instead of constructing a new access track. • Minimise the number of bank cuttings and fills (e.g. for access tracks) to the extent necessary. • Avoid destroying mature native trees in association with destruction of non-native vegetation (e.g. weed control).
Carrying out the activity must not adversely impact water quality within the watercourse.	**Acceptable solutions to not adversely impact water quality within the watercourse** • Divert water run off around areas of disturbance. • Prevent or minimise water turbidity by using sediment traps. • Avoid carrying out activities on the outside of the watercourse bend, on steep banks or where the soil type is prone to erosion (dispersive soils). • Store, refuel and maintain all machinery used in the activities outside the outer banks of the watercourse. • Limit the amount of fill placed under the authority of this guideline to fill which occurs naturally and is free from contamination i.e. does not contain weeds, chemicals, oils, pesticides, trash, etc.

Required outcome	Acceptable solutions (proponents can propose an alternative solution to meet the required outcome)
Carrying out the activity must not permanently impound or impede the natural flow of water within the watercourse.	**Acceptable solutions to not impound or impede the natural flow of water within the watercourse.** • Construct drainage and discharge structures without altering the natural bed and bank profile. • Spread material excavated that is not waste material evenly within the bed and banks of the watercourse so that it does not interfere with the flow of water. • Contain waste at least 50m from the outer banks of watercourses and lakes. Remove all remaining waste materials from the site after completing the activities. • Avoid stockpiling of fill within the bed and banks. • Ensure natural stream bed controls or features that create natural waterholes are not lowered or removed. • Ensure access tracks do not interrupt low flow along the watercourse. • Orientate any access tracks, crossings or culverts perpendicular to the stream channel within a tolerance of ± 10°. • Ensure uninterrupted low flows and minimise the occurrence of blockage of culverts caused by flood-borne debris by selecting culverts of sufficient size.

Required outcome	Acceptable solutions (proponents can propose an alternative solution to meet the required outcome)

Carrying out the activity must not result in de-stabilisation of the bank associated with the watercourse.	**Acceptable solutions that will not result in de-stabilisation of the bank associated with the watercourse.**
	• Cut trees near or at ground level to retain the root mass in the ground, other than removing trees to build infrastructure.
	• Use bed and bank stabilisation measures such as rock revetment, reinforced matting and large woody debris, log piling or similar.
	• Orientate ramps cut into the bank for crossings are downstream.
	• Construct access tracks that are:
	  ◦ provided with a scour apron and cut off the wall on the downstream side sufficient to prevent bed erosion
	  ◦ orientated perpendicular to the stream channel within a tolerance of ± 10°
	  ◦ located at riffles.
	• Stabilise mechanically cleared banks before clearing adjacent areas.
	• Ensure fill placed in the bed of the stream does not redirect flow into a bank.
	• Use only naturally occurring fill for backfill around in-stream structures and/or to return a bank profile to pre-disturbance condition.
	• Revegetate areas of bank cleared of vegetation and not required for the final work with trees, shrub and grasses endemic to the area.

6.1 Best Practice Principles

Best practice principles promote actions to enhance riverine management outcomes when carrying out an activity. The fact sheet Riverine management—a best practice approach when carrying out activities in a watercourse, lake or spring can be found on the department's website <www.derm.qld.gov.au>. Authority holders are encouraged to draw on the principles outlined in the fact sheet when using this guideline.

7. Legislative responsibilities

Activities carried out in accordance with this guideline are permitted only for the purposes of the Water Act. Compliance with this guideline does not remove the authority holder's obligation to comply with other relevant legislation.

All Queensland government Acts are listed on the Office of the Queensland Parliamentary Counsel website <www.legislation.qld.gov.au>.

Definitions

Definitions used in this guideline

Access tracks are constructed to allow stock, vehicles and machinery (excavators and so on) to safely and easily move into, along, across and out of a stream channel. Access tracks commonly involve the cutting and/or filling of a section of bank to provide reasonable track grades.

