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Department of
**Environment and
Heritage Protection**

12 October 2012

Chief Executive Officer
QCLNG Pipeline Pty Ltd
Level 30, 275 George Street
BRISBANE QLD 4000

Attention: Mr Ken Berry

Dear Sir

Water course crossing – Columboola Creek - PEN100953310 - PPL153

I refer to the pending water course crossing of Columboola Creek associated with pipeline works on Petroleum Pipeline Lease 153 (PPL153). The Department of Environment and Heritage Protection (the department) has received a number of complaints from members of the public alleging the proposed use of open cut trenching techniques, as opposed to horizontal directional drilling (HDD), at this site.

The department is hereby requesting a copy of all investigation summaries, alignment sheets and specific crossing drawings for the Columboola Creek crossing, in accordance with condition (E28) of the Environmental Authority PEN100953310 (the EA).

Furthermore, QGC is directed to condition (E27) which states that:

(E27) All crossings must be in accordance with the construction methods described in the Gas Collection Header Watercourse Assessment – Addendum to Appendix 1 of the EM Plan.

The crossing of Columboola Creek, identified as crossing 8 in this document, states that the construction method is to be by HDD. Given the nature of the complaints received by the department, QGC are requested to provide confirmation on the construction method for the Columboola Creek crossing. If the works are not to be undertaken as per the *Gas Collection Header Watercourse Assessment – Addendum to Appendix 1 of the EM Plan*, QGC are invited to explain the circumstances surrounding the apparent deviation from the Gas Collection Header Watercourse Assessment.

In view of the imminent commencement of construction around Columboola Creek the department requests that this information is supplied by no later than **19 October 2012**.

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ABN 87 221 158 788 Page 1 of 265

If you have any questions in relation to this matter please contact Tim Reid on (07) 4699 4350.

Yours sincerely

[Redacted Signature]

David Darvall [Redacted]
Manager
Southern Region
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RTI DL RELEASE - EHP

19 October 2012

David Darvall
Manager, Southern Region Environmental Services and Regulation
Department of Environment and Heritage Protection
PO Box 731, Toowoomba
Queensland 4350

Ref: ENV-COM-ADE-121019-01

Dear Mr Darvall

RE: Water Course Crossing – Columboola Creek – PEN100953310 – PPL153

I refer to your letter of 12 October requesting further information regarding the Columboola Creek crossing.

Condition (E27) of the environmental authority PEN100953310 (EA) provides that "All crossings must be in accordance with the construction methods described in the *Export Pipeline Watercourse Crossing Assessment – Addendum to Appendix 1 of the EMP*."

The Addendum to Appendix 1 of the EMP (**Addendum**), identified construction methods proposed to be applied to each type of watercourse crossing (Minor Water Crossings, Major Water Crossings, Horizontal Directional Drilling (**HDD**)).

QGC confirms that those construction methods will be implemented.

In terms of the construction technique for Columboola, QGC advises that it intends to undertake open trenching.

The attachment to the Addendum comprised a 'Gas Collection Header Major Crossing Investigation Summary', described as providing the current level of assessment that had been conducted at that time for each respective major crossing. HDD was identified as being the construction technique anticipated to be adopted for Columboola Creek, in that attachment.

However, the Addendum clearly stated that site specific construction techniques would be finalized and subject to detail design, following further geotechnical assessment (see for e.g., page 2). Accordingly, the change in construction technique following the undertaking of further assessment is consistent with the Addendum, and therefore condition (E27).

In addition to further geotechnical investigations, QGC was required by the Commonwealth Government to consider the outcome of investigations into the presence of Matters of National Environmental Significance (**MNES**) or potential MNES breeding grounds.

The outcome of those investigations are set out in the QCLNG Pipeline Aquatic Values Management Plan, which has been approved by the Commonwealth (**AVMP**). A copy of the AVMP is attached.

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Those investigations observed no MNES or potential MNES breeding grounds in the vicinity of the crossing location. The investigations also observed that the creek was predominantly dry, and possessed overall poor habitat quality.

As identified in the AVMP, QGC has selected crossing techniques based on the following considerations: the location of the crossing and any access limitations; the practicalities of employing HDD based on geotechnical investigations; the potential for associated environmental impacts outside of the aquatic environment; and whether or not the aquatic values identified at each crossing point are of a significant quality and can be protected via mitigation methods associated with the open-cut trenching technique.

Having regard to those considerations, QGC determined that trenching was the most appropriate construction technique for Columboola Creek. This determination is identified in table 1 of the AVMP.

On that basis, the Addendum was updated to reflect the change in construction technique, and to ensure consistency with the AVMP. This update was foreshadowed in the EMP. While we note there is no requirement under the EA for QGC to submit an updated EMP, we enclose a copy of the updated EMP for your information.

Finally, the current pipeline alignment sheet for the area and the plan and profile drawing are enclosed under cover of this letter as requested.

If you have further queries, please don't hesitate to contact Ken Berry on (07) 3024 7639.

Yours sincerely

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Tracey Winters
Vice President - Environment

Encl.

1. QCLNG Pipeline Aquatic Values Management Plan: QCLNG-BG00-ENV-RPT-000009
2. Addendum to appendix 1 of the Environmental Management Plan: QCLNG-BG00-ENV-PLN-000004
3. QCLNG Gas Collection Header Pipeline Alignment Sheet KP 89.0 to KP 92.0: QCLNG-BG00-PLA-ALS-000013-33
4. QCLNG Gas Collection Header Columboola Creek Crossing KP 90.135 plan and profile drawings: QCLNG-BG00-CON-DET-000011

QCLNG Pipeline Aquatic Values Management Plan

QCLNG-BG00-ENV-RPT-000009

Rev 2

December 2011

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QCLNG PROJECT

DOCUMENT INFORMATION SHEET

TITLE: QCLNG Pipeline Aquatic Values Management Plan

PURPOSE AND SCOPE:

The purpose of this document is to address Conditions 35, 36, 37 and 38 of **EPBC Approval 2008/4399** requiring the development of an Aquatic Values Management Plan for the QCLNG Pipeline, to be approved by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC).

This document is applicable only to the Gas Collection Header and mainland Export Pipeline (extending at the northern extent to Mainline Valve 7) components of the QCLNG Pipeline. A pipeline crossing at The Narrows connecting the mainland Export Pipeline with the LNG Facility on Curtis Island is subject to separate management plans.

DOCUMENT VERIFICATION

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Date: 9 December 2011

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Date: 9 December 2011

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Name: Ken Berry

Date: 9 December 2011

RACIE Terms

R	Responsible:	the person who actually produces the document
A	Accountable:	the person who has to answer for the success or failure of the quality and timeliness of the document
C	Consulted:	those who must be consulted before the document is published
I	Informed:	those who must be informed after the document is published
E	Endorsed:	the person who must approve the document before publication

Revision Record

Issue	Date	Reason for Issue	Responsible	Accountable
2	8 December 2011	Post approval re-submission to SEWPaC incorporating Addendum to Aquatic Values Survey Report (Appendix V) and associated amendments	E. Clement	B. French
1	19 September 2011	Re-submission to SEWPaC incorporating RFI of 30/08/2011	B. French	J. MacDermott
0	26 July 2011	Submission to SEWPaC	B. French	J. MacDermott
B	22 July 2011	Draft for QGC review	E. Clement	B. French
A	14 July 2011	Draft for QGC review	E. Clement	B. French

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1.0 INTRODUCTION

The Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) approved the Pipeline component of the Queensland Curtis Liquefied Natural Gas (QCLNG) Project under Sections 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 22 October 2010. Approval was subject to fulfilment of a range of conditions by QGC Pty Ltd (QGC) as specified in EPBC Approval No 2008/4399 (the Pipeline Approval).

These conditions included the requirement to provide a detailed assessment of aquatic values for any listed riparian, aquatic and water dependent flora and fauna under the EPBC Act that may potentially be impacted by the Pipeline Project.

QGC has prepared the QCLNG Pipeline Aquatic Values Management Plan (AVMP) for approval by SEWPaC in accordance with the following conditions of the Pipeline Approval:

Condition 35

Where reasonably possible, horizontal directional drilling must be used for major waterway crossings, including:

- a) those within the Dawson, Calliope and Condamine River catchments and any water crossings within the known distribution of the Fitzroy River Turtle (*Rheodytes leukops*) and Murray Cod (*Maccullochella peelii peelii*). Pipeline construction across waterways within the known distribution of the Fitzroy River Turtle must not take place during the nesting and breeding season;*
- b) Humpie and Targinie Creeks*

Condition 36

*Trenchless techniques are not required in minor creek beds within the known distribution of the Fitzroy River Turtle (*Rheodytes leukops*) and Murray Cod (*Maccullochella peelii peelii*) where there is no water at the crossing site and the distance to the nearest water is sufficient to buffer any potential impacts resulting from the crossing technique.*

Condition 37

The proponent must prepare an Aquatic Values Management Plan. This plan must include:

- a) a detailed assessment of aquatic values, including animal breeding locations for listed threatened and migratory species within the RoW;*
- b) measures to minimise impacts on listed riparian, aquatic and water dependant flora and fauna;*
- c) measures to minimise erosion and sediment impacts to waterways;*
- d) measures to maintain water quality and water flow requirements, including treatment and disposal methods for hydrostatic test water;*
- e) site-specific mitigation measures for any potential impacts from construction and operation of the pipeline on listed threatened species, including but not limited to the Fitzroy River Turtle.*

Condition 38

The Aquatic Values Management Plan must be approved in writing by the Minister. Activities the subject of the Plan must not start without approval. The Plan must be implemented.

The AVMP is primarily based on the findings of the Technical Report – Aquatic Values Survey (Aquatic Values Survey Report) undertaken by a SEWPaC approved ecologist in June 2011(Appendix I)and the Addendum to the Aquatic Values Survey Report undertaken by the same ecologist in October 2011 (Appendix V).

1.1 The QCLNG Pipeline Project

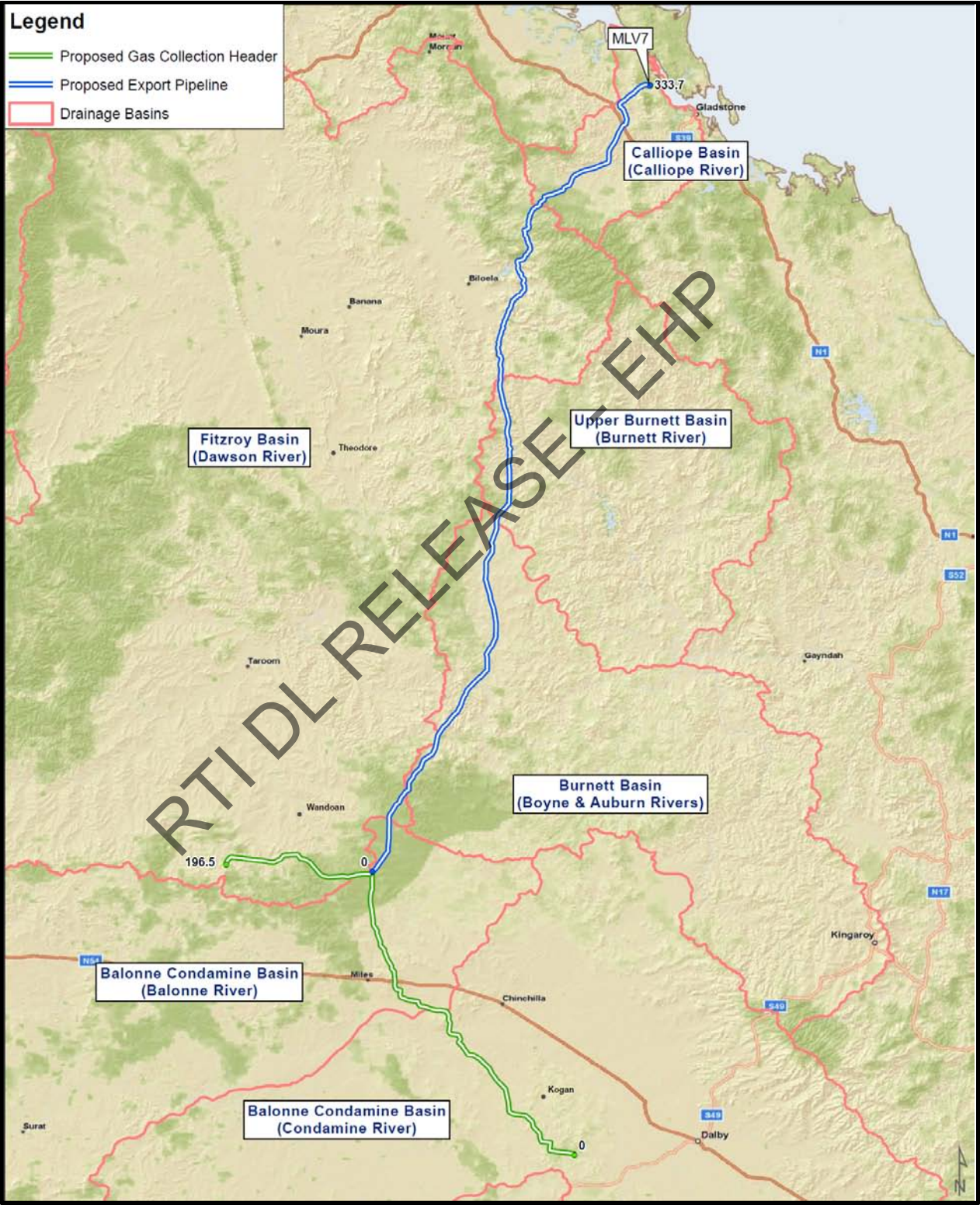
The QCLNG Project (the Project) involves the expansion of QGC's existing Coal Seam Gas operations in the Surat Basin of southern Queensland. Gas from the Surat Basin will be transported via an underground 42 inch diameter pipeline to a LNG facility on Curtis Island off the central Queensland coast, prior to export to global markets.

The QCLNG Pipeline component of the Project (the Pipeline) is made up of a 191 km Gas Collection Header (GCH) and a 334 km Export Pipeline (EP). The GCH extends from GCH kilometre post (KP) 0 near the town of Kogan to GCH KP 196.5 west of Wandoan and transfers gas from centralised compressor facilities across the Surat Basin gas field to the EP. The EP extends from EP KP 0 east of Wandoan to the LNG facility on Curtis Island. The EP is separated into a mainland section extending from EP KP 0 to Mainline Valve 7 (MLV7) at EP KP 333.7 several kilometres west of Gladstone, and a separate QCLNG project component referred to as the Narrows which connects the mainland EP with the LNG Facility on Curtis Island.

The overall QCLNG Pipeline route (including GCH and EP) is located within a 40 metre wide Right of Way (RoW) through the Balonne-Condamine, Burnett, Upper Burnett, Fitzroy and Calliope drainage basins. The majority of aquatic habitats crossed by the Pipeline RoW are minor ephemeral watercourses which only contain water during and immediately after flowing events. The major riverine habitats along the RoW are the Condamine and Calliope Rivers. A number of riparian and wetland regional ecosystems (REs 11.3.27b, 11.3.27f, and 11.3.25) also occur along the RoW.

Figure 1 shows the location of the QCLNG Pipeline and the drainage basins which the Pipeline route crosses.

Figure 1 Location map of QCLNG Pipeline and associated drainage basins



1.2 Scope

This AVMP is applicable only to watercourses along the GCH and mainland component of the EP. Works associated with the Narrows crossing connecting the mainland EP with the LNG Facility on Curtis Island are addressed in separate management plans and are not covered within this AVMP. As such, Humpy and Targinie Creeks as identified in Condition 35(b) of the Pipeline Approval, have not been assessed in this AVMP.

This AVMP applies to aquatic and riparian environments occurring along the Pipeline RoW, specifically aquatic or riparian species or communities which may occur within the banks of a watercourse as described in the definitions provided at Section 1.5. Terrestrial surveys for MNES were undertaken separately as part of the Pipeline Pre-clearing Ecological Survey in April 2010, which included surveys of riparian vegetation. Therefore the recent aquatic ecology surveys associated with this AVMP (see Aquatic Values Survey Report at Appendix I and the Addendum to the Aquatic Values Survey Report at Appendix V)), focused on only aquatic species and communities designated as Matters of National Environmental Significance (MNES) under the EPBC Act.

A preliminary desktop assessment and field validation identified only 25 watercourse crossings along the entire Pipeline that were likely to accommodate flowing water, or standing water, and had the potential to support aquatic or riparian values that may be impacted by construction activities. Two of the 25 crossings that were identified, the Condamine River and Columboola Creek, were not surveyed in the original aquatic ecology surveys undertaken in June 2011, due to the potential likelihood of undertaking the horizontal directional drilling (HDD) technique underneath these watercourses. Following a request from SEWPaC these crossings were surveyed in October 2011 and an Addendum to the Aquatic Values Survey Report was produced. As per the commitments made in revision 1 of this AVMP which was approved by SEWPaC on 30th September 2011, this revision 2 of the AVMP has been updated to include reference to the findings of these additional surveys and to incorporate the Addendum report (refer Appendix V). In addition, this revision includes a description of the selected method of construction at two watercourse crossings (Columboola Creek and Kroombit Creek), which was not confirmed in the previous revision and which has now been finalised based on the findings of the geotechnical investigations and additional aquatic ecology survey.

Any potential impacts to the aquatic values of the watercourses that were not surveyed are considered to be minor, provided the management measures identified throughout this document are complied with. Therefore, while the watercourses which have the potential to support aquatic values and may be impacted by construction are the primary focus of the AVMP, the construction mitigation measures identified in the AVMP will be implemented at all watercourses along the Pipeline where applicable.

While this AVMP has been developed in order to address Conditions 37 and 38 of the Pipeline Approval, it also encompasses the requirements of Conditions 35 and 36 relating to construction techniques as defined in Section 1 of this AVMP.

Due to the greater potential for impacts to and disturbance of MNES and other aquatic values during installation and establishment of the Pipeline, the AVMP focuses on the Construction phase of the works. The Pipeline operational phase is expected to have limited potential for impacts to MNES, primarily due to the nature of the partially subterranean pipeline infrastructure. Under normal Pipeline operating conditions such infrastructure requires minimal maintenance and inspection throughout operational life with very limited potential for impacts to the aquatic environment. However, as discussed in Section 7 all necessary operational maintenance activities in the aquatic or riparian zones will also be undertaken in accordance with this AVMP.

Similarly, decommissioning is anticipated to have limited potential for impacts to MNES. However, this is difficult to assess due to the timeframes involved (useful life of Pipeline infrastructure being approximately fifty years). Difficulties also arise due to the lack of similar pipeline infrastructure projects across the world that have been decommissioned to date. Despite this lack of clarity, it is intended that an Environmental Management Plan (EMP) (or similar) which encompasses management of aquatic values,

will be developed specifically for and prior to the decommissioning phase of the Pipeline. Such an EMP would include aquatic rehabilitation planning in accordance with specific legislative, regulatory and industry practice requirements at that time. Similarly the decommissioning methodology would also be conducted in accordance with the relevant practices and standards of the industry at the time when decommissioning occurs. As such decommissioning processes, and their associated impacts on MNES, may radically change within the useful operational lifetime of the Pipeline, the specific content of such a decommissioning phase EMP has not been documented within this AVMP or associated documents at this time.

1.3 Objectives

The overall intent of the AVMP is to provide an assessment of aquatic values at watercourse crossings along the Pipeline RoW and to outline the mitigation measures which shall be implemented to minimise impacts to these aquatic values, in particular MNES.

The document initially outlines the nature of the watercourse crossings encountered along the Pipeline and the proposed construction techniques, in order to provide an understanding of the potential impacts to the watercourses and the mitigation measures which may be required.

It then describes the methodology and findings of the Aquatic Values Survey undertaken at selected watercourse crossings along the Pipeline RoW. Recommendations as to the significance of the aquatic values and how they should be protected have been used to inform the selection of crossing construction technique and the development of construction mitigation measures included in Section 7.

1.4 Distribution and Intended Audience

This document is intended to be reviewed by government regulators for endorsement, to be used by QGC personnel, Contractors and Consultants to identify EPBC listed aquatic species that may be impacted by the Pipeline, and to specify the mitigation measures which shall be implemented to minimise impacts to aquatic values along the Pipeline RoW.