Activity means destroying vegetation, excavating or placing fill in a watercourse, lake or spring.

Activity site is a unique location where an activity takes place. A project may include multiple activity sites provided the activity sites are in different reaches of the watercourse. A reach is the stretch of water visible between bends in a river or channel. Note: laterally adjacent activities are considered to be a single activity site.

Authority holder is the holder of:

- an environmental authority granted for a resource activity under the *Environmental Protection Act 1994*.
- a mineral development licence or mining lease (for mining operations) under the *Mineral Resources Act 1989*.

Mature native trees are trees >20 centimetres diameter measured at 1.3 metres from the ground.

Mining operations means mining activities carried out on land over which there is a mineral development licence or mining lease under the *Mineral Resources Act 1989*.

Waste means left over material or an unwanted by-product of activities in a watercourse, lake or spring associated with mining operations that does not have any commercial use or value.

Definitions taken from the *Water Act 2000* or other Acts

Clear, for vegetation—(a) means remove, cut down, ringbark, push over, poison or destroy in any way including by burning, flooding or draining; but (b) does not include destroying standing vegetation by stock, or lopping a tree.

Destruction, of vegetation, means the removing, clearing, killing, cutting down, felling, ringbarking, digging up, pushing over, pulling over or poisoning of the vegetation.

Environmental authority means an environmental authority granted under the *Environmental Protection Act 1994* for a resource activity.

Fill means any kind of material in solid form (whether or not naturally occurring) capable of being deposited at a place. Fill does not include material that forms a part of, or is associated with, a structure constructed in a watercourse, lake or spring including a bridge, road, causeway, pipeline, rock revetment, drain outlet works, erosion prevention structure or fence.

Infrastructure means plant or works including for example, communication systems, compressors, powerlines, pumping stations, reservoirs, roads and tracks, water storage dams, evaporation or storage ponds and tanks, equipment, buildings and other structures built for the purpose and

duration of the conduct of the petroleum activity(ies) including temporary structures or structures of an industrial or technical nature, including, for example, mobile and temporary camps.

Lake, includes:
a) a lagoon, swamp or other natural collection of water, whether permanent or intermittent
b) the bed and banks and any other element confining or containing the water.

Outer bank
The outer bank, at any location on one side of a watercourse is, if there is a floodplain on that side of the watercourse, the edge of the floodplain that is on the same side of the floodplain as the watercourse. If there is not a floodplain on that side of the watercourse, the outer bank is the place on the bank of the watercourse marked by either a scour mark, a depositional feature or if there are two or more scour marks, two or more depositional features or one or more scour marks and one or more depositional features, whichever scour mark or depositional feature is highest.
If, at a particular location in the watercourse there is a floodplain on one side of the watercourse and the other side of the watercourse is confined by a valley margin, the outer bank on the valley margin side of the watercourse is the line on the valley margin that is at the same level as the outer bank on the other side of the watercourse.

Quarry material
1. Quarry material means material, other than a mineral within the meaning of any Act relating to mining, in a watercourse or lake.
2. Quarry material includes stone, gravel, sand, rock, clay, earth and soil unless it is removed from the watercourse or lake as waste material.

Resource activity is an activity that involves—
a) a geothermal activity that, under the *Geothermal Energy Act 2010*, is an authorised activity for a geothermal tenure
b) a GHG Storage activity that, under the *Greenhouse Gas Storage Act 2009*, is an authorised activity for a greenhouse gas storage authority under that Act
c) a mining activity that, under the *Mineral Resources Act 1989*, is an authorised activity for a mining tenure
d) a petroleum activity that is
    i. an activity that, under the *Petroleum Act 1923*, is an authorised activity for a petroleum tenure under that Act
    or
    ii. an activity that, under the *Petroleum and Gas (Production and Safety) Act 2004*, is an authorised activity for a petroleum authority under that Act.

Resource authority means land subject to a permit, authority, lease, tenement or licence granted under *Greenhouse Gas Storage Act 2009*, *Geothermal Energy Act 2010*, *Mineral Resources Act 1989*, *Petroleum Act 1923* or *Petroleum and Gas (Production and Safety) Act 2004*.