1.5 Definitions

In this document, the following definitions apply:

Term	Meaning
Aquatic environment	Riverbeds, creek beds and wetlands that serve as habitat for interrelated and interacting communities and populations of plants and animals.
Construction Contractor, the Contractor	McConnell Dowell Constructors (Aust) Pty Ltd – Consolidated Contracting Company Australia Pty Ltd Joint Venture for the QCLNG Project (MCJV). MCJV is undertaking the construction of the GCH and Export Pipeline to Mainline Valve 7.
Department	Department means the Australian Government department responsible for administering Part 4 of the EPBC Act.
Endangered	Designated as 'Endangered' under the EPBC Act, NC Act and / or VM Act. Refer to definitions of 'EPBC Act conservation status', 'NC Act conservation status' and 'VM Act conservation status' for meaning of Endangered under each Act
Environmental Authorities	Environmental Authorities PEN100953310 and PEN100953110 issued by DERM for the QCLNG Pipeline
EPBC Act	EPBC Act means the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
Export Pipeline	The mainland component only of the Export Pipeline from Miles to Mainline Valve 7.
Gas Collection Header	The gas collection component of the pipeline that feeds the Export Pipeline
Habitat	An area or areas permanently, periodically or occasionally occupied by a species, population or ecological community, including any and all biotic and abiotic features of the area or areas occupied.
Kilometre Post	Measurement of distance along the Pipeline RoW.
Minor watercourse	Watercourse (see definition below) that has peak 100 year Average Recurrence Interval (ARI) flood event velocities of less than 2m/s and a ratio of flow to catchment area of less than 20.
Major watercourse	Watercourse (see definition below) that has peak 100 year Average Recurrence Interval (ARI) flood event velocities that are greater than 2m/s and the ratio of flow to catchment area is more than 20.
MCJV	McConnell Dowell Constructors (Aust) Pty Ltd consolidated Contracting Company Australia Pty Ltd Joint Venture
MNES	Matters of National Environmental Significance under the EPBC Act
Plan	Plan includes a report, study, plan, or strategy (however described).
Pipeline Approval, the Approval	Approval: To develop, construct, operate and decommission a 730km pipeline network to link coal seam gas fields in the Surat Basin, Queensland to the proposed Queensland Curtis LNG Plant located on Curtis Island as described in referral EPBC 2008/4399
Pipeline	Gas Collection Header and Export Pipeline from Miles to Mainline Valve 7
QCLNG Project, the	The QCLNG Project, including upstream gas collection, the pipeline

Term	Meaning
Project	corridor and the Curtis Island LNG site, plus ancillary sites including temporary construction access corridors, plus associated shipping and vessel activity.
QGC Pty Ltd	QGC Pty Ltd, A BG-Group business, for the purpose of this document, the Proponent.
Proponent	Proponent means the person to whom the approval is granted, and includes any person acting on behalf of the proponent.
Regional Ecosystem	A vegetation community, within a bioregion, that is consistently associated with a particular combination of geology, landform and soil. REs may be classified under schedules 1–3 of the Vegetation Management Regulation 2000 as either Endangered, Of Concern or Least Concern. Refer to 'VM Act conservation status' for meaning of Endangered, Of Concern or Least Concern under the VC Act.
Remnant vegetation	Remnant woody vegetation is defined as vegetation where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy (Neldner et al. 2005).
Right of Way	Corridor of land accessed for pipeline construction, nominally 40m wide
SEWPaC Conditions, the Conditions	Development conditions contained within the EPBC Act Pipeline Approval: to develop, construct, operate and decommission a 730km pipeline network to link coal seam gas fields in the Surat Basin, Queensland to the proposed Queensland Curtis LNG Plant located on Curtis Island (as described in referral EPBC 2008/4399).
Vulnerable	Designated as 'Vulnerable' under the EPBC Act. Refer to definitions of 'EPBC Act conservation status' for meaning of 'Vulnerable' under these Acts.
Watercourse	As described in the Queensland Water Act 2000, 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. A watercourse encompasses the area from outer bank to outer bank, with outer bank being the highest of any depositional or scour marks and is also referred to as high bank.

1.6 Acronyms and Abbreviations

In this document, the following acronyms and abbreviations apply:

Acronym/Abbreviation	Meaning
AVMP	Aquatic Values Management Plan
AVMAP	Aquatic Values Management Action Plan
DERM	Queensland Department of Environment and Resource Management
DEEDI	Queensland Department of Employment, Economic Development and Innovation
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
EP	Export Pipeline
EVNT	Endangered, Vulnerable and Near Threatened flora and fauna species
GCH	Gas Collection Header
HDD	Horizontal Directional Drilling
KP	Kilometre Post
MCJV	McConnell Dowell Constructors (Aust) Pty Ltd consolidated Contracting Company Australia Pty Ltd Joint Venture
MLV	Mainline Valve
MNES	Matters of National Environmental Significance
NC Act	Queensland <i>Nature Conservation Act 1992</i>
NT	Near Threatened
QCLNG	Queensland Curtis Liquefied Natural Gas Project
RE	Regional Ecosystem
RoW	Right of Way
SEWPaC	Commonwealth Department of Sustainability, Environment, Water, Populations and Communities

2.0 WATERCOURSE CROSSINGS

2.1 General

The Pipeline has been aligned to avoid wetlands and riverine habitats wherever possible. Where watercourse crossings are unavoidable, a range of management actions have been developed to mitigate the impacts to aquatic values. In order to provide an understanding of the potential impacts to the watercourses and the mitigation measures which may be required, this section describes the nature of the watercourse crossings encountered along the Pipeline and the proposed construction techniques.

The QCLNG Pipeline Project has classified all watercourse crossings along the Pipeline RoW as either Minor or Major water crossings. Pipeline construction techniques and associated mitigation measures for protection of aquatic values vary according to this description. Minor watercourse crossings have been defined as those crossings where the risk of significant scouring and erosion has been judged to be low. These drainage features are ephemeral with no permanent flowing or standing water, have peak 100 year Average Recurrence Interval (ARI) flood event velocities of less than 2m/s and a ratio of flow to catchment area of less than 20.

Major watercourse crossings have been defined as those crossings where the risk of significant scouring and erosion is judged to be medium to high. These watercourses are also ephemeral with all crossings occurring at locations where there may be no permanent or standing water. The peak 100 year ARI flood event velocities are greater than 2m/s and the ratio of flow to catchment area is more than 20. This definition potentially differs from SEWPaC's use of the term 'major waterway', which is noted within Condition 35 of the Pipeline Approval. While there is no definition of a 'major waterway' provided within the Pipeline Approval, it is anticipated that a 'major waterway' alludes to a waterway that can be clearly distinguished from other smaller waterways and contains significant aquatic habitat values, including water flow.

There are 55 Minor crossings and 21 Major crossings (as defined by the QCLNG Pipeline Project) along the GCH RoW. Along the EP there are 234 Minor crossings and 86 Major water crossings. The location of all Minor and Major watercourse crossings along the GCH and EP including those water crossings surveyed as part of the Aquatic Values Survey are shown in the location maps of the GCH and EP within Appendix II. A complete list of all watercourse crossings for the EP and GCH is also provided within Appendix II.

2.2 Watercourse Crossing Construction Techniques

All construction activities occurring within watercourses along the Pipeline RoW will be undertaken in accordance with management actions outlined in Section 7 of the AVMP and associated survey reports, as well as any relevant requirements of current versions of the following SEWPaC and DERM approved management plans: *QCLNG Pipeline Significant Species Management Plans* (QCLNG-BG00-ENV-RPT-000002); *QCLNG Pipeline Species Management Program – Tampering with the Breeding Place of a Protected Animal Species* (SMP) (QCLNG-BG00-ENV-RPT-000004); *Framework Environmental Management Plan GCH and EP* (QCLNG-BG00-ENV-RPT-000007); *Environmental Management Plan – Gas Collection Header Pipeline*; *Environmental Management Plan – Export Pipeline from Miles to MLV 7*.

In addition, any watercourse crossing works will be undertaken in accordance with the following Queensland Department of Environment and Resource Management (DERM) and Department of Employment Economic Development and Innovation (DEEDI) guidelines to further minimise potential impacts on any significant species or habitats:

- DEEDI Code for self-assessable development – Temporary waterway barrier works (WWBW02 September 2010);

- DEEDI Code for self-assessable development – Minor waterway barrier works (WWBW01 September 2010); and
- DERM Guideline – Activities in a watercourse, lake or spring associated with mining operations (WAM/2008/3435 – v2).

Two watercourse crossing techniques will be used along the Pipeline RoW. They include the Standard Open-Cut, and Trenchless techniques. Irrespective of the technique to be used, the design and construction of the pipeline shall:

- Avoid and minimise impacts on riparian, aquatic and water dependent flora and fauna;
- Protect flora and fauna during construction and operation, including reduction or disruption to habitat particularly of any potential listed species habitat;
- Rehabilitate disturbed riparian areas including use of locally sourced species.

Clear and grade operations adjacent to watercourses will be restricted to the minimum necessary for construction purposes. The required clearing will only be undertaken at the time of pipeline construction to minimise potential for waterway erosion and degradation and will be performed in a manner which will minimise reinstatement requirements. Where trees and vegetation cannot be preserved above ground, stabilising root materials will be left undisturbed wherever possible.

Pipeline construction works undertaken within watercourses will be completed within a maximum ten day period as per the conditions of the Pipeline Environmental Authorities unless otherwise authorised by DERM. In Minor watercourses works will not be undertaken when there is water present at the crossing unless impacts to any potential MNES can be mitigated effectively. Major watercourses will also be transected at times of no flow unless appropriate construction mitigation measures to protect the aquatic values, particularly MNES, can be implemented effectively.

Further details of the two construction techniques are provided below. An explanation of the selected construction technique for Major and Minor watercourses and details on the mitigation measures to be implemented for protection of the associated aquatic values, specifically MNES and MNES breeding locations, are included in Section 7.

2.2.1 Standard Open-Cut

The majority of watercourse crossings encountered along the Pipeline are generally dry or with a low flow making a standard open-cut trenching technique appropriate.

The standard open-cut method involves establishing a stable working platform either side of the watercourse and using excavators to create a trench at the crossing location. The trenching equipment works through the creek bed with tie-in points located on high ground well away from any potential water flow. Watercourse bed and bank material and trench spoil will be stockpiled separately, with excavated material being stockpiled above high bank level.

As the majority of watercourses along the Pipeline RoW are dry for most of the year water diversion techniques will not generally be required. However for any Minor or Major watercourses which may be crossed using this technique while there is water present at the crossing location, diversion berms, pumps or flume pipes will be used to divert water away from the construction area to ensure a continuous flow is maintained to downstream areas.

2.2.2 Trenchless

Trenchless techniques where the pipeline is constructed underneath a watercourse can be used where standard open-cut is not appropriate for operational or ecological reasons. Of the available trenchless watercourse crossing techniques, HDD is the method which will be used for the QCLNG Pipeline.

The installation of the pipeline by HDD involves drilling a hole at a shallow angle beneath the surface through which the pipe is threaded. Drilling is conducted by a specially designed drill rig, operated by a specialist contractor. A variety of equipment and infrastructure is required and the work area for equipment layout may exceed the 40 metre RoW width as typically a 50 metre operating area is required. The distance of the HDD entry and exit pads from the watercourse varies depending on a range of factors but for the QCLNG Pipeline this distance is anticipated to be at the very minimum 150 metres from the centreline of the watercourse and in most instances significantly further than this.

The feasibility of using HDD is limited by site conditions such as soil stability, slope, access, available workspace and nature of subsurface rock. The length of the drill and the pipe diameter also influences the ability to use HDD as the risk of unsuccessful construction increases with larger pipe diameter and increasing drill length. Although HDD reduces the impacts in the immediate area of the crossing, the technique can introduce additional environmental management considerations such as the requirement for additional work areas either side of the watercourse.

There is also a very low risk of a 'frac out' occurring during HDD, where a drill bit intersects a fracture within a riverbed. When this occurs bentonite mud may be released into the watercourse. Bentonite is a natural clay-like substance formed from the deposition of volcanic ash. When it is released into a watercourse through a 'frac out' it will cause increased turbidity until the material is fully dispersed. As expansive clay, bentonite works to reseal the fracture and released material normally settles quite rapidly. 'Frac out' occurs only rarely with the HDD technique, however it has been addressed in the mitigation measures contained at Section 7 to ensure potential impacts can be minimised.

3.0 METHODOLOGY

3.1 Desk Top Assessment of Aquatic Values

A desktop assessment of the aquatic values along the Pipeline RoW was undertaken as the first phase of the Aquatic Values Survey (refer Appendix I). This assessment primarily identified those watercourses which had the potential at the time of the assessment to contain water and therefore should be included within the field survey of aquatic values.

The desktop assessment included review of the following published literature and publicly available databases:

- Relevant published literature for the wider Project area;
- Department of Environment and Resource Management (DERM) Wildlife Online;
- Matters of National Environmental Significance (MNES) Online;
- Directory of Important Wetlands (Blackman et al. 1999); and
- DERMs Biodiversity Planning Assessment which identifies ecological features and values of local, regional and state significance as recognised by the DERM and Queensland Museum.

The desktop search identified the following three EPBC listed fauna species that may potentially occur within aquatic habitats impacted by the Pipeline RoW:

- *Maccullochella peelii peelii* (Murray Cod);
- *Rheodytes leukops* (Fitzroy River Turtle); and
- *Adclarkia dawsonensis* (Boggomoss Snail).

The desktop assessment provided guidance to direct the more detailed site based aquatic surveys that focussed primarily on the occurrence of MNES throughout the Pipeline RoW.

3.2 Field Surveys

3.2.1 Pipeline Pre-Clearing Ecological Survey

Throughout May and August 2010 a Pre-clearing Ecological Survey of the Pipeline RoW was undertaken which consisted of a walk-through of the entire RoW. The Pre-clearing Ecological Survey targeted areas of standing vegetation and creek lines identified as part of a desktop assessment, with the aim of identifying significant ecological values, such as Endangered Regional Ecosystems, habitat trees and MNES. A Pre-clearing Ecological Survey report was prepared which documented the findings of the survey. This report was subsequently submitted to SEWPaC and is publicly available on QGC's website.

While the Pre-clearing Ecological Survey provided confirmation of terrestrial flora and fauna constraints within the alignment, it did not specifically target aquatic habitats and species and more detailed Aquatic Values Surveys were undertaken in June 2011 and October 2011 to provide an additional level of detail about the aquatic environment.

3.2.2 Pipeline Aquatic Values Survey

In addition to the desktop studies and the RoW Pre-clearing Ecological Survey Report, a walk through Aquatic Values Survey of all watercourses with flowing or standing water transected by the Pipeline RoW, with the exception of two watercourses on the GCH, was undertaken in June 2011 by Unidel Group. During the field survey dry drainage lines were also assessed opportunistically.

These two watercourses on the GCH which were not included in the June survey, the Condamine River at KP 68.6 and the Columboola Creek at KP 90.1, were surveyed in October 2011 and the findings provided in an Addendum to the original Aquatic Values Survey Report (refer Appendix V).

The purpose of the Aquatic Values Surveys was to assess the overall value of the aquatic habitats to be impacted by the Pipeline and determine the presence, or likely presence, of MNES within the aquatic environments. The full list of watercourses that were assessed during the aquatic ecology field surveys and full details on the survey methodology can be located within the Aquatic Values Survey Report and Addendum (Appendix I and Appendix V) prepared by Unidel Group. The locations of the watercourses that were surveyed are shown on the maps within Appendix II and within the Addendum at Appendix V.

In general, an assessment was undertaken at each watercourse to identify the aquatic values within the vicinity of the Pipeline crossing, followed by targeted surveys for the potentially occurring MNES species identified in the desktop assessment. The surveys were undertaken in accordance with relevant EPBC Act Survey Guidelines for the potentially occurring target species, being the Murray Cod, Fitzroy River Turtle and Boggomoss Snail.

In addition, observations were undertaken at all surveyed crossings for any migratory bird species, or the breeding colonies of such species which may be associated with waterway or riparian vegetation. For surveyed watercourses within the Dawson River catchment observations were also made for sandy areas along the banks within which the Fitzroy River Turtle is known to breed.

Surveys were conducted during the daytime and consisted of the following techniques:

- Visual assessment and documentation of typical habitat features within the vicinity of the impacted area;
- Lure fishing for Murray Cod in streams with pools over 0.5m deep;
- Wading through riffle areas and pools in areas that were up to 1.5m deep. This included undertaking visual surveys of the streambed, stream banks and around woody debris;
- Snorkelling in pools that were greater than 1.5m deep;
- Hand searches for Boggomoss Snail where there was dense riverine vegetation present.
- Observations for the occurrence of any migratory bird species or the presence of their breeding colonies; and
- Observations for sandy areas which may be potential Fitzroy River Turtle breeding habitat.

A more detailed description of the survey methods employed within each of the watercourses and for each of the targeted species, as directed by the relevant EPBC guidelines, is provided as part of the Aquatic Values Survey Report (Appendix I) and Addendum (Appendix V).

4.0 DESKTOP ASSESSMENT OF AQUATIC VALUES

4.1 Gas Collection Header Aquatic Values

The GCH is located within the Balonne-Condamine and Fitzroy Basins. The aquatic environment occurring within the vicinity of the GCH is limited to ephemeral watercourses including Wambo Creek (KPs 45.9 and 63.2), Dogwood Creek (KP112.7), Columboola Creek (KP 90.1) and the ephemeral section of the Condamine River (KP 68.6). The GCH does not transect the perennial section of any rivers or creeks.

The aquatic habitats along the GCH have the potential to support a range of aquatic species including riparian and aquatic vegetation, freshwater turtles, freshwater fish and macroinvertebrates. However few of the potentially occurring species have a status under the EPBC Act. A description of each of the potentially occurring MNES is provided in Section 4.4 and in detail within the attached Aquatic Values Survey Report (Appendix I).

4.2 Export Pipeline Aquatic Values

The EP is located within the Burnett, Fitzroy and Calliope Basins and traverses a number of sub-catchments including the Auburn, Dawson, Upper Burnett and Calliope. The EP traverses over 300 watercourses which are either ephemeral, or the crossing location occurs at an ephemeral section of the watercourse. These watercourses have the potential to support a range of aquatic species including riparian and aquatic vegetation, freshwater turtles, freshwater fish and macroinvertebrates. Again few of the potentially occurring species have a status under the EPBC Act. A description of each of the potentially occurring MNES is provided in Section 4.4 and in the Aquatic Values Survey Report (Appendix I).

A search of the Directory of Important Wetlands in Australia indicates that the only listed wetland to be intersected by the EP is adjacent to The Narrows marine crossing to Curtis Island and as such is not included in the scope of the Pipeline AVMP. The desktop assessment did not identify any other wetlands that would be intersected by the EP.

4.3 Potentially Occurring EPBC Listed Aquatic Flora Species within the Pipeline RoW

The only EPBC Act listed aquatic species identified in the vicinity of the EP is *Eriocaulon carsonii* subsp. *orientale* (Salt Pipewort). The preferred habitat of Salt Pipewort is artesian mound springs and associated bore drains. No such springs, drains or swamps are to be crossed by the Pipeline RoW so it is not anticipated that this species will be identified within the RoW.

In addition, the Pre-clearing Ecological Survey of the entire Pipeline RoW undertaken in 2010 did not identify any EPBC Act listed aquatic or riparian flora species as occurring in the vicinity of the Pipeline.

4.4 Potentially Occurring EPBC Listed Aquatic Fauna Species within the Pipeline RoW

The desktop review identified the following three EPBC Act listed aquatic fauna species as potentially occurring in the vicinity of the Pipeline RoW:

- Murray Cod (*Maccullochella peelii peelii*).
- Fitzroy River turtle (*Rheodytes leukops*)
- Boggomoss Snail (*Adclarkia dawsonensis*)

All three of these species were targeted in the surveys conducted in June 2011 and October 2011 with further details provided within the Aquatic Values Survey Report and Addendum (Appendix I and Appendix V). In addition Significant Species Management Plans have been developed for each of these species and are included at Appendix III.

The desktop review did not identify the Boggomoss Snail as a potentially occurring species within the study area however habitat typically supporting the species is traversed by the EP and GCH, therefore it was considered prudent to include the species within the AVMP.

The desktop assessment also included investigation of Queensland Lungfish, as the EP RoW will traverse part of the Burnett Basin which is within its known distribution. However, as detailed within the Aquatic Values Survey Report (Appendix I), the Queensland Lungfish was not targeted as part of the surveys as the watercourses being traversed by the EP within the Burnett River catchment did not accommodate sufficient flow or potential habitat that would be impacted by the Pipeline construction and operation.

A summary of the relevant details for each of the three targeted species that may potentially occur within the Study area is provided below:

4.4.1 Murray Cod

The Murray Cod (*Maccullochella peelii peelii*) is listed as Vulnerable under the EPBC Act. This species is widespread throughout the Murray-Darling system originally being found in virtually all waterways of that system, including some surprisingly small streams. In the Project area, it occurs in the Condamine River and connected smaller streams in large permanent or sometimes semi-permanent waterholes and weirs.

The Murray Cod has the potential to be impacted by the construction of water crossings if adequate mitigation measures are not implemented. For example erosion and sedimentation may cause pollution of downstream watercourses within the Condamine River catchment (Condamine-Balonne Basin) and impact the quality of available aquatic habitat. The known distribution of the Murray Cod within the Study area is identified within the Significant Species Management Plan for the Murray Cod (attached as Appendix III) and is restricted to the Condamine River catchment. The GCH traverses the known distribution of Murray Cod between KP 0 and approximately KP 150. The surveyed crossings within the potential distribution of Murray Cod along the GCH include Wambo Creek (two crossings), Condamine River, Columbula Creek, Dogwood Creek, L Tree Creek and Bottle Tree Creek. The EP traverses the known distribution of Murray Cod between KP 0 and approximately KP 20. There were no surveyed crossings within the known distribution of Murray Cod along the EP.

4.4.2 Fitzroy River Turtle

The Fitzroy River Turtle (*Rheodytes leukops*) is listed as Vulnerable under the EPBC Act and occurs in flowing rivers with large deep pools and rocky, gravelly or sandy substrates, connected by shallow riffles (Cogger et al., 1993; EPA, 2007; Latta & Latta 2005). Preferred areas have high water clarity and are often associated with Ribbonweed (*Vallisneria sp.*) beds (Cogger et al. 1993). The species has been found in the Fitzroy, Connors, Dawson, Isaac and Mackenzie Rivers, Windah Creek and Develin or Marlborough Creek (DERM 1996).

The known distribution of the Fitzroy River Turtle with respect to the Study area is identified within the Specific Species Management Plan for Fitzroy River Turtle (attached as Appendix III) and is restricted to the Dawson River catchment (Fitzroy Basin). The GCH traverses tributaries of the Dawson River between KP 150 and KP 195. This includes surveyed crossings at Juandah Creek and Wooleebee Creek. The EP traverses tributaries of the Dawson River between approximately KP 20 and KP 32, and then again between approximately KP 194 and KP 267. This includes surveyed crossings at Roche, Grevillia, Kariboe, Kroombit, Rainbow (2 crossings), Callide and Bell Creeks. There are a number of crossings within this area that could potentially contain habitat for Fitzroy River Turtle, however generally these tributaries are low order ephemeral streams.

4.4.3 Boggomoss Snail

The Boggomoss Snail (*Adclarkia dawsonensis*) is listed as Critically Endangered under the EPBC Act. Living populations of *Adclarkia dawsonensis* are currently documented from only two localities in the Greater Taroom area. One is situated adjacent to a boggomoss (artesian spring) on Mt Rose Station. A second and seemingly more robust population is present on a camping and water reserve on the Isla-Delusion crossing of the Dawson River approximately halfway between Taroom and Theodore (Stanisic 2008). Both of these populations are a considerable distance from the Pipeline RoW.

SunWater undertook snail surveys in 2010 to search previously unexamined locations within the vicinity of the proposed Nathan Dam, located on the Dawson River approximately 70 km downstream of Taroom. The surveys were successful and resulted in the discovery of an estimated 18,000 individuals.

Based on knowledge of the species' current distribution in the Taroom area the Boggomoss Snail appears to prefer grassy eucalypt woodland (Speck 1968) on alluvial flats along drainage lines (Stanisic 1996). Key habitat requirements for the Boggomoss Snail are a well-developed leaf litter layer for food, shelter and breeding sites, and a good coverage of vegetation to support the leaf litter environment and maintain a moist microclimate (Stanisic 2008). These areas are identified as Regional Ecosystems (REs) 11.3.3, 11.3.4 and 11.3.25. A map showing where these REs are located with respect to the Pipeline RoW is provided within the Significant Species Management Plan for Boggomoss Snail (attached as Appendix III).

4.5 Downstream Aquatic Values

There are several nationally significant wetlands located on the lower Balonne River system. These include the Narran Lake Nature Reserve (which includes Back and Clear Lakes), which is part of the large terminal wetlands of the Narran River at the end of the Condamine River system. The Narran Lake Nature Reserve is approximately 450 km south-west of the Gas Fields in New South Wales and therefore it is quite remote from the Pipeline RoW.

In addition to the Narran Lake Nature Reserve, there are two major wetlands within the Condamine catchment. These are the Lake Broadwater Conservation Park and Resources Reserve, 25 km south-west of Kogan, and The Gums Lagoon approximately 10 km west of KP 24 of the GCH.

Lake Broadwater is classified as a palustrine system with lacustrine wetlands on the outskirts and supports four wetland communities: open water, lake edge, marsh and riparian communities. The Gums Lagoon is classified as a palustrine system with a relatively undisturbed wooded swamp in a small reserve of similarly undisturbed woodlands and open forest (Australian Wetlands Database). The Gums Lagoon supports 79 identified species of birds, some of which come under the Japan-Australia Migratory Bird Agreement, China-Australia Migratory Bird Agreement and the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA). It is noted that both of the wetland areas are a significant distance downstream of the Pipeline RoW. It is not anticipated that construction or operation of the Pipeline will impact on either of the wetlands due to the significant separation distances. This will be further ensured through implementation of the management measures that are identified throughout this document.

The Dawson-Fitzroy River system flows towards the coast entering the Pacific Ocean in the Gladstone-Rockhampton region. The Ramsar wetland site at Shoalwater and Corio Bays is approximately 50 km north of the proposed EP alignment at its closest point. The EP does not traverse any of the catchments which feed directly into this or any other Ramsar site. The catchments which are traversed by the alignment feed water into the ocean at least 60 km to the south of this Ramsar wetland site.

5.0 AQUATIC VALUES SURVEY

The Aquatic Values Survey was undertaken by Unidel in June 2011 and October 2011. The Aquatic Values Survey Report and Addendum are attached as Appendix I and Appendix V. A summary of the key findings is included below.

5.1 Gas Collection Header

5.1.1 Minor Watercourse Crossing Survey

There are a total of 55 drainage features traversed by the GCH that are defined by the QCLNG Pipeline Project as Minor watercourses. None of these watercourses were identified during the desktop aquatic values assessment as having the potential to support any aquatic or riparian ecology values at the time of survey and were not included in the field assessment. Observations were made opportunistically at some of these Minor Crossings as part of the Aquatic Values Survey however, as anticipated, none of these features were found to be conveying water at this time.

5.1.2 Major Watercourse Crossing Survey

There are a total of 21 drainage features traversed by the GCH that are defined by the QCLNG Pipeline Project as Major watercourses.

Of the 21 Major watercourses identified as part of the desktop assessment, there were a total of nine watercourses that were conveying surface water, or had standing water occurring within the vicinity of the proposed RoW, at the time of the Aquatic Values Survey. Seven of these crossings were assessed as part of the Aquatic Values Survey in June 2011 and the remaining two watercourses, the Condamine River and Columbula Creek, were surveyed in October 2011. With the exception of the Condamine River (KP 68.6), none of the watercourses surveyed contained pools deeper than 2m and all had been significantly impacted by cattle grazing and/or the major flood event in December 2010. As a result much of the aquatic and riparian vegetation within the vicinity of the Pipeline RoW was either non-existent or of a poor quality. Additionally all of the watercourses were characterised by heavily turbid water with limited aquatic value.

No MNES or MNES breeding locations were identified at any of the surveyed crossings along the CGH. Juandah Creek (KP 154.6) was the only location where potential MNES breeding habitat was identified, for the Fitzroy River Turtle. However as Condition 35(a) stipulates that no construction works shall occur within the breeding season of this species at locations within its known distribution, the potential for impact to this species will be mitigated. No migratory birds or evidence of their breeding colonies were observed in either waterway or riparian vegetation.

The Aquatic Values Survey Report and Addendum (Appendix I and Appendix V) identifies the aquatic values at each of the nine crossings and provides recommendations for those aquatic values that should be retained where possible during Pipeline construction to minimise the potential impact to any MNES. These recommendations have been incorporated into the Aquatic Values Management Action Plan (AVMAP) at Table 2, and shall be implemented during the construction of watercourse crossings.

5.2 Export Pipeline

5.2.1 Minor Watercourse Crossing Survey

There are a total of 234 drainage features traversed by the EP that are defined by the QCLNG Pipeline Project as Minor watercourses. None of these watercourses were identified during the desktop aquatic values assessment as having the potential to support any aquatic or riparian ecology values at the time of survey and were not included in the field assessment. Observations were made opportunistically at some

of these Minor Crossings as part of the Aquatic Values Survey however, as anticipated, none of these features were found to be conveying water at this time.

5.2.2 Major Watercourse Crossing Survey

There are a total of 84 drainage features traversed by the EP that are defined by the QCLNG Pipeline Project as Major watercourses.

Of the 84 major watercourses identified as part of the desktop assessment, there were a total of 14 watercourses in the vicinity of the EP that at the time of the aquatic survey were conveying surface water, or had standing water present. All 14 of the crossings with flowing or ponding water were assessed as part of the Aquatic Values Survey. Two other Major crossings, Grevillia Creek and Kariboe Creek, were also surveyed but did not contain flowing or significant ponding water.

Overall as the pipeline moved north, water quality in the streams improved along with the quality of riparian vegetation and potential habitat. With the exception of Callide Creek (KP 241.3), all of the pools within the vicinity of the EP were generally no greater than 2m in depth. The only stream where native fish communities were observed outside of the Calliope River catchment was Fishy Creek, where Yellowbelly (*Macquaria ambigua*) and Spangled Perch (*Leiopotherapon unicolor*) were caught. Other aquatic fauna such as turtles, frogs, platypus and freshwater mussels were also observed in various parts of the EP. Unidentified small fish (no greater than 20cm in length) were observed at Larcom Creek, Calliope River and other tributaries of the Calliope River. One significant observation was the amount of water at the Callide Creek crossing. Due to the Callide Dam being at capacity it had backed-up into the section of Callide Creek that is to be traversed by the EP. It is unknown if the dam is likely to drain by the time construction commences at the site but the area currently accommodates a relatively good quality aquatic habitat. Sandy banks which may be potential breeding habitat for the Fitzroy River Turtle were also identified at this crossing location. Potential habitat for this species was also identified along the banks of Kroombit Creek at KP 230.

Additionally, *Gonocarpus Urceolatus*, was identified within close proximity to the stream banks at Rainbow Creek at KP 243.2 and KP 244.8. While this species is not an aquatic plant it is listed as 'Vulnerable' under the NC Act and DERM has granted QGC a Clearing Permit to allow for its removal.

As with the GCH, the survey did not identify any MNES or MNES breeding locations at any of the surveyed crossings along the EP and no migratory birds or evidence of their breeding colonies were observed in waterway or riparian vegetation. Callide Creek and Kroombit Creek were the only locations where potential MNES breeding habitat for the Fitzroy River Turtle was identified, however as Condition 35(a) stipulates that no construction works shall occur within the breeding season of this species at locations within the known distribution, the potential for impact to this species will be mitigated.

However it was identified that three of the watercourse crossings, Kroombit Creek, Callide Creek, and Harper Creek contained particularly good quality aquatic and riparian habitat which should be protected, or any impacts minimised, to the greatest extent possible. Those water crossings which contained particularly good aquatic habitat were generally characterised by significant pool and riffle areas and dense riparian vegetation that provided habitat in the form of snags and over-hanging vegetation.

The Aquatic Values Survey Report (Appendix I) identifies the aquatic values at each of the 14 crossings and provides recommendations for those values that should be retained where possible during Pipeline construction to minimise the potential impact to any MNES. These recommendations have been incorporated into the AVMAP (Table 2) and shall be implemented during the construction of watercourse crossings.

6.0 POTENTIAL IMPACTS TO AQUATIC VALUES

There are a range of potential impacts to aquatic values that may result from the construction of the Pipeline. There will be very minimal (if any) impacts to waterways associated with Pipeline operation.

Potential impacts to watercourses, particularly those which contain flowing or standing water at the time of construction, include the following:

- Direct impacts to aquatic fauna through physical disturbance from the construction process;
- Destruction of, or damage to, aquatic or riparian flora from the construction process;
- Impacts to the habitat of aquatic fauna, caused by the construction process disturbing aquatic plants and riparian trees and vegetation that encroach into the stream channel providing important fish habitat in the form of snags and overhangs;
- Impediment to fish passage if temporary waterway barriers are created during the construction process and inadequate provision is made for stream flow;
- A decline in water quality if machinery is used in creek beds with flowing water or there is an accidental release of oil or other chemicals into the watercourse;
- A decline in water quality through the accidental discharge of hydrotest water to a watercourse;
- A decline in water quality through sedimentation caused by physical disturbance to the bed and banks of the watercourse;
- Impacts on watercourse depths and hydrology through altered topography of low and high flow banks as well as alluvial terraces;
- Dispersion of weed species if vehicles are located within the stream environment and have not been subject to an appropriate 'washdown' after relocating from weed impacted areas; and
- Downstream erosion and sedimentation of watercourses if:
 - construction areas are not adequately protected through bunding or silt fencing;
 - watercourse banks are not reinstated and rehabilitated adequately or in an appropriate manner;
 - erosion of the RoW leads to surface water runoff into watercourses; or
 - a heavy rainfall event occurs during or immediately after construction and adequate mitigation measures are not in place.

7.0 MITIGATION OF POTENTIAL IMPACTS TO AQUATIC VALUES

The preservation of aquatic values is best achieved by avoidance of higher value sections of the water course and management of the timing of construction. Wherever possible the exact location of the watercourse crossings along the QCLNG Pipeline route will have been surveyed so as to avoid any higher quality aquatic areas. Flexibility in the timing of watercourse crossings to avoid construction during times of flow is optimal, however this is not always possible due to construction timeframes.

The choice of construction method will also contribute to the protection of aquatic values although all techniques have some degree of associated impacts. A number of issues are taken into consideration when selecting a construction method including a range of logistical and geotechnical considerations as well as potential environmental impacts.

The following sections provide an explanation as to how the potential construction impacts associated with Minor and Major watercourse crossings will be mitigated.

7.1 Minor Watercourse Crossings

All watercourse crossings along both the GCH and EP which are defined by the QCLNG Pipeline Project as being Minor crossings (refer Section 2.1), are ephemeral watercourses. Such crossings do not contain permanent flowing or standing water and in many instances take the form of very minor drainage depressions. Due to the ephemeral nature of these Minor watercourses and the absence of water at the crossing locations for the majority of the year, it is anticipated that construction will occur at most of these locations when there is no water present. However due to seasonal fluctuations in water levels it is possible that construction works may be undertaken when there is water present at Minor watercourse crossings.

Minor crossings were identified in the Aquatic Values Survey as unlikely habitat for aquatic or migratory MNES due to the lack of water. However, if these crossings are located within the potential distribution areas of the identified MNES, it is possible that these species may occur if increased water levels result in changes to the actual species distribution. To mitigate the potential for impacts to occur to these species under such circumstances, the following approach will be undertaken at Minor watercourse crossings within the potential distribution areas of the Murray Cod and the Fitzroy River Turtle, as defined in Sections 4.4.1 and 4.4.2:

- Wherever possible works will be scheduled so that they are undertaken when there is no flow at the crossing location;
- Prior to any works occurring Environmental Advisors will inspect the crossing and verify if there is any potential for the presence of the MNES, i.e. any flowing or standing water which has the potential to accommodate a Murray Cod or Fitzroy River Turtle. If required, additional verification will be provided by a SEWPaC approved ecologist via the use of photographs and/or a site inspection;
- If any flowing or standing water at the crossing point, or within a 20 metre buffer zone, is identified as potential MNES habitat, works will not be undertaken until the potential for impact to the MNES is either avoided through a natural reduction in the water level, or mitigated effectively. Mitigation will be through the development and implementation of a site specific crossing plan with associated management actions which enable protection of the MNES.
- If flowing or standing water which may be present at the crossing point, or within a 20 metres buffer zone, is identified as not being suitable MNES habitat, works will proceed in line with the general watercourse construction mitigation measures included in the AVMAP (Table 2) as well as the conditions of the DERM Pipeline Environmental Authorities.

Condition 36 of the Pipeline Approval states that *'Trenchless techniques are not required in minor creek beds within the known distribution of the Murray Cod and Fitzroy River Turtle where there is no water at the crossing site and the distance to the nearest water is sufficient to buffer any potential impacts resulting from the crossing technique'*.

Due to their ephemeral nature Minor watercourse crossings along the Pipeline have been identified as having limited potential for aquatic values specifically MNES and MNES habitat and breeding locations. Therefore it is considered appropriate for these crossings to be traversed via the open-cut trenching construction technique, with the implementation of mitigation measures detailed in the AVMAP (Table 2). At those watercourses within the potential distribution areas of the identified MNES, the measures outlined above will be adopted to ensure protection of the MNES at the times when there is water present.

7.2 Major Watercourse Crossings

All Major watercourse crossings along both the GCH and EP are ephemeral, with the crossings occurring at locations where there may be no permanent or standing water and correspondingly limited potential for aquatic values.

Only 25 of the Major watercourse crossings along both the GCH and Export Pipelines were identified in the Aquatic Values Survey (refer Appendix I), as being likely to contain flowing or standing water at the time of survey. 23 of these crossings were surveyed in June 2011 and the two crossings which were not included in this survey, the Condamine River (KP68.6) and Columboola Creek (KP 90.1), were surveyed in October 2011 (refer Appendix V).

As with the Minor watercourse crossings, it is anticipated that construction will occur at most of the Major watercourse crossings locations when there is no water present. However it is also understood that due to seasonal fluctuations in water levels it is possible that construction works may occur at crossings when there is water present.

With the exception of those 25 crossings surveyed, the majority of Major crossings were identified in the Aquatic Values Survey as unlikely habitat for aquatic or migratory MNES due to the lack of water. However, if these crossings are located within the potential distribution areas of the identified MNES, it is possible that these species may occur if increased water levels result in changes to the actual species distribution. To mitigate the potential for impacts to occur to these species under such circumstances, the following approach will be undertaken at Major watercourse crossings within the potential distribution areas of the Murray Cod and the Fitzroy River Turtle, as defined in Sections 4.4.1 and 4.4.2:

- Wherever possible works will be scheduled so that they are undertaken when there is no flow at the crossing location;
- Prior to any works occurring Environmental Advisors will inspect the crossing and verify if there is any potential for the presence of the MNES, i.e. any flowing or standing water which has the potential to accommodate a Murray Cod or Fitzroy River Turtle. If required, additional verification will be provided by a SEWPaC approved ecologist via the use of photographs and/or a site inspection;
- If any flowing or standing water at the crossing point, or within a 20 metre buffer zone, is identified as potential MNES habitat, works will not be undertaken until the potential for impact to the MNES is either avoided through a natural reduction in the water level, or mitigated effectively. Mitigation will be through the development and implementation of a site specific crossing plan with associated management actions which enable protection of the MNES.
- If flowing or standing water which may be present at the crossing point, or within a 20 metres buffer zone, is identified as not being suitable MNES habitat, works will proceed in line with the

general watercourse construction mitigation measures included in the AVMAP (Table 2) as well as the conditions of the DERM Pipeline Environmental Authorities.

Condition 35 of the Pipeline Approval states that, *'where reasonably possible HDD must be used for major waterway crossings within the Dawson, Calliope and Condamine River catchments and any water crossing within the known distribution of the Fitzroy River Turtle and Murray Cod'*. However, as noted in Section 2.1, the use of 'major waterway' above potentially differs from the QCLNG Pipeline Project's definition of a 'major watercourse'. While there is no definition of a 'major waterway' within the Pipeline Approval, it is anticipated that in Condition 35 a 'major waterway' alludes to a waterway that can be clearly distinguished from other smaller waterways and contains significant aquatic habitat values, including water flow. Subsequently, it is considered that those Major crossings which were not subject to aquatic ecology survey due to their lack of water and any aquatic habitat are unlikely to meet SEWPaC's expectation of a 'major waterway'.

In addition, it is considered that the aquatic ecology benefits, particularly to MNES and MNES habitat and breeding locations, associated with undertaking HDD at crossings with no flowing or standing water, are unlikely to be realised and the associated environmental impacts which may occur outside of the aquatic environment have the potential to be more significant than any advantage to potential MNES through undertaking HDD. Therefore, the Major watercourse crossings which were not surveyed due to the lack of potential for aquatic values at that time, will be traversed by open-cut trenching with the implementation of appropriate construction mitigation measures as defined in the AVMAP (Table 2). As with the Minor crossings, for those Major watercourses which could not be surveyed but are within the potential distribution areas of the identified MNES, the measures outlined in the bullet points above will be adopted to ensure protection of the MNES if there is water present at the crossing location at the time of construction.

Those Major watercourse crossings which were identified in the Aquatic Values Survey as containing flowing or ponded water with the potential to support aquatic values will be traversed either by open-cut trenching or HDD. While due consideration has been given to Condition 35, the selection of a crossing technique involves a number of parameters. The chosen method depends on the location of the crossing and any access limitations; the practicalities of employing HDD based on geotechnical investigations; the potential for associated environmental impacts outside of the aquatic environment; and whether or not the aquatic values identified at each crossing point are of a significant quality and can be protected via mitigation methods associated with the open-cut trenching technique.

As detailed in the Aquatic Values Survey Report and Addendum (Appendix I and Appendix V) and summarised at Table 1, the aquatic and riparian habitat at the majority of surveyed crossings was generally considered to be of poor or moderate quality. Overall the aquatic values throughout the EP were generally greater than those identified throughout the GCH, particularly toward the northern end of the RoW where water quality and the quality of the riparian vegetation improved. Only three of the 25 Major crossings surveyed were identified as having good quality habitat with aquatic and riparian values worth protecting where possible. These crossings were all towards the northern end of the EP and were: Kroombit Creek (KP 230); Callide Creek (KP 241.3); and Harper Creek (KP 288.8).

Of these three crossings, only Kroombit Creek and Callide Creek on the EP are within the potential distribution areas of any of the targeted MNES, namely the Fitzroy River Turtle. Although there were no MNES actually identified at these crossings, or indeed at any of the watercourse crossings throughout the entire Pipeline RoW, the good quality habitat of Kroombit Creek and Callide Creek may potentially accommodate Fitzroy River Turtle. While identified as having relatively good quality aquatic and riparian habitat, Harper Creek is outside the potential distribution of both the Murray Cod and Fitzroy River Turtle and is not located directly within any preferred REs of the Bogomoss Snail.

Aquatic survey of the Condamine River undertaken in October 2011 confirmed that this watercourse can accommodate relatively good, consistent flows and has associated moderate aquatic and riparian habitat values. Survey conducted at the Columboola Creek at the same time confirmed that this is a predominantly dry creek with limited potential habitat for MNES. In selection of the construction technique

for those 25 Major watercourse crossings which were identified as possibly containing water and for which Aquatic Values Surveys have been undertaken, consideration has been given to the overall quality of the aquatic and riparian habitat at the crossing location and specifically if any MNES, potential MNES habitat or MNES breeding locations have been identified.