Specified works means:
a) infrastructure and works prescribed under a regulation to be necessary for disaster management
or
b) desnagging that is the minimum necessary to allow safe navigation of a marked navigable channel
or
c) the following infrastructure and works:
    i. roads
    ii. railways

iii. jetties and boat ramps for use by the public
iv. works for the rehabilitation of land, including, for example, rehabilitation of abandoned mines
v. infrastructure for the transmission or distribution of electricity
vi. pipelines
vii. conveyor belts
viii. cables
ix. other infrastructure, prescribed under a regulation, that relates to the transportation, movement, transmission or flow of anything through a wild river area including, for example, goods, materials, substances, matter, particles with or without charge, light, energy, information and anything generated or produced.

Spring means the land to which water rises naturally from below the ground and the land over which the water then flows.

Vegetation means native plants including trees, shrubs, bushes, seedlings, saplings and reshoots and for a wild rivers area, includes dead vegetation.

Watercourse
A watercourse is a river, creek or other stream, including a stream in the form of an anabranch or a tributary, in which water flows permanently or intermittently, regardless of the frequency of flow events, in a natural channel, whether artificially modified or not; or in an artificial channel that has changed the course of the stream. It includes any in-stream islands, benches and bars located in it. Further, a watercourse is anywhere in a river, creek or other stream that is:

1. upstream of the downstream limit of the watercourse
2. downstream of the upstream limit, if there is an upstream limit of the watercourse
3. between the outer bank on one side of the watercourse and the outer bank on the other side of the watercourse.

A watercourse does not include a drainage feature but does include in-stream islands, benches or bars.

Note: generally, the non-tidal boundary (watercourse) of land bounded by a watercourse, as provided for under the *Survey and Mapping Infrastructure Act 2003*, would not correspond precisely with the line of the outer bank of a watercourse as defined under the Water Act.

Appendix B

Watercourse Determination - Supporting Information

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Appendix B
Watercourse Determination – Supporting Information

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I. Eight Mile Creek (Crossing 87)

I.I. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	3
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location fits the definition of a **drainage feature**. • Funnels immediate localised rainfall only. • Only flows for a short period following rainfall. • Lacks a riverine environment.

Photo: Eight Mile Creek

1.2. Field Determination

Eight Mile Creek is an ephemeral drainage feature. This location was assessed following a dry period and therefore no water was present. No riverine communities were observed which, in combination with the prevailing sandy substrate, indicates this area only holds water for short periods following extensive rainfall events. The 'mapped watercourse' is broadly defined as a shallow erosion channel with fringing *Eucalyptus* and *Acacia* species. This area is considered to meet the definition of a 'drainage feature' and is therefore not considered a 'watercourse' as relevant to the *Water Act 2000*.

Photo: Eight Mile Creek

2. North Creek (Crossing 84)

2.1. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	2
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location fits the definition of a **drainage feature**. • Funnels immediate localised rainfall only. • Only flows for a short period following rainfall. • Lacks a true riverine environment.

Photo: North Creek

2.2. Field Determination

Assessment of this location occurred following a period of rainfall and therefore small standing pools of water were retained. To the South of the alignment is a small constructed dam. The catchment area for North Creek appears more extensive than Eight Mile Creek when viewing aerial imagery, with this 'drainage feature' retaining fringing vegetation along the majority of its length.

Eucalyptus coolabah is the dominant tree species along the 'drainage feature' banks. Other species identified included *Acacia harpophylla*, *Eucalyptus camaldulensis, Terminalia oblongata* and *Eremophila mitchellii*. Shrub and ground species recorded along the banks included *Carissa ovata, Pennisetum ciliare*, and *Eremophila mitchellii*. Weed species located within, and adjoining, the 'drainage feature' included *Pennisetum ciliare, Eriocereus martini* and *Opuntia tomentosa*.