As is the case for those Major crossings with no water present, for those crossings with poor or moderate quality habitat and unlikely potential for impact to MNES, it is also considered that the aquatic ecology benefits, particularly to MNES and MNES habitat and breeding locations, associated with undertaking HDD are unlikely to be realised. The associated environmental impacts which may occur outside of the aquatic environment have the potential to be more significant than any advantage to potential MNES through undertaking HDD. As such, these crossings will be crossed by the open-cut trenching technique, with the implementation of appropriate construction mitigation measures as defined in the AVMAP (Table 2). These crossings are identified in Table 1.

The two crossings, Kroombit Creek and Callide Creek which were identified as having good quality habitat and being within the potential distribution of the Fitzroy River Turtle have been subject to geotechnical investigation to determine if HDD is a practical construction technique at these locations.

These investigations have shown that both Callide Creek and Kroombit Creek, which is located approximately 10km south of Callide Creek, are not suitable for HDD due to the composition of the geotechnical subsurface materials at the crossing locations. Concerns relate to weak non-cohesive soil structure/s at lower elevations and considerable gravel and boulder inclusions which are relatively widespread in this particular region. Geotechnical boreholes identified significant amounts of gravel and cobbles to a depth of approximately 15 metres, indicating the potential for voids in the formation which may reduce the stability of the drill hole amongst other issues. HDD specialists have confirmed that undertaking HDD through this subsurface material would have a range of inherent risks such as tunnel collapse, 'frac out', or pipe failure caused by damage to the coating leading to accelerated corrosion over time. In addition, to enable the HDD pipe string to be installed in line with the necessary HDD profile there would be further impacts associated with the requirement for additional surface vegetation clearance.

Due to the issues associated with HDD it is necessary for these crossings to be transected by the open-cut trenching technique with the implementation of appropriate construction mitigation measures as defined in the AVMAP (Table 2). The AVMAP includes a range of measures to protect the Fitzroy River Turtle from the potential impacts of this technique, particularly the commitment to undertake no watercourse work during the breeding season. This will remove the risk of impact to the species occurring from disturbance to the sandy banks identified at this crossing as being potential breeding habitat. Reinstatement will be undertaken following pipeline construction to ensure that the crossing is returned to a state which preserves it as a potential breeding location for the Fitzroy River Turtle. Table 1 shows the approach to construction technique being taken at both Kroombit Creek and Callide Creek

Based on relatively high flows compared to surrounding watercourse and a range of advantages associated with HDD at such a location, the Condamine River will be crossed by the HDD technique as shown in Table 1. The location of the HDD exit and entry pads for this crossing will be a significant distance from the watercourse, with the northern pad being approximately 440 metres from the top of bank and the southern pad approximately 180 metres from the top of bank. As such there is very limited potential for any impact to the aquatic environment, however all applicable mitigation measures in the AVMAP (Table 2) will still be implemented. Aquatic ecology survey of the Condamine River undertaken in October 2011 (refer Appendix V), has provided an assessment of the aquatic values at this location in case the HDD is unsuccessful and an alternative crossing technique is required. While the presence of the Boggomoss Snail at this location is highly unlikely due to the distance from its current known distribution, it was intended to survey for this species due to the proximity of a preferred RE. However once site conditions were assessed, this survey was not undertaken due to the lack of available microhabitat resulting from the recent flooding and high disturbance of the area.

Additional aquatic ecology survey was undertaken in early October 2011 for the Columboola Creek on the CGH (refer Appendix V) to ascertain the aquatic ecology values at the watercourse crossing location and

enable a determination regarding if the HDD or open-cut crossing technique was most appropriate at this location. No MNES were identified in the survey and overall the assessment was of poor habitat quality for the targeted MNES at this location. Following the approach outlined in the approved revision 1 of this AVMP, whereby the open-cut crossing technique would be adopted at this location if no MNES were identified and the aquatic habitat was identified as being of poor or moderate quality, Columboola Creek will be crossed by the open-cut trenching technique. With the adoption of the mitigation measures specified in the AVMAP at Table 2 no adverse impacts to MNES species are anticipated from this construction technique.

The AVMAP (Table 2) details a range of management actions designed to minimise impacts to listed threatened species which shall be followed by the Construction Contractor when undertaking works within the banks of all Minor or Major watercourse crossings. These management actions are intended to form the basis for the construction documentation and shall be expanded on where relevant and incorporated into applicable construction method statements and procedures to ensure implementation and an appropriate level of direction on site.

As detailed in the AVMAP (Table 2), site specific watercourse crossing plans will also be developed prior to works in Major crossings which have been assessed as moderate to good habitat quality. These plans will incorporate site specific recommendations contained in the Aquatic Values Survey Report and Addendum (Appendix I and Appendix V) around retention of specific habitat features.

At present no MNES or breeding locations have been identified through aquatic ecology survey. If any MNES are identified prior to or during works, additional mitigation measures specific to that species and site will be implemented in accordance with the AVMAP (Table 2) and the species specific SSMPs contained at Appendix III, or for terrestrial species within the riparian zone the *QCLNG Pipeline Significant Species Management Plans* (SSMP) (QCLNG-BG00-ENV-RPT-000002). If any MNES breeding locations are identified they will be managed in accordance with the *QCLNG Pipeline Species Management Program – Tampering with the Breeding Place of a Protected Animal Species* (SMP) (QCLNG-BG00-ENV-RPT-000004).

As outlined in the Scope of this document, the AVMAP focuses on the mitigation of potential impacts associated with construction phase of Pipeline development, as any Pipeline operational impacts will be minimal and potential aquatic impacts associated with decommissioning have not been confirmed at this stage. Potential operational impacts will primarily be limited to maintenance activities associated with vegetation management (for example weed control) within the RoW. All necessary on-going maintenance activities in the aquatic or riparian zones will also be undertaken in accordance with the relevant measures described within the AVMAP at Table 2.

Table 1: Major Watercourse Crossings along the Pipeline RoW which have the potential for Aquatic Values

Watercourse Crossing	Location	Potential MNES	Water Present at Survey	Habitat Quality	Potential Impact to MNES	Construction Technique
Gas Collection Header						
Wambo Creek	KP 45.9	Murray Cod	Yes (ephemeral crossing)	Poor	Unlikely	Open-cut
Wambo Creek	KP 62.3	Murray Cod	Yes (ephemeral crossing)	Moderate	Unlikely	Open-cut
Condamine River	KP 68.6	Murray Cod / Boggomoss snail	Yes (ephemeral crossing)	Moderate	Unlikely with HDD technique	HDD
Columboola Creek	KP 90.1	Murray Cod/ Boggomoss snail	Yes (ephemeral crossing)	Poor	Unlikely.	Open-cut
Dogwood Creek	KP 112.7	Murray Cod / Boggomoss Snail	Yes (ephemeral crossing)	Moderate	Unlikely	Open-cut
L Tree Creek	KP 128.9	Murray Cod	Yes (ephemeral crossing)	Moderate	Unlikely	Open-cut
Bottle Tree Creek	KP 133.8	Murray Cod	Yes (ephemeral crossing)	Moderate	Unlikely	Open-cut
Juandah Creek	KP 154.6	Fitzroy River Turtle	Yes (ephemeral crossing)	Poor	Unlikely	Open-cut
Woleebee Creek	KP 183.2	Fitzroy River Turtle	Yes (ephemeral crossing)	Poor	Unlikely	Open-cut
Export Pipeline						
Roche Creek	KP 24.3	Murray Cod / Boggomoss Snail	Yes (ephemeral crossing)	Poor	Unlikely	Open-cut

Watercourse Crossing	Location	Potential MNES	Water Present at Survey	Habitat Quality	Potential Impact to MNES	Construction Technique
Fishy Creek	KP 73.4	None	Yes (ephemeral crossing)	Moderate	Unlikely	Open-cut
Auburn River	KP 99.1	Boggomoss Snail	Yes (ephemeral crossing)	Moderate	Unlikely	Open-cut
Grevillia Creek	KP 211.1	Fitzroy River Turtle / Boggomoss Snail	No	Poor	Unlikely	Open-cut
Kariboe Creek	KP 216.6	Fitzroy River Turtle / Boggomoss Snail	No	Poor	Unlikely	Open-cut
Kroombit Creek	KP 230.0	Fitzroy River Turtle / Boggomoss Snail	Yes (ephemeral crossing)	Good	Unlikely with specified mitigation measures	Open-cut – unsuitable for HDD
Callide Creek	KP 241.3	Fitzroy River Turtle / Boggomoss Snail	Yes (ephemeral crossing)	Good	Unlikely with specified mitigation measures	Open-cut – unsuitable for HDD
Rainbow Creek	KP 243.2	Fitzroy River Turtle	Yes (ephemeral crossing)	Moderate	Unlikely	Open-cut
Rainbow Creek	KP 244.8	Fitzroy River Turtle	Yes (ephemeral crossing)	Moderate	Unlikely	Open-cut
Bell Creek	KP 266.2	Fitzroy River Turtle	Yes (ephemeral crossing)	Moderate	Unlikely	Open-cut
Calliope River	KP 280.9	Boggomoss Snail	Yes (ephemeral crossing)	Moderate	Unlikely	Open-cut
Harper Creek	KP 288.8	Boggomoss Snail	Yes (ephemeral crossing)	Good	Unlikely with specified mitigation measures	Open-cut
Un-named major watercourse	KP 293.4	None	Yes (ephemeral crossing)	Poor	Unlikely	Open-cut
Alarm Creek	KP 296.9	Fitzroy River Turtle / Boggomoss Snail	Yes (ephemeral crossing)	Poor	Unlikely	Open-cut

Watercourse Crossing	Location	Potential MNES	Water Present at Survey	Habitat Quality	Potential Impact to MNES	Construction Technique
Un-named major watercourse	KP 304.2	None	Yes (ephemeral crossing)	Poor	Unlikely	Open-cut
Larcom Creek	KP 306.6	Boggomoss Snail	Yes (ephemeral crossing)	Poor	Unlikely	Open-cut

Table 2: Aquatic Values Management Action Plan

1. OBJECTIVES		
<ul style="list-style-type: none"> To minimise potential impacts on listed threatened species, including the Murray Cod (<i>Maccullochella peelii peelii</i>); Fitzroy River turtle (<i>Rheodytes leukops</i>) and the Boggomoss Snail (<i>Adclarkia dawsonensis</i>); To protect riparian and aquatic vegetation where possible to maintain and enhance the integrity of water resources and habitat; To protect nationally important wetland habitats within downstream waters; To minimise erosion and sediment impacts on waterways; and To maintain water quality and water flow requirements in all waters affected by construction activities. 		
2. MANAGEMENT ACTIONS	Responsibility	Timing
2.1. General		
<ul style="list-style-type: none"> The pipeline construction schedule shall wherever possible allow watercourse crossings to be constructed in drier months (e.g. April – October), to maximise the opportunity for major watercourse crossings to be constructed in no or low-flow conditions. In ephemeral minor watercourses works shall be undertaken at times of no flow. 	QCLNG Pipelines Planner	Prior to construction commences
<ul style="list-style-type: none"> All pipeline construction works within watercourses (defined as extending from edge of high bank to edge of high bank as per the AVMP definitions) shall be completed within a 10 day period unless otherwise authorised as per the Pipeline DERM Environmental Authorities. High 	Construction Superintendent Contractor –	Throughout construction

2. MANAGEMENT ACTIONS	Responsibility	Timing
<p>bank, also referred to as outer bank, is the highest point from the bed where there is scour marking or depositional material. Construction works include all activities from clearing through to backfilling and stabilisation.</p> <ul style="list-style-type: none"> Whenever it is identified that extensions of time beyond 10 days may be required to facilitate major bank reinstatement at any of the watercourses DERM will be consulted regarding potential for alternative arrangements. 	Environmental Manager	
<ul style="list-style-type: none"> Clearing and grading of the RoW will cease at the edge of high bank on either side of a watercourse. Clearing and grading within the watercourse, which includes the banks and slopes from the top of high bank to the bed, shall be delayed until pipe is ready to be installed. Thereby protecting the watercourse from damage associated with high flow events prior to the construction work. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> All equipment required for construction of a watercourse crossing will be on-site and in good working order prior to crossing works commencing to minimise potential impacts associated with prolonged periods of flow diversion. Pipe section/s shall be fabricated prior to trenching/HDD to enable rapid installation. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Project schedulers shall receive daily weather reports and subscribe to flood warning services to ensure work within watercourses is not commenced approaching times of potential flooding and adequate management measures can be taken for existing work areas. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> In the event of flooding within a watercourse construction area, the Project Emergency Response Plan shall be implemented. All personnel shall be aware of and have rehearsed emergency response measures in the event of flooding. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Watercourse crossings shall be subject to a visual inspection following significant rainfall or floods to ensure that environmental degradation has not occurred and there has been no damage to Pipeline infrastructure. In the event that environmental degradation has occurred, appropriate remediation shall be undertaken to restore the watercourse to a stable and self-sustaining state. 	Construction Superintendent	Throughout construction

2. MANAGEMENT ACTIONS	Responsibility	Timing
<ul style="list-style-type: none"> Mandatory induction and training packages for all site personnel shall include but will not be limited to: <ul style="list-style-type: none"> Background information on environmental values associated with watercourses, including but not limited to: the potential presence of specific fauna and flora particularly listed species; general aquatic and riparian habitat values; water quality; and areas of downstream significance. Detailed work methods to be followed by site operatives on how they will work in watercourses to minimise their impact on the watercourse and ensure the protection of environmental values; Weed hygiene and control protocols for operating within and adjacent to watercourses; Fuel and chemical handling procedures within and adjacent to watercourses; and Erosion and sediment control procedures within and adjacent to watercourses. 	Contractor – Environmental Manager	Prior to construction activities
<ul style="list-style-type: none"> Where it is not possible for HDD work areas to be contained within the Pipeline RoW, all additional areas will be subject to relevant EPBC and EA conditions for additional work spaces. 	Contractor – Environmental Manager	Throughout construction
2.2. Protection of Aquatic and Riparian Fauna		
<ul style="list-style-type: none"> Protection of aquatic and riparian fauna species, particularly EPBC listed species, and their habitat, will be achieved by implementation of the measures outlined in this management action plan as well as any relevant additional commitments contained in the following documents: <ul style="list-style-type: none"> Significant Species Management Plans (SSMPs) for the Fitzroy River Turtle, Murray Cod, Boggomoss Snail (refer Appendix III); QCLNG Pipeline Species Management Program – Tampering with the Breeding Place of a Protected Animal Species (SMP) (QCLNG-BG00-ENV-RPT-000004); Framework Environmental Management Plan GCH and EP (QCLNG-BG00-ENV-RPT-000007); 	Contractor – Environmental Manager Construction Superintendent	Throughout construction

2. MANAGEMENT ACTIONS	Responsibility	Timing
<ul style="list-style-type: none"> - Environmental Management Plan – GCH (QCLNG-BG00-ENV-PLN-000002, Rev 2); and - Environmental Management Plan – EP from Miles to MLV 7 (QCLNG-BG00-ENV-PLN-000003, Rev 3). 		
<ul style="list-style-type: none"> • Construction shall be undertaken outside of the breeding and nesting season of the Fitzroy River Turtle and Murray Cod for watercourses identified in the Aquatic Values Survey Report (refer Appendix I) as being potential habitat for these species. Particular care shall be taken at Callide Creek (KP 241.3) and Kroombit Creek (KP 230) along the EP and Juandah Creek (KP154.6) along the GCH where possible breeding locations have been identified. The breeding and nesting season is from the beginning of September to the end of October for the Fitzroy River Turtle and from mid-October to mid-December for the Murray Cod. 	Contractor – Environmental Manager Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> • Should a breeding location of any EPBC listed fauna be identified prior to or during construction activities, any relevant commitments identified in the <i>QCLNG Pipeline Species Management Program – Tampering with the Breeding Place of a Protected Animal Species (SMP)</i> (QCLNG-BG00-ENV-RPT-000004) shall be adhered to. These locations shall also be included on the Environmental Constraints Maps (ECMs) designed for site use. 	Contractor – Environmental Manager Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> • Identified high probability locations for potential occurrence of EPBC listed aquatic and riparian fauna species along the Pipeline RoW, particularly the Fitzroy River Turtle, Murray Cod or Boggomoss Snail, shall be included on ECMs designed for site use, to ensure Environmental Representatives are aware of these areas and can promote particular vigilance during construction. • Positive identifications of any EPBC listed aquatic and riparian fauna during construction of the Pipeline shall also be updated onto the ECMs as 'no go zones'. 	Contractor – Environmental Manager Contractor – Environmental Representative	Prior to and during construction
<ul style="list-style-type: none"> • For major watercourses where moderate and good quality values have been identified (refer Aquatic Values Survey Report at Appendix I) site specific watercourse crossing plans will be developed prior to works commencing at the watercourse. These plans shall in part identify the site specific aquatic values and riparian features, such as snags and large riverine trees and potential MNES breeding locations, which are recommended for protection at the watercourse 	Contractor – Environmental Manager Contractor Engineering	Prior to construction activities within specific watercourses

2. MANAGEMENT ACTIONS	Responsibility	Timing
<p>crossing and all associated mitigation measures.</p> <ul style="list-style-type: none"> Should any MNES or their breeding locations be identified at either a Major a Minor watercourse crossing prior to commencement of construction, a site specific watercourse crossing plan with associated management actions shall also be developed prior to works to identify how the MNES and any associated habitat features will be protected. 		
<ul style="list-style-type: none"> Prior to commencing works at any watercourse, the Construction Contractors Field Environmental Representatives will identify in situ the aquatic values and riparian features, such as snags and large riverine trees, which are recommended for protection within Sections 4 and 5 of the Aquatic Values Survey Report (refer Appendix I) and identified on the site specific watercourse crossing construction plans. These features shall be retained wherever possible and will be identified on site by appropriate high visibility tape or barricade webbing. 	<p>Contractor – Environmental Representative</p> <p>Construction Superintendent</p>	<p>Throughout construction</p>
<ul style="list-style-type: none"> Wherever practicable, signage shall be erected to increase the general awareness amongst work crews of any potential aquatic or riparian fauna species in the area, particularly the Fitzroy River Turtle or Murray Cod. 	<p>Contractor – Environmental Representative</p> <p>Construction Superintendent</p>	<p>Throughout construction</p>
<ul style="list-style-type: none"> Prior to commencing works in watercourses, a qualified fauna spotter/catcher shall survey and record any riparian and aquatic fauna species which are identified within the RoW crossing area. If it is considered practical and beneficial to relocate an individual they shall be moved to a location either upstream or downstream, which is sufficiently far away from the works and of suitable habitat type to afford appropriate protection to the animal as determined by the spotter/catcher. A qualified fauna spotter/catcher will also be on hand during the works in case further relocation of any individuals is required. 	<p>Contractor – Fauna Spotter/ Catcher</p>	<p>Throughout construction</p>
<ul style="list-style-type: none"> With the exception of identified pest fish species, any fauna stranded within trench pits or pools within the dry construction work area which is created within the watercourse, shall be managed appropriately and relocated to an aquatic environment outside of the work area. The same approach shall be taken for pools upstream and downstream that are impacted as a result of 	<p>Contractor – Environmental Representative</p> <p>Contractor</p>	<p>Throughout construction</p>

2. MANAGEMENT ACTIONS	Responsibility	Timing
<p>temporary flow disruption.</p> <ul style="list-style-type: none"> If stranded, the following pest fish species shall be euthanised and removed from the watercourse: Common Carp (<i>Cyprinus carpio</i>), Mozambique Mouth-brooder (<i>Oreochromis mossambicus</i>) and Mosquito Fish (<i>Gambusia holbrooki</i>). 	Fauna Spotter/ Catcher	
<ul style="list-style-type: none"> In accordance with DERM requirements as outlined in the SMP, a 30 metre buffer zone shall be left around any platypus den identified within or adjacent to the construction area. The ground within this area shall not be excavated or disturbed. If the den cannot be avoided by construction activities and it contains eggs or young these shall be removed and transported to a licensed wildlife carer. DERM will be notified immediately. 	Contractor – Environmental Representative Contractor Fauna Spotter/ Catcher	Throughout construction
<ul style="list-style-type: none"> All recorded sightings and relocations of EPBC or NC Act listed species shall be documented to enable appropriate reporting to DERM and SEWPaC and the calculation of any offsets which may be required for listed species. The documentation procedure shall be aligned with DERM reporting requirements. Consultation shall be undertaken with appropriate regulators regarding any offset requirements and details included in the QGC Offset Program. 	Contractor – Environmental Representative QCLNG Pipeline Environment Manager	Throughout construction
<ul style="list-style-type: none"> If an EPBC listed threatened fauna species, migratory species or ecological community is encountered during construction, work will cease at this location until a SSMP has been prepared for the species and approved by SEWPaC, or an approved SSMP has been updated with the new site specific details and the revised version approved by SEWPaC. 	QCLNG Pipeline Environment Manager	Throughout construction
<ul style="list-style-type: none"> Each watercourse crossing shall be assessed as 'Assessable Development' or 'Self-Assessable Development' with regard to DEEDI Waterway Barrier Works Approval. For all 'Assessable Developments', a development application detailing site specific construction methodology and the potential impacts to fish passage, shall be submitted to DEEDI for approval. 	Contractor – Environmental Manager	Throughout construction
<ul style="list-style-type: none"> To minimise impacts to fish passage any diversion of water flows during the watercourse construction works shall be undertaken for the minimal possible time. 	Construction Superintendent	Throughout construction

2. MANAGEMENT ACTIONS	Responsibility	Timing
2.3. Protection of Aquatic and Riparian Flora		
<ul style="list-style-type: none"> Protection of aquatic and riparian flora species, particularly EPBC listed species, will be achieved by implementation of the aquatic focused measures outlined in this management action plan as well as any relevant additional commitments in the following documents: <ul style="list-style-type: none"> QGLNG Pipeline Significant Species Management Plans (QCLNG-BG00-ENV-RPT-000002); Framework Environmental Management Plan GCH and EP (QCLNG-BG00-ENV-RPT-000007); Environmental Management Plan – GCH (QCLNG-BG00-ENV-PLN-000002, Rev 2); and Environmental Management Plan – EP from Miles to MLV 7 (QCLNG-BG00-ENV-PLN-000003, Rev 3). 	Contractor – Environmental Manager	Throughout construction
<ul style="list-style-type: none"> Any high probability locations for potential occurrence of EPBC listed aquatic or riparian flora which may be identified through future surveys conducted along the Pipeline RoW shall be included on the Environmental Constraints Maps designed for site use, to ensure Environmental Representatives are aware of these areas and can promote particular vigilance during construction. Positive identifications of any EPBC listed aquatic and riparian flora during construction of the Pipeline shall also be updated onto the ECMS as 'no go zones'. 	Contractor – Environmental Manager Contractor – Environmental Representative	Throughout construction
<ul style="list-style-type: none"> For major watercourses where moderate and good quality values have been identified (refer Aquatic Values Survey Report at Appendix I) site specific watercourse crossing construction plans will be developed prior to works commencing at the watercourse. These plans shall identify the site specific aquatic values and riparian features, such as snags and large riverine trees, which are recommended for protection at the watercourse crossing. Should any MNES be identified at a Major or Minor watercourse crossing prior to commencement of construction, a site specific watercourse crossing plan with associated management actions shall also be developed prior to works to identify how the MNES will be 	Contractor – Environmental Manager Construction Superintendent	Prior to construction within specific watercourses

2. MANAGEMENT ACTIONS	Responsibility	Timing
protected.		
<ul style="list-style-type: none"> Prior to commencing works at any watercourse, the Construction Contractors Environmental Representatives will identify in situ the aquatic values and riparian features, such as snags and large riverine trees, which are recommended for protection and identified on the site specific watercourse crossing construction plans. These features shall be retained wherever possible and will be identified on site by appropriate high visibility tape or barricade webbing. 	Contractor – Environmental Representative Construction Superintendent	Prior to construction within specific watercourses
<ul style="list-style-type: none"> Destruction of mature riparian trees shall be avoided wherever possible unless their presence compromises safe construction. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> No riparian vegetation shall be cleared for construction camps or additional work areas. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Clearing boundaries within all riparian RE shall be marked on Environmental Constraints Maps and protected on site by appropriate high visibility tape or barricade webbing. 	Contractor – Environmental Manager Contractor – Environmental Representative	Throughout construction
<ul style="list-style-type: none"> Snags and other such habitat features shall be retained within the watercourse wherever practicable. Any snags requiring removal for construction purposes shall be stored at a practical, nearby location for replacement as part of watercourse reinstatement and rehabilitation. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Wherever practicable, root stock shall be retained for stabilisation of the banks and aquatic habitat. 	Construction Superintendent	Throughout construction
2.4. Management of Pest and Weed Species		
<ul style="list-style-type: none"> Prior to accessing a watercourse all vehicles and construction machinery shall be declared 	Construction	Throughout

2. MANAGEMENT ACTIONS	Responsibility	Timing
weed, seed and mud free in accordance with recognised wash down standards.	Superintendent	construction
<ul style="list-style-type: none"> Any vehicle/construction equipment wash down areas which are required in the vicinity of watercourses shall be designed to ensure that no water will drain into the watercourse. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Rehabilitation of exposed banks and riparian zones shall be undertaken immediately following the engineering reinstatement to minimise potential for the establishment of weed species. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Control of weed species in the banks and riparian zone shall be undertaken by an appropriately licenced contractor under the Agricultural Chemicals Distribution Control Act 1966 (ACDC Act), in accordance with manual or chemical removal methods suited to the sensitivity of the receiving aquatic and riparian environment. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Any imported fill shall be sourced from a location verified to be clean from pest and weed species and be free from potential pollutants. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> If stranded, the following pest fish species shall be euthanised and removed from the watercourse: Common Carp (<i>Cyprinus carpio</i>), Mozambique Mouth-brooder (<i>Oreochromis mossambicus</i>) and Mosquito Fish (<i>Gambusia holbrooki</i>). 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Water from one catchment shall not be released into, or adjacent to, a watercourse in another catchment. Hydrostatic testing pipes shall contain inline filters to ensure any aquatic pests which may be contained in testing water are removed. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Unnecessary water traps associated with the construction works shall be removed from around the watercourse to prevent establishment of mosquito-breeding areas. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> All rubbish shall be removed daily from watercourse crossings during and post construction to avoid the attraction of pest species. 	Construction Superintendent	Throughout construction
2.5. Protection of Water Quality		
<ul style="list-style-type: none"> Routine monitoring shall be conducted during, and post, watercourse construction activities to ensure that water quality is maintained at levels consistent with the immediate upstream water 	Contractor – Environmental	Throughout construction

2. MANAGEMENT ACTIONS	Responsibility	Timing
quality.	Representative	
<ul style="list-style-type: none"> All hydraulic, fuel and lubricating systems of machinery used in the construction of watercourse crossings shall be in good repair to avoid water pollution occurring. Only specified equipment that has been proven to be without any oil or lubricant leakage will be used. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> All construction equipment shall be stored and maintained at least 100 metres from any watercourse at the end of each work day. Refuelling of vehicles and machinery shall not occur within 100 m of a watercourse unless a risk assessment has been undertaken and appropriate controls are implemented. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Hazardous waste shall be stored in lined, bunded areas at least 100 m from watercourses or flood plains. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> All construction activities shall be undertaken in a manner that minimises interference to the flow of water to downstream users (including the environment). 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Trench water shall not be discharged to either a wet or dry watercourse. On release, trench water shall be filtered through sedimentation filtration devices and discharged to an appropriately stabilised area which is at least 100 metres from any watercourse. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Any drainage and discharge structures which may be constructed during watercourse crossing construction works shall not alter the natural profile of the bed and bank. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Spill control equipment capable of managing the worst possible spill shall be present on site prior to commencing work in a watercourse and shall include booms installed around any hydrocarbon containing machinery. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> When surface water is present in the watercourse, diversion berms, pumps or flume pipes shall be used to divert water away from the construction area and ensure water flow is maintained to downstream areas and water uses. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Any hydrostatic test water released to the environment shall meet all requirements of relevant Environmental Authority conditions and shall occur at least 100 metres from the nearest 	Construction	Throughout

2. MANAGEMENT ACTIONS	Responsibility	Timing
<p>watercourse.</p> <ul style="list-style-type: none"> No water used for the purpose of hydrostatic testing and commissioning shall be discharged directly to a watercourse. 	Superintendent	construction
<ul style="list-style-type: none"> The very low risk of bentonite to be released into a watercourse through 'frac out' during HDD activities shall be mitigated by undertaking geotechnical survey prior to selection of the construction method to assure substrate soil conditions are of adequate strength. If 'frac out' occurs within a dry watercourse the works shall be stopped immediately and any escaped bentonite shall be left to dry out on the surface before removal and disposal. In the highly unlikely event that 'frac out' occurs within a watercourse which contains water, the water shall be immediately tested to ensure water quality levels do not exceed the levels immediately upstream of the construction area and HDD activities will cease at that location. An alternative construction process will be investigated and regulators consulted if impacts arising from any change in technique have potential for an increased impact to significant aquatic values. 	<p>Construction Superintendent</p> <p>Contractor – Environmental Representative</p>	Throughout construction
2.6. Erosion and Sediment Control		
<ul style="list-style-type: none"> To minimise impacts from water turbidity, construction activities shall be surrounded by erosion and sediment control measures which are appropriate for each individual situation and environment. If works are within a watercourse which contains water, the construction area shall be dammed off and water removed until the installation of pipe is complete. The dammed area shall then be gradually filled with water and allowed to settle prior to removal of the dam, to avoid water with high turbidity levels being released into the watercourse. During works, water shall be diverted around the dammed area to ensure a continual flow is maintained. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> All activities within and adjacent to watercourses including vegetation clearing, pre-stripping and stockpiling of topsoil, and trenching shall be in accordance with international standard construction techniques and work practices which minimise as much as possible the potential for soil erosion. 	Construction Superintendent	Throughout construction

2. MANAGEMENT ACTIONS	Responsibility	Timing
<ul style="list-style-type: none"> Gypsum shall be used to stabilise sodic subsoils on slopes approaching stream crossings. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Sandbags filled with a combination of sand and cement, stabilized earth or equivalent materials shall be installed to control erosion of the trench-line in sloping terrain adjacent to watercourses. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Routine, regular and frequent visual monitoring shall be undertaken during watercourse construction activities to ensure turbidity does not increase outside of the contained areas. Works shall cease immediately and sediment control measures will be rectified if any breach is detected. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> To minimise the potential for scouring, erosion and subsequent sedimentation of the watercourse, banks shall be restored to a stable and self sustaining state in accordance with the measures outlined in the following reinstatement and rehabilitation section. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Rock checks and berms shall be constructed in appropriate locations to minimise erosion of the outer bank areas and adjacent slopes of the RoW. 	Construction Superintendent	Throughout construction
2.7. Reinstatement and Rehabilitation		
<ul style="list-style-type: none"> Reinstatement and rehabilitation at a watercourse shall commence immediately following pipeline construction. Watercourse banks shall be restored as soon as possible after backfilling and prior to dismantling any flow diversion measures. Where possible, re-vegetation of disturbed areas shall be completed within two weeks of construction completion to ensure stabilisation of the soil surface. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> To minimise the potential for erosion and sedimentation, watercourse banks shall be restored to a stable and self sustaining state compatible with the strength of the site's soil type, by reinstalling the natural contours or the natural angle of repose of the stream bank material. They shall be smoothly contoured into adjoining undisturbed banks and shall not be returned to a slope which is steeper than the original condition prior to construction. 	Construction Superintendent	Throughout construction

2. MANAGEMENT ACTIONS	Responsibility	Timing
<ul style="list-style-type: none"> Specific bank protection measures such as rock protection, stabilised sandbags, Reno mattresses, Terramesh / Green Terramesh and gabions shall be installed where necessary to ensure successful reinstatement of the banks and minimise the potential for scouring and sedimentation of the watercourse. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Watercourse bed shall be left in a state which is stable, resistant to erosion and as near as practicable to the pre-construction profile to ensure smooth transitions to adjoining bed upstream and downstream. Obstructions resulting from construction of the pipeline shall be removed and disposed of. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Depending on the natural site conditions, a surface layer of cobbles, coarse gravel or rock may be placed over disturbed areas as rip-rap. Particular care shall be taken to ensure that the material is replaced on the river bed to a depth equivalent to the original conditions so that it is not likely to act as a barrier to the passage of aquatic fauna. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Any snags which were removed from a watercourse for replacement after construction shall be returned to the watercourse and placed in a manner which is sympathetic to the creation of fauna habitat and in accordance with any site specific crossing plans which were developed for sites with high quality aquatic values. Advice shall be sought from fauna specialists around placement location if required. 	Contractor – Environmental Representative Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Topsoil shall be re-spread over the area from which it was removed and seeding of areas of disturbance shall be undertaken in accordance with detailed rehabilitation requirements outlined in the Environmental Authorities and site specific rehabilitation plans. This shall include the use of locally sourced species and intensive planting to support bank stabilisation. Natural rehabilitation of aquatic and riparian vegetation shall be encouraged in the RoW area. Large trees are not permitted to grow within 5 metres either side of the Pipeline due to the 	Contractor – Environmental Representative Construction Superintendent	Throughout construction

2. MANAGEMENT ACTIONS	Responsibility	Timing
maintenance of Pipeline integrity.		
<ul style="list-style-type: none"> Erosion control berms, rock checks and sediment control fences shall be installed at strategic locations (e.g. on slopes, top and foot of the approaches to watercourses). During operation of the Pipeline, these areas will be reviewed during routine inspection and after heavy rain to ensure that they are still required and operating correctly. 	Construction Superintendent	Throughout construction

3. PERFORMANCE INDICATORS	Responsibility	Timing
<ul style="list-style-type: none"> Installation of drainage, erosion and sediment controls are to be commenced immediately after clear and grade activities within the banks of the watercourse. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> No accelerated erosion of the watercourse or release of contaminants shall occur as a result of watercourse construction activities. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> Water quality to be consistent with water quality immediately upstream of the construction area to ensure no project impacts. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> No direct impacts to watercourses outside the construction footprint. 	Construction Superintendent	Throughout construction
<ul style="list-style-type: none"> No impact to EPBC listed aquatic and riparian flora and fauna species and communities, including the Murray Cod, Fitzroy River Turtle and the Boggomoss Snail. 	Construction Superintendent Contractor – Environmental Manager	Throughout construction
<ul style="list-style-type: none"> Restoration and rehabilitation of watercourse completed such that watercourses are returned to a stable and self sustaining state, as close as possible to their original profiles. 	Construction Superintendent	Throughout construction

3. PERFORMANCE INDICATORS	Responsibility	Timing
<ul style="list-style-type: none"> Any necessary DERM and SEWPaC reporting undertaken in accordance with conditions of the Environmental Authorities and the Pipeline Approval. 	QCLNG Pipeline Environment Manager	Throughout construction

4. MONITORING	• Responsibility	• Timing
<ul style="list-style-type: none"> Daily monitoring of construction activities in watercourses containing water shall be undertaken for the duration of the construction works as appropriate. The nature of monitoring requirements will vary depending on whether the watercourse contains water at the time of the works. Monitoring shall include the following as applicable: <ul style="list-style-type: none"> Measurement of turbidity, suspended solids, pH and dissolved oxygen at the crossing location and upstream and downstream; Visual observations of sediment plumes and surface sheen; Checking for the use of inline filters as part of the hydrostatic testing process; Confirmation that release locations for trenching water and hydrostatic testing water are not into or adjacent to watercourses; Confirmation of appropriate weed control works adjacent to the watercourse; Checking of the integrity of sediment fences and diversion banks. 	<ul style="list-style-type: none"> Contractor – Environmental Manager Contractor – Environmental Representative QCLNG Pipeline Environmental Representative 	Daily
<ul style="list-style-type: none"> Post-construction monitoring shall be regularly undertaken to: <ul style="list-style-type: none"> ensure that the integrity of rehabilitation works and the stability of the watercourses is at least equal to the pre-construction condition; and check the status of revegetation in accordance with markers for successful rehabilitation to be defined in the site specific rehabilitation plans. Timing of post construction monitoring shall be specified in site specific rehabilitation plans. 	<ul style="list-style-type: none"> Contractor – Environmental Representative QCLNG Pipeline Environmental Representative 	

5. REPORTING	• Responsibility	• Timing
<ul style="list-style-type: none"> Any water quality, drainage, erosion and/or sedimentation issues shall be reported immediately to the Construction Superintendent as well as the Contractor Environmental Representative who shall advise the Contractor Environmental Manager. 	Construction Superintendent	Immediately
<ul style="list-style-type: none"> Contractor Environmental Manager to report to QGC any major incidents (any aquatic fauna deaths or unpermitted clearing of watercourse vegetation) within 12 hours of the occurrence verbally, and in writing with full information within 5 business days of the incident occurring to support notification by QGC to regulatory agencies (DERM and SEWPaC) within required timeframes 	Contractor Environmental Manager	At time of event
<ul style="list-style-type: none"> Any water quality results not in accordance with Environmental Authority Conditions shall be reported to QGC as soon as practicable to enable DERM reporting within required timeframes. 	Contractor Environmental Manager	At time of event
<ul style="list-style-type: none"> All recorded sightings and relocations of EPBC listed species, including the Murray Cod, Fitzroy River Turtle and Boggomoss Snail, will be reported to QGC as soon as practicable for forward reporting to DERM/SEWPaC as part of the Project reporting. 	Contractor Environmental Manager	At time of event
6. RECORD KEEPING	• Responsibility	• Timing
<ul style="list-style-type: none"> Survey data should be made available to state and federal environment departments to be included in fauna databases where appropriate. 	Contractor Environmental Manager	Throughout construction
<ul style="list-style-type: none"> Accurate records must be maintained, including measures taken to implement the AVMP. The records must be made available to SEWPaC or an independent auditor in accordance with Section 458 of the EPBC Act when required. 	Environmental Manager	Throughout Project

7. CORRECTIVE ACTIONS	• Responsibility	• Timing
<ul style="list-style-type: none"> In the event of erosion and sedimentation of watercourse crossings, corrective actions relating to water quality, drainage and sediment and erosion control should be implemented immediately. 	Construction Superintendent	At time of event
<ul style="list-style-type: none"> Any contamination of a watercourse as a result of waste or hazardous materials is to be rectified immediately in accordance with the Project specific management measures relating to waste and hazardous materials. 	Construction Superintendent	At time of event
<ul style="list-style-type: none"> Any damage or injury to watercourse vegetation and fauna species to be reported in accordance with the incident and emergency response reporting procedure. 	Construction Superintendent	At time of event
<ul style="list-style-type: none"> Should a threatened species such as the Murray Cod, Fitzroy River Turtle or the Boggomoss Snail or their habitat, be positively identified during Pipeline construction and it is determined the clearing of their habitat is unavoidable, corrective actions shall be implemented as per the relevant SSMP (Appendix III). 	Contractor Environmental Manager	In the event of impact to a threatened species

8.0 CONCLUSION

The QCLNG Pipeline alignment has been selected to avoid wetlands and, where possible, permanent and perennial water bodies.

An Aquatic Values Survey of selected Major watercourse crossings along both the GCH and EP components did not confirm the presence of any MNES along the entire Pipeline RoW. The majority of the surveyed watercourse crossings were found to be in a partially degraded state with only three of the 25 more significant crossings surveyed being identified as having good quality aquatic values. Based on the findings of the Aquatic Values Survey it is considered that the use of the HDD construction technique at the Condamine River crossing and the implementation of the management actions outlined in the AVMAP (Table 2) at all watercourse crossings will enable the successful mitigation of potential impacts to MNES and other aquatic values, both at the construction locations and downstream.

A checklist demonstrating how the QCLNG Pipeline complies with the Conditions 35 to 38 of the Pipeline Approval is attached as Appendix IV. No works shall commence in water crossings which have been assessed as potential habitat for MNES prior to the approval of this AVMP.

In accordance with the SEWPaC approved revision 1 of this AVMP, QGC have updated this document to incorporate recent findings of aquatic ecology surveys and geotechnical investigations and the confirmed construction technique for Columboola Creek at KP 90.1 on the GCH and Kroombit Creek at KP 230 on the EP, and are providing this AVMP revision 2 for SEWPaC's reference.

At the conclusion of construction of the QCLNG Pipeline this AVMP will be reviewed and any management actions which may be relevant to the operational component of the project will either be incorporated into the relevant operational aquatic management plan, or this document will be updated to reflect the operational practices and any associated mitigation measures for protection of aquatic values. Similarly, on decommissioning of the QCLNG Pipeline an appropriate management plan will be developed and implemented in accordance with the appropriate management techniques of that time, to ensure protection of the aquatic values along the Pipeline, specifically impacts to MNES and MNES habitat and breeding locations.

APPENDIX I – AQUATIC VALUES SURVEY REPORT

RTI DL RELEASE - EHP

QCLNG Project

Technical Report – Aquatic Values Survey Gas Collection Header and Export Pipeline

QGC020-ENV-RPT-0014

Rev 1

RTI DL RELEASE - EHP

Release authorisation

Originator	Joe Gray
Reviewed	Richard Floyd
Approved	Berlinda Ezzy

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1 Background

1.1 Scope

This report provides a summary of the aquatic ecology values found along the Gas Collection Header (GCH) and Export Pipeline (EP) components of the Queensland Curtis Liquefied Natural Gas Project (QCLNG), where the Pipeline Right of Way (RoW) intersects streams and aquatic ecosystems. The report focuses on Matters of National Environmental Significance (MNES), as protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), associated with aquatic ecosystems. It is based on the findings of a field aquatic ecology survey undertaken in June 2011 by Department of Sustainability, Environment, Water, Population and Communities' (SEWPaC) approved ecologist Richard Floyd (CV attached as **Appendix C**).

The Study area for this aquatic ecology survey spanned the linear 40 metre wide RoW, approximately 530km from Chinchilla to Port Curtis on the Central Queensland Coast. To ensure recognition of important habitats both upstream and downstream of the watercourse crossing points, observations were made within 50m of either side of each proposed crossing. The entire Study area is shown on the location map attached as **Appendix A**. The GCH is to be located from south east of Chinchilla to west of Miles, while the EP extends from north of Chinchilla to Port Curtis.

The majority of watercourses crossed by the RoW are minor ephemeral watercourses which only contain water during and immediately after rainfall events. A total of 25 watercourse crossings were identified through preliminary desktop assessment and field validation as being the only crossings along both the GCH and EP RoW which potentially contain flowing or standing water and may be capable of supporting any aquatic or riparian ecology values.

Two of the crossings that are known to contain flowing water, The Condamine River (KP 68.6) and Columbula Creek (KP 90.1), were not surveyed due to advice from QGC that it is likely these watercourse crossings will be crossed by drilling underneath with subsequent minimal potential impact to the watercourse. A total of 23 watercourse crossings were surveyed for this aquatic ecology survey with seven of these watercourse crossings being along the Gas Collection Header and 16 along the EP. The maps of the Study area included at **Appendix A** show the location of all 25 watercourse crossings.