Species observed within the 'drainage feature' bed included *Juncus* and *Cyperus* species, with their presence potentially linked to wetter conditions maintained by the nearby dam. Due to its location within the upper catchment area, North Creek is considered to be a 'drainage feature' and not a 'watercourse'.

Photo: North Creek

3. Ogenbeena Creek (Crossing 80)

3.1. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	1
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location does not contain any defined channel features and is considered a flood plain.

Photo: Ogenbeena Creek

3.2. Field Determination

This part of Ogenbeena Creek is situated within a flood plain and is best described as a shallow drainage depression, which includes a mapped lacustrine wetland. This location does not have any characteristics consistent with the definition of a 'watercourse'.

Photo: Ogenbeena Creek

4. Ogenbeena Creek (Lower - Crossing 79)

4.1. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	1
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location fits the definition of a **drainage feature**. • Funnels immediate localised rainfall only. • Only flows for a short period following rainfall. • Lacks a true riverine environment.

Photo: Ogenbeena Creek (lower crossing)

4.2. Field Determination

Vegetation associated with this site included *Eucalyptus coolabah* with a sparse mid layer containing *Eucalyptus populnea* and *Terminalia oblongata*. *Muehlenbeckia florulenta* was present within the shrub layer, but, in general, the shrub and ground layer was very sparse. Grazing and cattle utilisation of this area was not as obvious with respect to other areas along the SP-1 alignment. Small individual *Parthenium hysterophorus* plants were observed within the silt deposited from recent flooding events.

This part of Ogenbeena Creek is best described as an overland flow path with occasional eroded areas and depressions. The area does not display characteristics associated with a 'watercourse'.

Photo: Ogenbeena Creek (lower crossing)

5. Belyando River Tributary (Crossing 78c)

5.1. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	2
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location fits the definition of a **watercourse.**

Photo: Belyando River Tributary

5.2. Field Determination

This 'watercourse' runs from South to North through *Eucalyptus coolabah* dominated remnant vegetation on an alluvial plain. Riparian vegetation included *Eucalyptus coolabah* and *Eucalyptus camaldulensis* with a sparse mid layer containing *Eucalyptus populnea* and *Terminalia oblongata*. *Acacia salicina* and *Muehlenbeckia florulenta* were recorded in the sparse shrub layer. Ground layer contained *Pennisetum ciliare*, *Bothriochloa bladhii, Bothriochloa ewartiana, Cyperus flavidus, Cyperus difformis* and *Cyperus exaltatus*.

The assessment followed a period of heavy rainfall and therefore water flow was apparent. This 'watercourse' appears to be seasonal in nature and during drier periods would not contain any permanently running water with only isolated pools of standing water remaining. Macrophytes were in general absent from the 'watercourse' and its banks. Sediments on the 'watercourse' bed were a combination of sand, small gravel, clays and silt deposits.

'Watercourse' banks showed signs of erosion and slumping associated with grazing and flood disturbance, with vegetation largely absent. Freshwater mussels and crab shells were observed scattered along the 'watercourse' bed, bank and riparian area.

Photo: Belyando River Tributary

6. Belyando River (Crossing 78b)

6.1. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	8
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location fits the definition of a **watercourse.**

Photo: Belyando River

6.2. Field Determination

This 'watercourse' forms the main section of the Belyando River. Vegetation either side of this 'watercourse' is mapped as containing a composite Endangered Regional Ecosystem categorised as RE 11.3.25 / 11.3.37 / 11.3.1. Species recorded throughout the assessment site were consistent with Least Concern RE 11.3.25 / 11.3.37. No species representing the Endangered RE 11.3.1 were observed.

Eucalyptus camaldulensis was the dominant species fringing the 'watercourse,' while *Eucalyptus coolabah* dominated the adjacent floodplain areas. It is also noted that some riparian species, including patches of *Melaleuca bracteata* and *Acacia salicina,* were also recorded within the sub-canopy layer. Although ground layer species were dominated by exotics, patches of native species were observed, including *Lomandra longifolia* and *Muehlenbeckia florulenta*. Some flood debris was noted high above the top bank indicating significant flow during flood events.