1.2 Objectives

The purpose of the aquatic ecology survey, and the preparation of this report, is to identify the aquatic habitat values of those streams that are to be traversed by the GCH and EP RoWs (referred to as Pipeline RoW) and provide an assessment of the potential impacts to inform the Aquatic Values Management Plan (AVMP).

The overarching objective of the survey was to satisfy the SEWPaC Conditions relating to aquatic and riparian MNES as specified in EPBC Approval 2008/4399.

1.3 Abbreviations

In this document, the following abbreviations apply:

Term/Abbreviation	Meaning
AVMP	Aquatic Values Management Plan
DERM	Department of Environment and Resource Management
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
EP	Export Pipeline
GCH	Gas Collection Header
HDD	Horizontal Directional Drilling
MNES	Matters of National Environmental Significance
QCLNG	Queensland Curtis Liquefied Natural Gas
RE	Regional Ecosystem
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities

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The following documents are referenced in this report:

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2 Matters of National Environmental Significance

A preliminary desktop assessment was undertaken to determine which aquatic and riparian MNES species and communities may potentially occur within the Study area. This assessment consisted of a review of the following documents:

- Relevant published literature for the wider Study area;
- Department of Environment and Resource Management (DERM) Wildlife Online;
- Matters of National Environmental Significance (MNES) Online;
- Directory of Important Wetlands (Blackman *et al.* 1999);
- DERM's Biodiversity Planning Assessment which identifies ecological features and values of local, regional and state significance as recognised by the DERM and Queensland Museum; and
- DERM's remnant vegetation and essential habitat mapping.

Following the preliminary desktop assessment, four species were identified as worthy of further investigation: Murray Cod (*Maccullochella peelii peelii*), Fitzroy River Turtle (*Rheodytes leukops*), Queensland Lungfish (*Neoceratodus forsteri*) and Boggomoss Snail (*Adclarkia dawsonensis*).

The purpose of the desktop assessment was to confirm the potential presence of MNES aquatic species and determine where targeted field ecology surveys for the individual species would take place along the Pipeline RoW.

The findings of the desktop assessment are discussed below.

2.1 Species identified from Preliminary Desktop Assessment

2.1.1 Murray Cod

Habitat Preference

The Murray Cod (*Maccullochella peelii peelii*) is listed as Vulnerable under the EPBC Act.

The species occurs naturally in the waterways of the Murray Darling Basin in a wide range of warm water habitats from clear, rocky streams to slow-flowing turbid rivers and billabongs (McDowall 1996). Wood debris and overhanging banks are important for the species and sampling should focus on habitats for adults. Generally, the species is found in waters up to 5m deep and in sheltered areas with cover from rocks, timber or overhanging banks (Kearney & Kildea 2001). The species is highly dependent on wood debris for habitat, using it to shelter from fast flowing water (Koehn 1997).

Life Cycle and Range

Murray Cod migrate upstream prior to spawning when water temperatures increase, with spawning occurring around mid-October to mid-December (Humphries 2005; Koehn & Harrington 2005a; 2005b).

Spawning sites are usually sunken red gum logs or submerged rocks but occasionally Murray Cod will excavate and lay eggs in depressions in clay banks (Native Fish 2004). Hatching will generally occur 5-7 days after fertilisation, and a batch of eggs takes 3-4 days to hatch (Kearney & Kildea 2001). The species has relatively low fertility compared to many other freshwater fish (Native Fish 2004). The Murray Cod reaches sexual maturity at 4 to 5 years of age and at 2 to 3kg in weight.

Murray Cod are sedentary during late summer, autumn and winter (Koehn 1997), staying within their "territory" (Kearney & Kildea 2001), which they continually return to after each spawning (Koehn 1997). Migratory tendencies and distances travelled when migrating upstream prior to spawning vary considerably between individual fish but many travel 40 or 50km upstream, some travelling up to 120km upstream (Koehn 1997; Native Fish 2004).

Feeding

The diet of Murray Cod changes with age, with the typical adult diet consisting of spiny crayfish, yabbies and shrimps (National Murray Cod Recovery Team 2009). It also feeds on other fish species such as Bony Herring, Catfish, Golden Perch, Western Carp Gudgeon and other Cod species, as well as introduced species such as Common Carp, Goldfish and Redfin Perch. Other species found in their diet include ducks, cormorants, grebes, tortoises, water dragons, snakes, mice, frogs and mussels (Kearney & Kildea 2001; Native Fish 2004).

Potential distribution within the Study area

This species is widespread throughout the Murray-Darling system originally being found in virtually all waterways of that system, including some surprisingly small streams. In the Study area, it is known to occur in the Condamine River (Condamine Balonne Basin) and connected smaller streams, in large permanent or sometimes semi-permanent waterholes and weirs. The potential distribution of the Murray Cod within the Study area is identified within the Significant Species Management Plan for the Murray Cod (attached as Appendix 3 of the QCLNG Pipeline Aquatic Values Management Plan). The GCH traverses the known distribution of Murray Cod between KP 0 and approximately KP 150. The EP traverses the known distribution of Murray Cod between KP 0 and approximately KP 20.

2.1.2 Fitzroy River Turtle

Habitat Preference

The Fitzroy River turtle (*Rheodytes leukops*) is listed as Vulnerable under the EPBC Act.

The Fitzroy River Turtle occurs in flowing rivers with large deep pools and rocky, gravelly or sandy substrates, connected by shallow riffles (Cogger et al., 1993; EPA, 2007; Latta & Latta 2005). Preferred areas have high water clarity and are often associated with Ribbonweed (*Vallisneria sp.*) beds (Cogger et al. 1993). The species has been found in the Fitzroy, Connors, Dawson, Isaac and Mackenzie Rivers, Windah Creek and Develin or Marlborough Creek (DERM 1996).

Life Cycle and Range

Nesting occurs between September and October (Legler 1985). Nests are generally found on river sandbanks 1–4m above water level (Cann 1998; Cogger et al. 1993), however they have also been found up to 15m from water on flat sandbanks (Cann 1998). The home ranges for both sexes of this species overlaps in riffle zones, within a mean distance of 258–359m upstream and downstream of the riffle zone (Tucker et al. 2001).

The annual reproductive potential of females is 46–59 eggs laid in three to five clutches (SEWPaC 2011), with records indicating eggs incubated in natural nests can take up to 90 days to hatch (Legler 1985). The Fitzroy River Turtle can take 15–20 years to reach sexual maturity (Limpus 2007).

In Marlborough Creek it has been observed that activity is greatest during daylight hours, specifically the twilight hours, however in other locations it has been observed that the turtles are more active at night (Gordos et al. 2003a).

Feeding

This species forages on the river bottom (Cann 1998) consuming a variety of foods, such as Ribbonweed (*Vallisneria* sp.), freshwater sponge, aquatic insect larvae, algae, small snails, terrestrial insects and terrestrial plant material such as leaves and bark (Cann 1998; Tucker et al. 2001).

Potential distribution within the Study area

The Fitzroy River Turtle is only found in the drainage system of the Fitzroy River, Queensland (which includes the Dawson River catchment within the Fitzroy Basin), in an estimated total area of less than 10 000 km² (Cogger et al. 1993; McDonald et al. 1991). The GCH traverses tributaries of the Dawson River between KP 150 and KP 195. The EP traverses tributaries of the Dawson River between approximately KP 20 and KP 32, and then again approximately between KP 194 and KP 267. The potential distribution of the Fitzroy River Turtle with respect to the Study area is shown the location map within the Significant Species Management Plan for Fitzroy River Turtle (attached as Appendix 3 of the QCLNG Pipeline Aquatic Values Management Plan).

2.1.3 Queensland Lungfish

Habitat preference

The Queensland Lungfish (*Neoceratodus forsteri*) is listed as Vulnerable under the EPBC Act.

The Queensland Lungfish requires still or slow-flowing, shallow, vegetated pools with clear or turbid water in which to spawn and feed (Allen 1989a; Merrick & Schmida 1984). The species is restricted to areas of permanent water (Brooks & Kind 2002) and cannot live in saline waters or migrate through sea water (Arthington 2008).

Life Cycle and Range

The species is considered long-lived, with estimates of life spans from 50 to 100 years (Arthington 2008). In rivers with natural flows of water, the Queensland Lungfish is largely sedentary (Kind 2002). In adults, home ranges of both sexes overlap, and daily ranges are smaller in winter (Kind 2002).

The Queensland Lungfish spawns at night between August and December, with peak activity in late October (Brooks & Kind 2002). Breeding occurs at around 15 years of age in males and 20 years in females (Kind 2002) and breeding can be delayed or skipped if spawning habitat is disrupted (Kemp 1993). Eggs hatch after 30 days (Kemp 1981, 1986) and a clutch consists of between 50 and 100 eggs (Kemp 1986).

Feeding

Adult Queensland Lungfish forage mainly at night, eating both animal and plant matter on the bottom of the river. They also eat frogs, tadpoles, fishes, shrimps, prawns, earthworms, aquatic snails, bivalve molluscs (pelecypods) such as mussels, moss, fallen flowers from *Eucalyptus* trees and aquatic plants. Young Queensland Lungfish will feed on a variety of prey including insect larvae and crustaceans (Allen 1989a; Illidge 1884, as cited in Kind 2002; Joss & Joss 1995; Kemp 1986).

Potential distribution within the Study area

The Burnett River, east of the Great Dividing Range is the known habitat for Queensland Lungfish. The species was also introduced to the Condamine River, west of the Great Dividing Range in the late Nineteenth Century but this introduction failed (O'Connor 1897) as there is currently no evidence that the species occurs there (Johnson 2001).

The Queensland Lungfish is unlikely to be impacted upon by the Project. While the Pipeline RoW is located partly within the Upper Burnett River Catchment, these areas are at the western limit of the catchment at relatively high elevations. This being the case the watercourses traversed by the EP,

within the Burnett River catchment, will not impact any significant riffle or pool environments that are Queensland Lungfish habitat, so the Queensland Lungfish was not targeted as part of the surveys.

2.1.4 Boggomoss Snail

Habitat Preference

The Boggomoss Snail (*Adclarkia dawsonensis*) is listed as Critically Endangered under the EPBC Act.

Based on knowledge of the species' current distribution in the Taroom area the Boggomoss Snail appears to prefer grassy eucalypt woodland (Speck 1968) on alluvial flats along drainage lines (Stanisic 1996).

The snail is a free sealer as in it lies free in the litter or soil under logs, sealing its aperture with a calcified mucous covering called an epiphragm (analogous to the operculum of marine species) while it aestivates (hibernates) during very dry periods. The epiphragm offers protection from desiccation. In semi-arid and arid areas, snails aestivate through many months of dry while they await the return of the wet season.

The preferred habitat for the Boggomoss Snail is found within Regional Ecosystems (REs) 11.3.3, 11.3.4 and 11.3.25 described by Sattler and Williams (1999). These are described as forests and grassy woodland to open woodland of *Eucalyptus tereticornis*, *E. camaldulensis* and *E. coolabah* on Cainozoic alluvial plains. Closer to the drainage line, the same species occur with a distinct mid and lower storey of sandpaper figs and the 'Rare' Camavon fan palm *Livistona nitida*. This community is best described as RE 11.3.25.

Key habitat requirements for the Boggomoss Snail are a well-developed leaf litter layer for food, shelter and breeding sites, and a good coverage of vegetation to support the leaf litter environment and maintain a moist microclimate (Stanisic 2008).

Life Cycle and Range

It is suggested that the species has a lifespan of 10–20 years (Stanisic 2008) and is active at night to avoid the dry environment (BAAM 2009). Living populations of *Adclarkia dawsonensis* are currently known from only two localities in the Greater Taroom area. One is situated adjacent to a boggomoss (artesian spring) on Mt Rose Station while a second, possibly more robust population is present on a camping and water reserve on the Isla-Delusion crossing of the Dawson River approximately halfway between Taroom and Theodore. A third record of the species derives from a sub-adult dead shell found on the edges of Cockatoo Creek to the south of Taroom. The Study area for this assessment occurs in excess of 150km from these known populations.

Feeding

It is assumed that the Boggomoss Snail, like many other snails, feeds on decaying plant matter, bacteria and fungi (Bishop 1981, cited in Clarke & Spier-Ashcroft 2003).

Potential Distribution within the Study area

Living populations of the Boggomoss Snail are currently documented from only two localities in the Greater Taroom area. One is situated adjacent to a boggomoss (artesian spring) on Mt Rose Station. A second and seemingly more robust population is present on a camping and water reserve on the Isla-Delusion crossing of the Dawson River approximately halfway between Taroom and Theodore (Stanisic 2008).

The total destruction of its preferred habitat (riparian on alluvial flats in the Dawson River Valley) led to the suggestion that the Boggomoss Snail has undergone a severe reduction in numbers. In the past, it is suspected that the snail was much more widely spread on these flats (Stanisic 2008).

SunWater are proposing the construction of the Nathan Dam on the Dawson River 70km downstream of Taroom. In early 2009, the Boggomoss Snail population within the dam area was estimated at 850. SunWater undertook further snail surveys in 2010 to search previously unexamined locations. The surveys were successful and resulted in the discovery of an estimated 18,000 individuals.

These known populations occur in excess of 150km west of the Study area. While it is considered unlikely that this species will be present in the vicinity of the Pipeline RoW, surveys were still conducted at water crossings, particularly where there was dense riparian vegetation present within, or within close proximity to RE's 11.3.3, 11.3.4 and 11.3.25. A map showing the preferred RE's of the Boggomoss Snail with respect to the Pipeline RoW is contained within the Significant Species Management Plan for the Boggomoss Snail (attached as Appendix 3 of the QCLNG Pipeline Aquatic Values Management Plan).

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3 Survey Methodology

Ecology field surveys were undertaken on all watercourses intersecting the Pipeline RoW where there was permanent water flow or ponded water occurring. Dry watercourses were also assessed opportunistically.

As a result of the desktop assessment the following three aquatic MNES fauna species were targeted for ecology field surveys: the Murray Cod; Fitzroy River Turtle; and Boggomoss Snail.

In addition, observations were undertaken at all surveyed crossings for any migratory bird species, or the breeding colonies of such species which may be present within the waterway or associated with riparian vegetation.

The survey approach included an overall habitat assessment to identify supported species as well as specific habitat features and values. The surveys involved a general assessment of the aquatic habitat values of each watercourse with flowing water (or pools of standing water) within the vicinity of the Pipeline RoW. The general assessment involved identification of (for example) significant riparian vegetation, presence of snags and presence of over-hanging vegetation. Following the general assessment of the crossing, specific survey techniques in accordance with the relevant EPBC Act Survey Guidelines were employed in order to identify target species.

Surveys were undertaken during the daytime and included the following techniques:

- Visual assessment and documentation of typical habitat features within the vicinity of the RoW;
- Lure fishing for Murray Cod in streams with pools over 0.5m deep;
- Wading through riffle areas and pools in areas that were up to 1.5m deep. This included undertaking visual surveys of the streambed, stream banks and around woody debris;
- Snorkelling in pools that were greater than 1.5m deep;
- Hand searches along banks of drainage lines for Boggomoss Snail where there was dense riverine vegetation present;
- Observations (number and occurrence of breeding sites) of any migratory bird species present at each water crossing; and
- Searches for large sandy areas within which Fitzroy River Turtle could potentially breed.

A description of the specific survey methods employed for the 3 target MNES species, as directed by the relevant EPBC Act survey guidelines, is provided below.

3.1 Murray Cod

Surveys along the Pipeline RoW were undertaken during the optimum time for the Murray Cod. The *Survey Guidelines for Australia's Threatened Fish* notes that the preferred survey period for the Murray Cod is March to August and surveys should not be conducted in September to December.

The following active survey techniques are recommended for identifying Murray Cod by the *Survey Guidelines for Australia's Threatened Fish* and were employed during the field survey:

- Lure fishing using barbless hooks;
- Funnel netting to identify invertebrates that are part of Murray Cod diet;

- Wading through riffle areas and pools in areas that were up to 1.5m deep. This included undertaking visual surveys of the streambed, stream banks and around woody debris; and
- Daytime snorkelling.

It is noted that boat-based electrofishing is also recommended by the guidelines during the day in areas of low turbidity. To be effective, fish must be visible to be stunned. The electrocution zone is approximately 1m from the end of submersed electrode. To be effective, this technique requires the operator to see the fish and stun it quickly. If the water is turbid it is not possible for the operator to identify the fish in order to stun them. Should any fish be stunned in turbid water, it may not be possible to identify them as the stunned fish will not necessarily float or be found.

Electrofishing was not undertaken as part of the surveys due to the high turbidity of the creeks traversed by the Pipeline RoW within the Condamine River catchment.

The distribution of Murray Cod is limited to the Condamine River and its catchments within the Study area. However as part of the survey all of the crossings with pools with a depth greater than 1m were fished with lure's and wading surveys were undertaken to determine the presence of suitable micro-habitats.

In pools with a depth greater than 1.5m and where visibility permitted, daytime snorkelling was undertaken and potential habitat along stream banks beneath overhanging vegetation and snags were observed.

3.2 Fitzroy River Turtle

The *Survey Guidelines for Australia's Threatened Reptiles* note that the Fitzroy River Turtle is readily observed in the riffle zones by diving with a face mask and snorkel (Legler & Cann 1980), or collected by seine netting.

Callide Creek was the largest water crossing identified within the potential distribution of the Fitzroy River Turtle. Due to the uncharacteristic amount of water present at the time, only a habitat assessment was undertaken at this watercourse and no targeted surveys were carried out. In all other watercourses identified as being within the potential distribution of the Fitzroy River Turtle (as identified within the Significant Species Management Plan map (attached as Appendix III of the QCLNG Pipeline Aquatic Values Management Plan), the water was not deep enough to warrant snorkelling. Instead, visual inspections for Fitzroy River Turtle were undertaken within the riffle and pool areas within the vicinity of the Pipeline RoW.

Targeted searches were undertaken to determine if suitable breeding habitat was present within all streams surveyed within the range of this species. Nests are generally found on river sandbanks 1–4m above water level (Cogger et al. 1993), however they have also been found up to 15m from water on flat sandbanks. Therefore surveys for the breeding habitat of this species involved the identification of streams containing broad sandy banks where the species is able to excavate a hole and lay its eggs.

3.3 Boggomoss Snail

No survey guidelines are available for this species however hand searches and turning of fallen and decaying timber, or raking of other debris in dense riverine vegetation (grass) or semi-aquatic vegetation near springs, or other permanent water sources, have the potential to successfully recover dead shells or live individuals for identification (Stanisic 2008).

The known distribution of the Boggomoss Snail is outside of the Pipeline RoW, however in areas of the pipeline where there was dense riparian vegetation and specifically in areas within the vicinity of

RE's 11.3.3, 11.3.4 and 11.3.25, known as potential habitat, hand searching during wading and during targeted searches along banks was undertaken in accordance with the above description.

4 Habitat Assessment of GCH Watercourse Crossings

The following seven watercourse crossings were surveyed along the GCH:

- Wambo Creek at KP45.9 and KP63.2;
- Dogwood Creek at KP112.7;
- L Tree Creek at KP128.9
- Bottle Tree Creek at KP133.8;
- Juandah Creek at KP154.6; and
- Woleebee Creek at KP183.2.

These were all Major watercourse crossings as defined by the QCLNG Pipeline Project and at the time of survey contained either flowing or ponded water. A habitat assessment for each of the surveyed crossings is provided below and images of the crossings are provided within **Appendix B**.

4.1 Wambo Creek at KP 45.9

Wambo Creek at KP 45.9 along the GCH is a Major watercourse crossing. This crossing is within the Balonne-Condamine catchment and as such the Murray Cod was the MNES species being specifically targeted at this crossing. Boggomoss Snail was not targeted due to the lack of dense vegetation at the site and the site was not within close proximity to any of the preferred REs for Boggomoss Snail.

Survey Techniques

General observation of water quality (form, turbidity, colour, vegetation and flow) and habitat availability was undertaken for a period of 15 minutes prior to in stream activities.

Lure fishing was undertaken for a period of 30 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats.

Description

This section of Wambo Creek had a channel width of approximately 10-15m with a top of bank to water depth of approximately 3m. The largest pool within the vicinity of the RoW was approximately 5m long and 10m wide, and had a depth that ranged between 1-1.5m. Pools were separated by slow flowing riffles.

The riparian vegetation within the vicinity of the CGH had been heavily damaged by the December 2010 floods and as a result there were a number of uprooted trees and snags that were scattered throughout the streambed and along the banks. No overhanging vegetation was present along the banks of this stream due to this flood damage. No aquatic vegetation was present within this watercourse.

The water within the creek was slow moving and of a murky brown colour with high turbidity. Iron leachate was also notable within the pools of water present in the stream.

An image of the Wambo Creek crossing at KP45.9 is provided within **Appendix B** (Figure 1).

Notable Flora and Fauna

The banks and adjoining terrestrial vegetation was characterised by *Eucalyptus tereticornis*, *Callitris glaucophylla* and *Lomandra spp.* on the upper banks, along with other tall reed grasses. North and south of the crossing was characterised by disused pasture, regrowth vegetation and on-going and historical grazing.

The only evidence of the presence of aquatic species were the shells of freshwater mussel (*Velesunio ambiguous*) along the banks of the creek.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

Recommendations

Overall this water crossing was observed to be in poor condition, primarily as a result of flood damage. Sand banks were present together with fresh snags having been washed down stream due to the recent floods. This creek line is expected to provide limited aquatic habitat in its current scoured condition.