Contemporary aerial imagery overlayed with a digital terrain model demonstrates that this part of the 'watercourse' system includes a series of pools, runs and sediment bars along its length. The analysis shows a flow path on the western and eastern sides of the broader floodplain. These areas appear to be eroded, lower lying parts of the flood plain which are regularly inundated.

Photo: Belyando River

7. Belyando River East Tributary (Crossing 78a)

7.1. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	1
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location fits the definition of a **watercourse.**

Photo: Belyando River (East Tributary)

7.2. Field Determination

This 'watercourse' forms part of the Belyando River floodplain. Review of the area suggests Stream Order mapping is incorrect for this location, with the channel appearing to branch from the main Belyando River (upstream) and reconnect further downstream of the alignment.

Riparian vegetation at this site is consistent with REs 11.3.25 and 11.3.37. Tree species present included *Eucalyptus coolabah* and *Eucalyptus camaldulensis*. Other species observed within the T2 and shrub layers included *Geijera parviflora, Terminalia oblongata* and *Acacia stenophylla*. The ground layer contained a mix of exotic and native grasses, including *Pennisetum ciliare, Dichanthium sericeum, Leptochloa digitata*, *Enteropogon acicularis* and *Bothriochloa ewartiana*

Some areas of severe erosion primarily caused by flooding and grazing pressure were observed. Materials deposited within the stream bed were comprised of sand, small gravel, clays and fine silts. Outside of the 'watercourse' the landscape appears highly erodible with a series of gullies and depressions evident.

Due to recent rainfall, the site contained pooled water, but, due to the seasonal nature of the 'watercourse', these pools would only be temporary and would not exist during extended periods of drier weather. The use of retained pools for long term survival of aquatic fauna species seems highly unlikely.

Photo: Belyando River (East Tributary)

8. Unnamed Flow Path I (Crossing 73)

8.1. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	1
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location fits the definition of a **drainage feature**. • Funnels immediate localised rainfall only. • Only flows for a short period following rainfall. • Lacks a true riverine environment.

Photo: Unnamed Flow Path (Crossing 73)

8.2. Field Determination

This 'mapped waterway' is situated within a highly disturbed agricultural paddock which retains limited canopy vegetation. The area displays no defined features or channels. The mapping error is believed to have originated from the digital Stream Order mapping layer which identifies an approximately 5 km long isolated drainage feature at this site. This mapping layer is generally inaccurate, especially within upper catchment areas.

The site does not meet the definition of a 'watercourse' and is best described as a 'drainage feature'.

Photo: Unnamed Flow Path (Crossing 73)

9. Water Body near Mistake Creek (Crossing 69d)

9.1. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	NA
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location fits the definition of a **watercourse.**

Photo: Water Body near Mistake Creek

9.2. Field Determination

This unmapped 'watercourse' includes an extensive water body which appears to form a tributary of Mistake Creek. Review of aerial imagery suggests that it branches from Mistake Creek upstream of the alignment and reconnects further downstream.

Banks of the water body associated with the alignment at this site are stabilised with grasses and sedges interspersed with variable states of erosion due to cattle activity. Numerous habitat values were observed within the waterhole, including submerged logs and macrophytes.

The riparian vegetation at this site can be described as woodland to open-woodland with a grassy understorey. Vegetation was dominated by *Eucalyptus coolabah, Acacia cambagei* and *Acacia harpophylla*. Scattered tree or shrub species, such as *Eucalyptus populnea*, *Terminalia oblongata, Eremophila mitchellii* and *Atalaya hemiglauca,* were occasionally present. The ground layer was very sparse and dominants included *Muehlenbeckia florulenta, Paspalidium caespitosum, Bothriochloa ewartiana, Iseilema vaginiflorum, Eragrostis macrocarpa* and *Aristida latifolia. Leptochloa digitata* and *Muehlenbeckia florulenta* dominated the vegetation on the banks of the water body.

This relatively extensive water body meets the definition of a 'watercourse'.

Photo: Water Body near Mistake Creek

10. Mistake Creek Anabranch (Crossing 69c)

10.1. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	2
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location fits the definition of a **watercourse.**

Photo: Mistake Creek Anabranch

10.2. Field Determination

This 'watercourse' runs from South to North and forms part of the Mistake Creek catchment. The agricultural property to the West is used for grazing cattle and the vegetation to the East adjoins the main tributary of Mistake Creek.

Riparian vegetation at this site is consistent with REs 11.3.25 and 11.3.37 and dominated by *Eucalyptus coolabah* and *Eucalyptus camaldulensis*. Other species observed within the T2 and shrub layers included *Geijera parviflora*, *Terminalia oblongata* and *Acacia stenophylla*. The ground layer contained a mix of exotic and native grasses, including *Pennisetum ciliare, Dichanthium sericeum, Leptochloa digitata, Enteropogon acicularis* and *Bothriochloa ewartiana*.

Stream bed materials were formed from sand, gravel, clay and silt materials. Sand formed the greatest percentage of the substrate within the stream bed. Temporary pools were observed in areas where timber, silt and sand materials had deposited from flood events preventing water deviation.

Observed severe bank erosion and slumping were predominantly caused by grazing and flood disturbances. Erosion has resulted in fallen trees and exposed roots for a number of trees within the assessment area.

Photo: Mistake Creek Anabranch

II. Mistake Creek (69b)

II.I. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	6
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location fits the definition of a **watercourse**.

Photo: Mistake Creek

11.2. Field Determination

This 'watercourse' runs North to South through remnant vegetation consistent with REs 11.3.25 and 11.3.37 dominated by *Eucalyptus coolabah* and *Eucalyptus camaldulensis*

The 'watercourse' bed was comprised of a combination of sands, gravel, clays and silts, with sand the dominant substrate observed within the 'watercourse'. Erosion and bank slumping were observed on the left and right banks predominantly caused by cattle accessing the watercourse and recent flood events.

Undercutting of riparian vegetation was observed in a number of locations resulting in exposed roots and fallen timber. Small turbid pools were observed within the 'watercourse' bed but the majority of the 'watercourse' contained no pooled or flowing water. *Cyperus* and *Juncus* species were only observed within soakage points along with the remains of freshwater molluscs, crustaceans and gastropods.

Photo: Mistake Creek

12. Gowrie Creek (crossing 68)

12.1. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	4
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location fits the definition of a **drainage feature**. • Funnels immediate localised rainfall only. • Only flows for a short period following rainfall. • Lacks a true riverine environment.

Photo: Gowrie Creek

12.2. Field Determination

Gowrie Creek does not possess all of the required characteristics to be defined as a 'watercourse'. The absence of riverine vegetation and the presence of areas where the channel becomes less defined suggest this site is more consistent with the definition of a 'drainage feature'.

No remnant or regrowth vegetation is associated with this 'drainage feature'. Adjoining tree species included *Acacia harpophylla, Acacia cambagei, Eucalyptus coolabah, Acacia salicina* and *Terminalia oblongata* up to 10 m in height. Shrub and ground layer species included *Citrus glauca, Carissa ovata, Lysiphyllum carronii, Archidendropsis basaltica, Leptochloa digitata, Enteropogon acicularis, Pennisetum ciliare, Parthenium hysterophorus, Eriocereus martini* and *Aristida latifolia*.

Photo: Gowrie Creek

13. Gowrie Creek Tributary (Crossing 67)

13.1. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	2
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location fits the definition of a **drainage feature**. • Funnels immediate localised rainfall only. • Only flows for a short period following rainfall. • Lacks a true riverine environment.

Photo: Gowrie Creek Tributary (Crossing 67)

13.2. Field Determination

This 'drainage feature' runs from the South-East to North-West across the alignment with aerial imagery showing the presence of two storage dams, one upstream and one downstream of the crossing. The 'drainage feature' is surrounded by pastoral areas utilised for cattle production. The area has been historically cleared of all woody vegetation and is now dominated by the exotic fodder grass species *Pennisetum ciliare*.