This creek line is expected to provide poor quality habitat. However, the following recommended mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- No construction activities should occur at this watercourse during the breeding season of the Murray Cod (from mid-October to mid-December);
- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible;
- Snags present within the watercourse should be removed and stored for later reinstatement; and
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line.

The proposed trenching of this creek line is not expected to result in any adverse impacts on MNES species.

4.2 Wambo Creek at KP 63.2

Wambo Creek at KP 63.2 along the GCH is a Major watercourse crossing. This crossing is within the Balonne-Condamine catchment and as such the Murray Cod was the MNES species being specifically targeted at this crossing. While the site was within close proximity to the preferred REs of Boggomoss Snail, the Boggomoss Snail was not targeted due to the lack of vegetation at the site.

Survey Techniques

General observation of water quality (form, turbidity, colour, vegetation and flow) and habitat availability was undertaken for a period of 15 minutes prior to in stream activities.

Lure fishing was undertaken for a period of 30 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats. Snorkelling of potential microhabitat features was then undertaken for a further 30 minutes.

Description

This section of Wambo Creek was similar in scale to that at KP 45.9, however the area appeared less impacted by floods and appeared to have more flow when compared to the previous Wambo Creek site. Iron leachate was also observed in the creek resulting in noticeable impacts upon water quality. The water had a similar level of turbidity as compared to the previous Wambo Creek site. The banks of the creek were characterised by rocky ironstone deposits. There were no aquatic plants observed.

A relatively deep pool (up to 2m) was located toward the western boundary of the Pipeline RoW. The streambed was characterised by muddy sand. There was also a large sand bank in the middle of the stream immediately east of the pool. The streambed on the eastern side of the RoW was generally characterised by a rocky bottom. No aquatic vegetation was present within this watercourse.

An image of the Wambo Creek crossing at KP 45.9 is provided within **Appendix B** (Figure 2).

Notable Flora and Fauna

The banks and adjoining terrestrial vegetation was characterised by *Eucalyptus tereticornis* and *Lomandra spp.* on the upper banks along with other tall reed grasses.

Improved pasture was identified to the north of the site and regrowth scrub to the south.

The only evidence of the presence of aquatic species were the shells of freshwater mussel (*Velesunio ambiguous*) along the banks of the creek.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

Recommendation

Overall this water crossing was observed to be of moderate condition. This condition is the result of adjacent grazing activities and the impacts associated with stream bank degradation by cattle. Sand banks were present together with fresh snags having recently been washed down stream due to the recent floods. This creek line is expected to provide limited aquatic habitat due to the impacts associated with cattle grazing.

This creek line is expected to provide poor quality habitat. However, the following recommended mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- No construction activities should occur at this watercourse during the breeding season of the Murray Cod (from mid-October to mid-December);
- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible;
- Where the banks cannot be reinstated to a stable and self sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion;
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line; and
- Snags present within the watercourse should be removed and stored for later reinstatement.

The proposed trenching of this creek line is not expected to result in any adverse impacts on MNES species provided the above mitigation measures are implemented.

4.3 Dogwood Creek at KP 112.7

Dogwood Creek at KP 112.7 along the GCH is a Major watercourse crossing. This crossing is within the Balonne-Condamine catchment and as such the Murray Cod was the MNES species being specifically targeted at this crossing. The site was also within relatively close proximity to preferred RE for Boggomoss Snail so the survey of the site included targeted searches for Boggomoss Snail.

Survey Techniques

General observation of water quality (form, turbidity, colour, vegetation and flow) and habitat availability was undertaken for a period of 15 minutes prior to in stream activities.

Lure fishing was undertaken for a period of 30 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats.

Four (4) funnel nets, baited with dog biscuits and a luminescent lure were left overnight within the creek line. Dogwood Creek was the only creek where funnel nets were used as, while relatively shallow, it did show the highest potential for Murray Cod habitat of all the watercourses surveyed.

A search of the drainage line banks was undertaken for Boggomoss Snail, involving wading survey, the turning and inspection of debris and litter, and searching the base of riparian vegetation. Because there was little vegetation present on the creek banks, the searches were limited to 15 minutes.

Description

The Dogwood Creek crossing consisted of a narrow channel approximately 5m in width. The banks of the creek were heavily incised which resulted in a slow moving stream approximately 1-2m in depth throughout the entire width of the pipeline RoW. There was a road causeway immediately east (downstream) of the RoW also. There was also evidence of flood damage upstream and downstream of the crossing site. Turbidity was high. There were no aquatic plants observed.

There were a number of large trees that lined the stream banks providing some shelter but there was limited overhanging vegetation. Cattle grazing had also resulted in some rill erosion along the steep banks of the stream.

An image of the Dogwood Creek crossing at KP 112.7 is provided within **Appendix B** (Figure 3).

Notable Flora and Fauna

The vegetation within the vicinity of Dogwood Creek was identified as *Eucalyptus tereticornis*, *Eucalyptus crebra*, *Eucalyptus intermedia*, *Angophora floribunda*, *Melaleuca bracteata* and *Lomandra longifolia*. While the immediate area was characterised by a noticeable canopy layer the understory had been heavily grazed.

Freshwater mussels (*Velesunio ambiguous*) shells were identified and bubbles in the stream were observed which may be attributable to either turtle or crustacean activity. Four freshwater shrimp (*Paratya australiensis*) were caught in the funnel nets which had been placed in the creek.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

Recommendation

Overall this water crossing was observed to be in moderate condition. This condition is the result of adjacent grazing activities, impacts from road crossings (sedimentation) and the impacts associated with stream bank degradation by cattle.

This creek line is expected to provide moderate quality habitat for aquatic species. The following mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- No construction activities should occur at this watercourse during the breeding season of the Murray Cod (from mid-October to mid-December);
- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible;
- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion;
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line; and
- Snags present within the watercourse should be removed and stored for later reinstatement.

The proposed trenching of this creek line is not expected to result in any adverse impacts on MNES species provided the above mitigation measures are implemented.

4.3 L Tree Creek at KP 128.9

L Tree Creek at KP 128.9 along the GCH is a Major watercourse crossing. This crossing is within the Balonne-Condamine catchment and as such the Murray Cod was the MNES species being specifically targeted at this crossing. Boggomoss Snail was not targeted due to the lack of dense vegetation at the site and the site was not within close proximity to any of the preferred REs for Boggomoss Snail.

Survey Techniques

General observation of water quality (form, turbidity, colour, vegetation and flow) and habitat availability was undertaken for a period of 15 minutes prior to in stream activities.

Lure fishing was undertaken for a period of 30 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats.

Description

The L Tree Creek crossing is located directly adjacent to an existing causeway. Flow was minimal however there was a large pool, approximately 20m long and 5-10m wide, that was located directly upstream (west) of the causeway. The pool was approximately 1.5m deep and had a sandy substrate with high turbidity. Further upstream, west of the alignment, was a rocky riffle area. No aquatic plants were apparent.

An image of the L Tree Creek crossing at KP 128.9 is provided within **Appendix B** (Figure 5).

Notable Flora and Fauna

The banks of the creek were primarily grass with some tea tree (*Leptospermum spp.*) overhanging. Other flora identified included *Eucalyptus tereticornis*, and *Corymbia spp.*

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

Recommendation

Overall this water crossing was observed to be of moderate condition. This condition is the result of adjacent grazing activities and the impacts associated with stream bank degradation by cattle and the operation of a causeway. This creek line is expected to provide limited aquatic habitat due to the impacts associated with cattle grazing. Habitat for Murray Cod is particularly constrained due to the lack of flow.

While this creek line is expected to provide limited quality habitat for aquatic species, the following mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible;
- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion;
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line; and
- Snags present within the watercourse should be removed and stored for later reinstatement.

The proposed trenching of this creek line is not expected to result in any adverse impacts on MNES species provided the above mitigation measures are implemented.

4.4 Bottle Tree Creek at KP 133.8

Bottle Tree Creek at KP 133.8 along the GCH is a Major watercourse crossing. This crossing is within the Balonne-Condamine catchment and as such the Murray Cod was the MNES species being specifically targeted at this crossing. Boggomoss Snail was not targeted due to the lack of dense vegetation at the site and the site was not within close proximity to any of the preferred REs for Boggomoss Snail.

Survey Techniques

General observation of water quality (form, turbidity, colour, vegetation and flow) and habitat availability was undertaken for a period of 15 minutes prior to in stream activities.

Lure fishing was undertaken for a period of 30 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats.

Description

The Bottle Tree Creek crossing at this location was characterised by an incised bank. Water flow was observed to be minimal. The stream banks and bed were characterised by rocky outcrops and a sandy bottom. There were no deep pools throughout the extent of the RoW and water quality appeared turbid. This creek line had a depth of between 0.2-0.3m. No aquatic plants were apparent.

There was evidence of cattle grazing at the site, and some erosion was apparent. An old farm track had also been formed within the RoW on the northern bank of the creek.

An image of the Bottle Tree Creek crossing at KP 133.8 is provided within **Appendix B** (Figure 4).

Notable Flora and Fauna

Eucalyptus tereticornis, *Corymbia intermedia*, *Angophora floribunda*, *Callitris glaucophylla*, *Xanthorrhoea* spp., *Leptospermum* spp. and *Lomandra longifolia* were identified within the vicinity. The area to the south was characterised as Heathland, and Eucalyptus woodland to the north.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

Recommendation

Overall this water crossing was observed to be of moderate condition. This condition is the result of adjacent grazing activities and the impacts associated with stream bank degradation by cattle. This creek line is expected to provide limited aquatic habitat due to the impacts associated with cattle grazing. Habitat for Murray Cod is particularly constrained due to the lack of flow.

While this creek line is expected to provide limited quality habitat for aquatic species, the following mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible;
- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion;
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line; and
- Snags present within the watercourse should be removed and stored for later reinstatement.

The proposed trenching of this creek line is not expected to result in any adverse impacts on MNES species provided the above mitigation measures are implemented.

4.6 Juandah Creek at KP 154.6

Juandah Creek at KP 154.6 along the GCH is a Major watercourse crossing. This crossing is within the Dawson River catchment and as such the Fitzroy River Turtle was the MNES species being specifically targeted at this crossing. While there are known to be preferred RE's for Boggomoss Snail within the vicinity of Juandah Creek, Boggomoss Snail was not targeted due to the lack of vegetation at the site.

Survey Techniques

General observation of water quality (form, turbidity, colour, vegetation and flow) and habitat availability was undertaken for a period of 15 minutes prior to in stream activities. There was extremely limited flow in the creek however riffle areas within the vicinity were visually inspected for Fitzroy River Turtle.

Lure fishing was undertaken for a period of 30 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats.

Description

The Juandah Creek crossing consisted of a large sandy channel, approximately 60m in width with a large sandbar in the centre. The flow channel was restricted to a small channel approximately 2m wide near the northern bank of the creek. The water was clear; however there was minimal surface flow (approximately 10cm deep) and no pools within the vicinity. No aquatic plants were apparent.

The surrounding area had been extensively cleared and cattle tracks were visible within the streambed. Searches were made for large sandy areas within which Fitzroy River Turtle could potentially breed.

An image of the Juandah Creek crossing at KP 154.6 is provided within **Appendix B** (Figure 6).

Notable Flora and Fauna

Eucalyptus tereticornis, *Eucalyptus melanophloia*, and *Angophora floribunda* were identified within the vicinity.

The sandy nature of the creek line, suggests there may be potential for the breeding habitat for the Fitzroy River Turtle to be present.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species were observed at this crossing.

Recommendation

Overall this water crossing was observed to be in poor condition. This condition is the result of adjacent grazing activities and the impacts associated with stream bank degradation. This creek line provides limited aquatic habitat due to the impacts associated with cattle grazing. Habitat for Fitzroy River Turtle is particularly constrained due to the lack of flow.

While this creek line provides limited quality habitat for aquatic species, the following mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- No construction activities should occur at this watercourse during the breeding season of the Fitzroy River Turtle (between September and October);
- Clearing of riparian vegetation and disturbance to the sandy banks adjacent to this watercourse should be minimised as much as possible;

- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion; and
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line.

The proposed trenching of this creek line is not expected to result in any adverse impacts on MNES species provided the above mitigation measures are implemented.

4.7 Woleebee Creek at KP 183.2

Woleebee Creek at KP 183.2 along the GCH is a Major watercourse crossing. This crossing is within the Dawson River catchment and as such the Fitzroy River Turtle was the MNES species being specifically targeted at this crossing. Boggomoss Snail was not targeted due to the lack of dense vegetation at the site and the site was not within close proximity to any of the preferred REs for Boggomoss Snail.

Survey Techniques

General observation of water quality, and habitat availability was undertaken for a period of 15 minutes prior to in stream activities. There was extremely limited flow in the creek however riffle areas within the vicinity were visually inspected for Fitzroy River Turtle. Searches were made for large sandy areas within which Fitzroy River Turtle could potentially breed.

Lure fishing was undertaken for a period of 30 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats.

Description

Woleebee Creek had a sandy substrate, limited flow and a relatively wide channel (approximately 20m). The western bank of the creek was steep where the main flow channel (approximately 10cm deep) adjoined. There was also a large exposed sandbar in the middle of the channel. No aquatic plants were apparent.

The area had also been extensively cleared to accommodate cattle grazing and was characterised as a Buffel grass floodplain.

An image of the Woleebee Creek crossing at KP 183.2 is provided within **Appendix B** (Figure 7).

Notable Flora and Fauna

Eucalyptus tereticornis and *Callitris glaucophylla* were present on the southern side of the creek.

Due to the high levels of disturbance associated with cattle grazing, it is unlikely that the Fitzroy River Turtle would breed in this location.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

Recommendation

Overall this water crossing was observed to be in a poor condition. This condition is the result of adjacent grazing activities and the impacts associated with stream bank degradation. This creek line

provides limited aquatic habitat due to the impacts associated with cattle grazing. Habitat for Fitzroy River Turtle is particularly constrained due to the lack of flow.

While this creek line provides limited quality habitat for aquatic species, the following mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible;
- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion;
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line; and

The proposed trenching of this creek line is not expected to result in any adverse impacts on MNES species provided the above mitigation measures are implemented.

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5 Habitat Assessment of EP Watercourse Crossings

The following 16 watercourse crossings were surveyed along the EP:

- Roche Creek at KP24.3;
- Fishy Creek at KP 73.4;
- Auburn River at KP 99.1;
- Grevillia Creek at KP 211.1;
- Kariboe Creek at KP 216.7;
- Kroombit Creek at KP 230.0;
- Callide Creek at KP 241.3;
- Rainbow Creek at KP 243.2;
- Rainbow Creek at KP 244.8;
- Bell Creek at KP 266.2;
- Calliope Creek at KP 280.9;
- Harper Creek at KP 288.8;
- Unnamed Drainage Channel at KP 293.4;
- Alarm Creek at KP 296.9;
- Un-named Drainage Channel KP 304.2; and
- Larcom Creek at KP 306.6.

The majority of these watercourse crossings were Major watercourse crossings as defined by the QCLNG Pipeline Project and at the time of survey contained either flowing or ponded water. Two unnamed minor watercourse crossings were also opportunistically assessed due to close proximity to other surveyed locations.

A habitat assessment for each of the surveyed crossings is provided below and images of the crossings are provided within **Appendix B**.

5.1 Roche Creek at KP 24.3

Roche Creek at KP 24.3 along the EP is a Major watercourse crossing. This crossing is within the Dawson River catchment and as such the Fitzroy River Turtle was the MNES species being specifically targeted at this crossing. The site was also within relatively close proximity to preferred RE for Boggomoss Snail and vegetation was present, so the survey of the site included targeted searches for Boggomoss Snail.

Survey Techniques

General observation of water quality (form, turbidity, colour, vegetation and flow) and habitat availability was undertaken for a period of 15 minutes prior to in stream activities.

Lure fishing was undertaken for a period of 30 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats. Observations during this time were also made for sandy areas within which Fitzroy River Turtle are known to breed.

A search of the drainage line banks was undertaken for Boggomoss Snail, involving wading survey, the turning and inspection of debris and litter, and searching the base of riparian vegetation. Because there was little vegetation present on the creek banks, the search was limited to 15 minutes.

Description

Roche Creek was dry apart from a shallow pool on the eastern side of the EP alignment, and other pools within the vicinity. The pool within the alignment was approximately 1-1.5m deep and had low turbidity, with visibility up to 30cm. Numerous snags were present. No aquatic plants were apparent.

Extensive clearing was evident on either side of the creek.

An image of the Roche Creek crossing at KP 24.3 is provided within **Appendix B** (Figure 8).

Notable Flora and Fauna

Eucalyptus tereticornis, *Eucalyptus viminalis*, *Eucalyptus populnea* and *Lomandra longifolia* were present within the vicinity of RoW.

A dead Green-thighed Frog (*Litoria brevipalmata*) was found in the pool and numerous yabbie (*Cherax destructor*) holes were present along the banks.

The rocky nature of the creek line, together with the high levels of disturbance from cattle suggests no breeding sites for Fitzroy River Turtle are likely to occur at this crossing location.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

Recommendation

Overall this water crossing was observed to be in poor condition. This condition is the result of adjacent grazing activities and the impacts associated with stream bank degradation. This creek line provides limited aquatic habitat due to the impacts associated with cattle grazing. Habitat for Fitzroy River Turtle is particularly constrained due to the lack of flow.

While this creek line provides limited quality habitat for aquatic species, the following mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible;
- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion;
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line; and
- Snags present within the watercourse should be removed and stored for later reinstatement.

The proposed trenching of this creek line is not expected to result in any adverse impacts on MNES species provided the above mitigation measures are implemented.

5.2 Fishy Creek at KP 73.4

Fishy Creek at KP 73.4 along the EP is a Major watercourse crossing. This crossing is outside of the known distribution of both the Murray Cod and the Fitzroy River Turtle. Boggomoss Snail was not targeted due to the lack of dense vegetation at the site and the site was not within close proximity to any of the preferred REs for Boggomoss Snail.

Survey Techniques

General observation of water quality (form, turbidity, colour, vegetation and flow) and habitat availability was undertaken for a period of 15 minutes prior to in stream activities.

Lure fishing was undertaken for a period of 60 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats. Snorkelling to observe potential microhabitat features was then undertaken for a further 30 minutes.

Description

The area of Fishy Creek traversed by the EP included a large pool on the eastern side of the alignment. The pool was between 5-10m wide, stretching approximately 60-70m to the east and had a depth that ranged between 1-2m. While there were limited snags present on the streambed, there were a number of trees and root systems on the bank of the creek that would provide good habitat for fish. The water quality was reasonably good (approximately 30cm visibility), of a higher quality to that observed throughout the GCH crossings. No aquatic plants were apparent.

A large dead tree (stag) is present to the east of the proposed alignment with fauna activity evident (i.e. presence of mammal scats).

Directly to the west (downstream) of the pool was a shallow riffle zone where the creek passed through a rocky area. While there were a number of large trees present directly adjoining the creek line, the land to the north and south had been extensively cleared for grazing.

An image of the Fishy Creek crossing at KP 73.4 is provided within **Appendix B** (Figure 9).

Notable Flora and Fauna

The trees directly adjoining the creek line included *Eucalyptus tereticornis*, *Melaleuca* spp., *E. crebra*, *Corymbia citriodora* and *Brachychiton populneum*.

Two fish were caught during the survey consisting of yellow-belly (*Macquaria ambigua*). Both fish were small, approximately 15-20cm in length. There were also two sightings of a platypus (*Ornithorhynchus anatinus*) and a small turtle was observed during the survey. This turtle did not match the description of the Fitzroy River Turtle and based upon the length of the neck, this species was identified as a Snake-necked Turtle (*Chelodina longicollis*).

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

Recommendation

Overall this water crossing was observed to be in moderate condition. This condition is the result of adjacent grazing activities and the impacts associated with stream bank degradation by cattle. This

creek line is expected to provide limited aquatic habitat at the crossing point due to the installation of rocky material associated with a vehicular crossing at this location.

While this creek line is expected to provide limited quality habitat for aquatic species, the following mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- Snags present within the watercourse should be removed and stored for later reinstatement;
- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible. The large dead tree (stag) adjacent to the proposed alignment should be retained and fenced from construction activities;
- Any in-stream activities should be restricted to the western boundary of the alignment where possible;
- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion; and
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line.

The proposed trenching of this creek line is not expected to result in any adverse impacts on MNES species provided the above mitigation measures are implemented.

5.3 Auburn River at KP 99.1

Auburn River at KP 99.1 along the EP is a Major watercourse crossing. This crossing is outside of the known distribution of both the Murray Cod and Fitzroy River Turtle. The site was within relatively close proximity to preferred RE for Boggomoss Snail and vegetation was present so the survey of the site included targeted searches for Boggomoss Snail.

Survey Techniques

General observation of water quality (form, turbidity, colour, vegetation and flow) and habitat availability was undertaken for a period of 15 minutes prior to in stream activities.

Lure fishing was undertaken for a period of 30 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats.

A search of the drainage line banks was undertaken for Boggomoss Snail, involving wading survey, the turning and inspection of debris and litter, and searching the base of riparian vegetation. Because there was little vegetation present on the creek banks, the searches were limited to 15 minutes.

Description

There was no visible flow within the Auburn River at the EP RoW crossing point. The water was turbid and a large pool was present that was approximately 1m deep and 6m wide. The water in the stream was turbid and the streambed was muddy. No aquatic plants were apparent.