This 'drainage feature' was completely dry during the survey and only appears to flow and contain water after periods of intense or continual rainfall. The substrate within the 'drainage feature' was comprised predominantly of cracking clays and silt materials.

The area was highly disturbed with very high levels of erosion and bank slumping throughout. The majority of the erosion was as a result of cattle grazing and watering.

Photo: Gowrie Creek Tributary (Crossing 67)

14. Gowrie Creek Tributary (Crossing 66)

14.1. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	1
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location does not contain any defined channel features and is not considered a 'watercourse' or 'drainage feature'.

Photo: Gowrie Creek Tributary (Crossing 66)

14.2. Field Determination

The area has been historically cleared of all woody vegetation and is now dominated by the exotic fodder grass species *Pennisetum ciliare*. This location contains a number of shallow dry depressions, however, has no features consistent with a 'watercourse'.

Photo: Gowrie Creek Tributary (Crossing 66)

15. Gowrie Creek Tributaries (Crossings 64 & 63)

15.1. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	1
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location does not retain any defined channel features and is not considered a 'watercourse' or 'drainage feature'.

Photo: Gowrie Creek Tributaries (Crossings 64 & 63)

15.2. Field Determination

This location contains no features consistent with a 'watercourse'. Vegetation observed included relatively small scattered *Acacia harpophylla, Terminalia oblongata* and *Citrus glauca* less than 2 m in height. *Pennisetum ciliare, Parthenium hysterophorus, Capparis lasiantha, Carissa ovata, Leptochloa digitata, Aristida latifolia* and *Cyperus exaltatus* formed a dense ground layer. Weed species observed included *Parthenium hysterophorus, Pennisetum ciliare, Opuntia tomentosa, Eriocereus martini* and *Xanthium pungens.*

Photo: Gowrie Creek Tributaries (Crossings 64 & 63)

16. Unnamed Flow Path 2 (Crossing 60)

16.1. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	1
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location does not contain any defined channel features and is not considered a 'watercourse' or 'drainage feature'.

Photo: Unnamed Flow Path (Crossing 60)

16.2. Field Determination

This area is not a 'watercourse' or 'drainage feature'. Vegetation observed included relatively small scattered *Acacia harpophylla, Terminalia oblongata* and *Citrus glauca* less than 2 m in height. A dense ground layer containing *Pennisetum ciliare, Parthenium hysterophorus, Capparis lasiantha, Carissa ovata, Leptochloa digitata, Aristida latifolia* and *Cyperus exaltatus* was observed.

Observed weed species included *Parthenium hysterophorus, Pennisetum ciliare, Opuntia tomentosa* and *Eriocereus martini.*

Photo: Unnamed Flow Path (Crossing 60)

17. Unmapped Flow Path 1 (Crossing 59)

17.1. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	NA
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location fits the definition of a **drainage feature**. • Funnels immediate localised rainfall only. • Only flows for a short period following rainfall. • Lacks a true riverine environment.

Photo: Unmapped Flow Path 1

17.2. Field Determination

The vegetation at this site is dominated by *Acacia harpophylla* and *Acacia cambagei*. The shrub and ground layer was comprised of *Eremophila mitchellii*, *Carissa ovata*, *Citrus glauca*, *Bothriochloa bladhii*, *Bothriochloa ewartiana*, *Pennisetum ciliare*, *Dichanthium sericeum*, *Leptochloa digitata* and *Enteropogon acicularis*.

The depression is formed by the concentration of overland flow with the substrate comprised of sand and gravel with areas of fine sediment and silts. No pools or areas capable of holding water were observed within the alignment area.

Photo: Unmapped Flow Path 1

18. Unnamed Flow Path 3 (Crossing 56)

18.1. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	1
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location is an open paddock with regrowth that does not contain any defined channel features and is not considered a 'watercourse' or 'drainage feature'. As such, no Field Determination is presented for this site.

Photo: Unnamed Flow Path (Crossing 56)

19. Logan Creek Tributary (Crossing 53)

19.1. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	2
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location fits the definition of a **drainage feature**. • Funnels immediate localised rainfall only. • Only flows for a short period following rainfall. • Lacks a true riverine environment.

Photo: Logan Creek Tributary (Crossing 53)

19.2. Field Determination

This flow path runs from South to North and is surrounded by remnant vegetation. Areas adjoining the remnant vegetation have historically been cleared and are now dominated by exotic *Pennisetum ciliare*. The area contains no formalised 'watercourse' structure, with no obvious channels, beds or banks observed during the field survey.

No ponds, pools, riffles or bars were observed within the survey area, and no aquatic habitats were present. Vegetation observed included *Eucalyptus coolabah*, *Terminalia oblongata*, *Eucalyptus populnea*, *Eremophila bigoniiflora*, *Geijera parviflora* and Citrus *glauca*. The shrub layer would be considered very sparse with the ground layer within remnant vegetation dominated by native grasses.

Photo: Logan Creek Tributary (Crossing 53)

20. Logan Creek (Crossing 52)

20.1. Assessment Overview

Overview	Comment / Description
Stream Order Number (according to State Government mapping databases)	5
Area determination (according to the *Water Act 2000* based on identified exclusion criteria)	This crossing location fits the definition of a **watercourse**.

Photo: Logan Creek

20.2. Field Determination

Logan Creek runs from South-East to North-West through the Suttor River catchment and is surrounded by intensive agriculture along large sections of its banks. This expansive water body is formed by a weir structure that is located approximately 8 km downstream of the proposed bridge crossing.

The riparian vegetation associated with this 'watercourse' is predominantly *Eucalyptus camaldulensis* and *Eucalyptus coolabah* with *Acacia cambagei* distant from the watercourse banks. Other species observed include *Geijera parviflora, Acacia salicina, Eremophila bigoniiflora, Eremophila mitchellii, Carissa ovata, Pennisetum ciliare, Parthenium hysterophorus, Terminalia oblongata, Dichanthium sericeum, Leptochloa digitata* and *Cyperus exaltatus*.

Substantial aquatic habitats in the form of submerged logs and macrophytes were present. Numerous avifauna were observed utilising this 'watercourse', including duck, cormorant, heron and ibis species.

Photo: Logan Creek

21. Summary

Separable Portion 1 (SP-1) of the Carmichael Coal Project (Rail) traverses approximately 120 km from the Mine site eastward to Moranbah. Detailed field assessment combined with GIS mapping of the corridor has identified a total of 21 locations where the rail line crosses an assessable flow path.

Each of these locations has been assessed to determine whether the feature meets the definition of a 'watercourse' or 'drainage feature' under the *Water Act 2000*. Of the 21 assessed flow paths, 14 locations are considered to meet the definition of a 'drainage feature' and therefore will not require assessment under the *Guideline* (*Activities in a watercourse, lake or spring associated with a resource activity or mining operations*' 2012, refer to **Attachment A**). The areas defined as 'drainage features' did not exhibit characteristics typical of a 'watercourse'. For example, none of the 'drainage feature' areas showed evidence of high velocity flow events, nor did they have enough flow to create a riverine environment. In addition, they had short flow periods which were consistent with episodes of heavy rainfall funnelled from their immediate surroundings.

The remaining 7 crossings (78c, 78b, 78a, 69d, 69c, 69b & 52) have been determined 'watercourses' as they form part of greater catchments and show evidence of continued flow periods. There is also evidence that these areas have enough flow to create a riverine environment. Due to works associated with the SP-1 alignment qualifying for an exemption, Riverine Protection Permits will not be required before their commencement. However, there must be consideration of the *Guideline*, mentioned above, with associated compliance and recording of outcomes and solutions that will need to be upheld for all works within these areas.