There were shrubs on either side of the creek that provided overhangs and snags. The area north and south of the crossing had been extensively cleared for grazing and cattle were present in the area at the time.

An image of the Auburn River crossing at KP 133.8 is provided within **Appendix B** (Figure 10).

Notable flora and fauna

Eucalyptus tereticornis, *Angophora floribunda* and *Melaleuca* spp were present within the vicinity.

The only notable evidence of aquatic species observed was a Platypus slide on the stream bank.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

Recommendation

Overall this water crossing was observed to be in moderate condition. This condition is the result of adjacent grazing activities and the impacts associated with stream bank degradation by cattle. This creek line is expected to provide limited aquatic habitat due to the impacts associated with cattle grazing activities.

While this creek line is expected to provide limited quality habitat for aquatic species, the following mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible;
- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion;
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line; and
- Snags present within the watercourse should be removed and stored for later reinstatement.

The proposed trenching of this creek line is not expected to result in any adverse impacts on MNES species provided the above mitigation measures are implemented.

5.4 Grevillia Creek at KP 211.1

Grevillia Creek at KP 211.1 along the EP is a major watercourse crossing. This crossing is within the Dawson River catchment and as such the Fitzroy River Turtle was the MNES species being specifically targeted at this crossing. While the site is a considerable distance north of the known distribution of the Boggomoss Snail, riparian vegetation was present and the area was within relatively close proximity to preferred REs so as a precaution searches were undertaken for Boggomoss Snail.

Description

There was no water present within Grevillia Creek at the crossing point therefore no aquatic surveys were undertaken at this location. No aquatic species were present.

A search for suitable sandy breeding sites for Fitzroy River Turtle was undertaken, but the high levels of disturbance associated with cattle grazing at this location, suggests that breeding by this species is unlikely.

A search of the drainage line banks was undertaken for Boggomoss Snail, involving inspection of debris and litter, and searching the base of riparian vegetation. Because there was little vegetation present on the creek banks, the searches were limited to 15 minutes.

An image of Grevillia Creek at KP 211.1 is provided within **Appendix B** (Figure 11).

Notable Flora and Fauna

Eucalyptus tereticornis, *Melaleuca* spp were identified within the riparian margin of the creek.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

The proposed trenching of this creek line is not expected to result in any adverse impacts on MNES species.

5.5 Kariboe Creek at KP 216.7

Kariboe Creek at KP 216.7 along the EP is a major watercourse crossing. This crossing is within the Dawson River catchment and as such the Fitzroy River Turtle was the MNES species being specifically targeted at this crossing. While the site is a considerable distance north of the known distribution of the Boggomoss Snail, riparian vegetation was present and the area was within relatively close proximity to preferred REs so as a precaution searches were undertaken for Boggomoss Snail.

Description

There was no water present at Kariboe Creek apart from a muddy pool, approximately 0.5m deep. There was no potential for fish habitat within the pool so no aquatic surveys were undertaken at this crossing. Riparian vegetation was present but no aquatic species were observed. Observations were made for sandy areas within which Fitzroy River Turtle are known to breed.

A search of the drainage line banks was undertaken for Boggomoss Snail, involving inspection of debris and litter, and searching the base of riparian vegetation. This technique was employed for 15 minutes at this site.

Images of the crossing point are provided within **Appendix B** (Figure 12).

Notable Flora and Fauna

Eucalyptus tereticornis, *Melaleuca* spp were identified within the riparian margin of the creek.

Fitzroy River Turtle are unlikely to utilise this location for breeding purposes due to the high levels of disturbance from adjoining land uses including cattle production.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

The proposed trenching of this creek line is not expected to result in any adverse impacts on MNES species.

5.6 Kroombit Creek at KP 230.0

Kroombit Creek at KP 230.0 along the EP is a Major watercourse crossing. This crossing is within the Dawson River catchment and as such the Fitzroy River Turtle was the MNES species being specifically targeted at this crossing. While the site was not near REs preferable to Boggomoss Snail and the site is a considerable distance north of the known distribution of the snail, the riparian vegetation at the site was relatively dense so as a precaution searches were undertaken for Boggomoss Snail.

Survey Techniques

General observation of water quality (form, turbidity, colour, vegetation and flow) and habitat availability was undertaken for a period of 15 minutes prior to in stream activities. Observations were made for sandy areas within which Fitzroy River Turtle are known to breed.

Lure fishing was undertaken for a period of 60 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats.

A search of the drainage line banks was undertaken for Boggomoss Snail, involving wading survey, turning and inspection of debris and litter, and searching the base of riparian vegetation. This technique was employed for 15 minutes at this site.

Description

The section of Kroombit Creek within the vicinity of the EP RoW was characterised by a meandering creek, approximately 5m wide, with fast flowing pools (up to 2m deep) and shallow riffle areas. There was a large amount of overhanging vegetation adjoining the creek which had the potential to provide habitat for fish species. The water quality was reasonably good (approximately 40cm visibility) and there were several aquatic plants evident on the streambed. Aquatic vegetation was observed within the creek but the species was not identified.

The stream was located within a larger channel that comprised a relatively dense riparian margin. The riparian margin (approximately 5m either side of the main creek channel) was approximately 4-5m lower than the land to the north and south. The land to the north and south of the wider Kroombit Creek channel had been cleared and was being heavily grazed.

An image of the Kroombit Creek crossing at KP 230.0 is provided within **Appendix B** (Figure 13).

Notable Flora and Fauna

Eucalyptus tereticornis, *Melaleuca spp* were identified within the riparian margin of the creek.

The Fitzroy River Turtle has potential to utilise this area for breeding purposes due to the reasonably high quality of the habitats present.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species were observed.

Recommendation

Overall this water crossing was observed to be in good condition. This condition is the result of limited grazing activities. This creek line is expected to provide good quality aquatic habitat to a variety of aquatic species due to the diversity of microhabitat components present.

To ensure the long term sustainability of this creek line for aquatic species, the following mitigation measures are required:

- No construction activities should occur at this watercourse during the breeding season of the Fitzroy River Turtle (between September and October);
- Clearing of riparian vegetation and disturbance to any sandy banks adjacent to this watercourse should be minimised as much as possible;
- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion;
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line; and
- Snags present within the watercourse should be removed and stored for later reinstatement.

Trenching of this creek line has the potential to degrade the good aquatic values associated with this watercourse. All mitigation measures outlined above and as detailed in the AVMP must be implemented to ensure impacts do not occur to any potentially occurring MNES (primarily Fitzroy River Turtle) and their habitat.

5.7 Callide Creek at KP 241.3

Callide Creek at KP 241.3 along the EP is a Major watercourse crossing. This crossing is within the Dawson River catchment and as such the Fitzroy River Turtle was the MNES species being specifically targeted at this crossing. While the Boggomoss Snail's known distribution is a considerable distance north of the site, the preferred RE's of the Boggomoss Snail are within relatively close proximity so survey for this species was undertaken at this watercourse crossing.

Survey Techniques

Due to extensive flooding at the proposed crossing location it was only possible to undertake a visual assessment of this site. Observation of flow, water and habitat availability was undertaken for 15 minutes. Observations were made for sandy areas within which Fitzroy River Turtle are known to breed.

Description

The section of Callide Creek that was to be traversed by the EP RoW had been inundated due to the back up of water from the Callide Dam in January 2011. A visual assessment of the crossing was undertaken from the road and the area inundated would span a 500m (approximately) length of the EP alignment. The water appeared to be of good quality.

In the middle of the inundated area was a submerged tree and other individual trees were located throughout the inundated area. The trees provided potential habitat for fish species in the form of overhangs and snags.

An image of the Callide Creek crossing at KP 241.3 is provided within **Appendix B** (Figure 14).

Notable Flora and Fauna

Flora within the inundated area was dominated by *Eucalyptus tereticornis* and *Melaleuca* spp. *Eucalyptus crebra* was evident on the upper banks.

There is potential for the Fitzroy River Turtle to utilise the habitats associated with Callide Creek for breeding purposes due to the presence of large sandy banks along this water course.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species were observed based on the observations which could be undertaken.

Recommendation

Overall this water crossing was observed to be in good condition. This condition is the result of limited grazing activities. This creek line is expected to provide good quality aquatic habitat to a variety of aquatic species due to the diversity of microhabitat components present.

To ensure the long term sustainability of this creek line for aquatic species, the following mitigation measures are required:

- No construction activities should occur at this watercourse during the breeding season of the Fitzroy River Turtle (between September and October);
- Clearing of riparian vegetation and disturbance to any sandy banks adjacent to this watercourse to be minimised as much as possible;
- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion;
- Appropriate sedimentation and erosion controls to be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line; and
- Snags present within the watercourse to be removed and stored for later reinstatement.

The proposed trenching of this creek line has the potential to degrade the good aquatic values associated with this watercourse. All mitigation measures outlined above and as detailed in the AVMP must be implemented to ensure impacts do not occur to any potentially occurring MNES (primarily Fitzroy River Turtle) and their habitat.

5.8 Rainbow Creek at KP 243.2

Rainbow Creek at KP 243.2 along the EP is a Major watercourse crossing. This crossing is within the Dawson River catchment and as such the Fitzroy River Turtle was the MNES species being specifically targeted at this crossing. While the site was in relatively close proximity to preferred REs for Boggomoss Snail, Boggomoss Snail was not targeted due to the lack of dense vegetation at the site.

Survey Techniques

General observation of water quality (form, turbidity, colour, vegetation and flow) and habitat availability was undertaken for a period of 15 minutes prior to in stream activities. Observations were made for sandy areas within which Fitzroy River Turtle are known to breed.

Lure fishing was undertaken for a period of 60 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats.

Description

The creek had a relatively wide (approximately 40m) channel but limited flow was observed. There were two smaller channels that were separated by a rocky outcrop but only one of the channels was conveying water. The water was very clear and consisted of shallow pools (approximately 30cm deep) and small riffle areas. The only aquatic flora observed at the site was identified as Ribbon-weed (*Vallisneria spp.*).

The wider channel was located within relatively steep topography. The surrounding area was characterised as poor grazing land. There were some large trees within the wider channel and snags were present. There were a number of weeds and mixed grasses observed within the channel also.

An image of the Rainbow Creek crossing at KP 243.2 is provided within **Appendix B** (Figure 15).

Notable Flora and Fauna

Eucalyptus tereticornis, *Melaleuca spp.*, *Callistemon spp.*, *Leptospermum spp.*, and *Allocasuarina cunninghamiana* was observed within and adjoining the wider creek channel. *Gonocarpus urceolatus*, listed as a Vulnerable flora species under the Queensland Nature Conservation Act 1992, was also observed higher on the banks of the creek.

The Fitzroy River Turtle is unlikely to utilise this location for breeding purposes due to the steep banks and rocky nature of the creek line sub-straight and banks.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

Recommendation

Overall this water crossing was observed to be in moderate condition. This condition is the result of adjacent grazing activities and the impacts associated with stream bank degradation by cattle. This creek line is expected to provide limited aquatic habitat due to the impacts associated with cattle grazing activities.

While this creek line is expected to provide limited quality habitat for aquatic species, the following mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible;
- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion;
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line; and
- Snags present within the watercourse should be removed and stored for later reinstatement.

The proposed trenching of this creek line is not expected to result in any adverse impacts on MNES species provided the above mitigation measures are implemented.

5.9 Rainbow Creek at KP 244.8

Rainbow Creek at KP 244.8 along the EP is a Major watercourse crossing. This crossing is within the Dawson River catchment and as such the Fitzroy River Turtle was the MNES species being specifically targeted at this crossing. While the site was in relatively close proximity to preferred REs for Boggomoss Snail, Boggomoss Snail was not targeted due to the lack of dense vegetation at the site.

Survey Techniques

General observation of water quality (form, turbidity, colour, vegetation and flow) and habitat availability was undertaken for a period of 15 minutes prior to in stream activities. Observations were made for sandy areas within which Fitzroy River Turtle are known to breed.

Lure fishing was undertaken for a period of 30 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats.

Description

At the (upstream) point of Rainbow Creek was a shallow flowing creek-line with riffles and small shallow pools (approximately 20cm deep) and excellent visibility. No aquatic plants were apparent.

Vegetation in the area provided a number of overhangs and snags. The streambed was rocky with pebbles at the bottom of the small pools. There were also weeds and several grasses/shrubs present within the vicinity of the creek.

An image of the Rainbow Creek crossing at KP 244.8 is provided within **Appendix B** (Figure 16).

Notable Flora and Fauna

Eucalyptus tereticornis, *Melaleuca spp*, *Callistemon spp.*, *leptospermum spp.*, *Allocasuarina cunninghamiana* and *Lomandra longifolia* were present. A significant population of *Gonocarpus urceolatus*, a species listed as Vulnerable under the Queensland Nature Conservation Act 1992 was also identified adjacent to the creek.

The only aquatic species of note observed was a small population of exotic mosquito fish (*Gambusia affinis*) in one of the small pools.

The Fitzroy River Turtle is unlikely to utilise this location for breeding purposes due to the rocky sub-straight and banks and the high levels of disturbance associated with cattle grazing activities.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

Recommendation

Overall this water crossing was observed to be in moderate condition. This condition is the result of adjacent grazing activities and the impacts associated with stream bank degradation by cattle. This creek line is expected to provide limited aquatic habitat due to the impacts associated with cattle grazing activities.

While this creek line is expected to provide limited quality habitat for aquatic species, the following mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible;
- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion;
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line; and
- Snags present within the watercourse should be removed and stored for later reinstatement.

The proposed trenching of this creek line is not expected to result in any adverse impacts on MNES species provided the above mitigation measures are implemented.

5.10 Bell Creek at KP 266.2

Bell Creek at KP 266.2 along the EP is a Major watercourse crossing. This crossing is within the Dawson River catchment and as such the Fitzroy River Turtle was the MNES species being specifically targeted at this crossing. Although no preferred REs for Boggomoss Snail were known to be within the vicinity and the site is a considerable distance from their known distribution, the Boggomoss Snail was also targeted as a precaution due to the relatively dense riparian vegetation at the site.

Survey Techniques

General observation of water quality (form, turbidity, colour, vegetation and flow) and habitat availability was undertaken for a period of 15 minutes prior to in stream activities. Observations were made for sandy areas within which Fitzroy River Turtle are known to breed.

Lure fishing was undertaken for a period of 30 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats.

A search of the drainage line banks was undertaken for Boggomoss Snail, involving turning and inspection of debris and litter, and searching the base of riparian vegetation. This technique was employed for 15 minutes at this site.

Description

At this crossing location Bell Creek was a shallow flowing creek line with riffles and small shallow pools (approximately 20cm deep). The water was very clear. No aquatic plants were apparent.

Vegetation in the area provided a number of overhangs and snags. The streambed was rocky with pebbles at the bottom of the small pools. There were also weeds and several grasses/shrubs present within the vicinity of the creek.

Notable Flora and Fauna

Eucalyptus tereticornis, *Melaleuca* spp, *Callistemon* spp., *Leptospermum* spp., *Allocasuarina cunninghamiana* and *Lomandra longifolia* were present.

The Fitzroy River Turtle is unlikely to utilise this location for breeding purposes due to the high levels of cattle grazing activity.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

Recommendation

Overall this water crossing was observed to be in moderate condition. This condition is the result of adjacent grazing activities and impacts from the adjacent roadway. This creek line is expected to provide limited aquatic habitat due to the impacts associated with cattle grazing activities.

While this creek line is expected to provide limited quality habitat for aquatic species, the following mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible;
- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion;
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line; and
- Snags present within the watercourse should be removed and stored for later reinstatement.

The proposed trenching of this creek line is not expected to result in any adverse impacts on MNES species provided the above mitigation measures are implemented.

5.11 Calliope River at KP 280.9

Calliope Creek at KP 280.9 along the EP is a Major watercourse crossing. This crossing is within the Calliope River catchment and is therefore outside of the known distribution of both the Fitzroy River Turtle and Murray Cod. Boggomoss Snail was targeted as a precaution due to the relatively dense riparian vegetation present and RE's within close proximity to the site. While the site is outside of the known distribution of Fitzroy River Turtle, the species was also targeted as a precaution.

Survey Techniques

General observation of water quality (form, turbidity, colour, vegetation and flow) and habitat availability was undertaken for a period of 15 minutes prior to in stream activities. Despite being outside of the known distribution for the species, observations were also made for sandy areas within which Fitzroy River Turtle are known to breed.

Lure fishing was undertaken for a period of 30 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats.

A search of the drainage line banks was undertaken for Boggomoss Snail, involving turning and inspection of debris and litter, and searching the base of riparian vegetation. This technique was employed for 15 minutes at this site.

Description

The creek was characterised by a clear flowing channel, approximately 5m wide ranging from 30cm to 1m deep pools were present. Riffles were also present within the site. There was a large amount of overhanging vegetation adjoining the creek which had the potential to provide habitat for fish species. The water quality was good and there were water plants and large logs/snags evident on the streambed.

An image of the Calliope River crossing at KP 280.9 is provided within **Appendix B** (Figure 17).

Notable Flora and Fauna

Ficus spp, *Corymbia tessellaris*, *Melaleuca* spp and *Callistemon* spp. were identified within the riparian margin of the river.

A number of unidentified small fish were observed within the pool, the largest being approximately 20cm in length. No aquatic plants were apparent.

The Fitzroy River Turtle is unlikely to occur within the aquatic habitats present, as this species has not been recorded in the Calliope River catchment.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

Recommendation

Overall this water crossing was observed to be in moderate condition. This condition is the result of adjacent grazing activities and impacts from the adjacent roadway. This creek line is expected to provide limited aquatic habitat due to the impacts associated with cattle grazing activities.

While this creek line is expected to provide limited quality habitat for aquatic species, the following mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible;
- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion;
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line; and
- Snags present within the watercourse should be removed and stored for later reinstatement.

The proposed trenching of this creek line is not expected to result in any adverse impacts on MNES species provided the above mitigation measures are implemented.

5.12 Harper Creek at KP 288.8

Harper Creek at KP 288.8 along the EP is a Major watercourse crossing. This crossing is within the Calliope River catchment and therefore is outside of the known distribution of both the Fitzroy River Turtle and Murray Cod. Boggomoss Snail was targeted as a precaution due to the relatively dense riparian vegetation present and RE's within close proximity to the site. While the site is outside of the known distribution of Fitzroy River Turtle, the species was also targeted as a precaution.

Survey Techniques

General observation of water quality (form, turbidity, colour, vegetation and flow) and habitat availability was undertaken for a period of 15 minutes prior to in stream activities. Despite being outside of the known distribution for the species, observations were also made for sandy areas within which Fitzroy River Turtle are known to breed.

Lure fishing was undertaken for a period of 30 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats.

A search of the drainage line banks was undertaken for Boggomoss Snail, involving turning and inspection of debris and litter, and searching the base of riparian vegetation. This technique was employed for 15 minutes at this site.

Description

The creek was characterised by a clear flowing channel, approximately 15m wide and up to 2m deep. There was a large amount of overhanging vegetation adjoining the creek which had the potential to provide habitat for fish species. The water quality was good (approximately 1m visibility) and there were water plants and large logs/snags evident on the streambed.

The stream was located within a larger channel that comprised a relatively dense riparian margin. The riparian margin (approximately 5m either side of the main creek channel) was approximately 4-5m lower than the land to the north and south. The land to the north and south of the wider Harper Creek channel had been cleared and was being grazed to the south and there was a commercial gum plantation to the north.

An image of the Harper Creek crossing at KP 288.8 is provided within **Appendix B** (Figure 18).

Notable Flora and Fauna

Corymbia tessellaris, *Ficus opposita*, *Melaleuca* spp and *Callistemon* spp. were identified within the riparian margin of the creek.

A number of unidentified small fish were observed within the pool, the largest being approximately 20cm in length.

This creekline could provide breeding habitat for the Fitzroy River Turtle, however the species is unlikely to occur as it has not been recorded in the Calliope River catchment

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

Recommendation

Overall this water crossing was observed to be in good condition. This condition is the result of limited grazing activities. This creek line is expected to provide good quality aquatic habitat to a variety of aquatic species due to the diversity of microhabitat components present.

To ensure the long term sustainability of this creek line for aquatic species, the following mitigation measures are required:

- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible;
- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion;
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line; and
- Snags present within the watercourse should be removed and stored for later reinstatement.

The proposed trenching of this creek line has the potential to degrade the good aquatic values associated with this watercourse. All mitigation measures outlined above and as detailed in the AVMP must be implemented to ensure impacts do not occur to any potentially occurring MNES (primarily Fitzroy River Turtle) and their habitat.

5.13 Unnamed drainage channel at KP 293.4

This un-named drainage line at KP 293.4 along the EP is a major watercourse crossing. This crossing is within the Calliope River catchment and is therefore outside of the known distribution of both the Fitzroy River Turtle and Murray Cod. No aquatic MNES species were specifically targeted at this crossing due to the lack of habitat for Fitzroy River Turtle and Boggomoss Snail. However, general techniques were employed to sample the drainage line.

Survey Techniques

General observation of water quality (form, turbidity, colour, vegetation and flow) and habitat availability was undertaken for a period of 15 minutes prior to in stream activities.

Lure fishing was undertaken for a period of 30 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats.

Description

This unnamed watercourse had a flow of approximately 1 litre per second and was adjoined by a narrow strip of riparian vegetation with overhanging vegetation that may provide limited aquatic habitat. No aquatic plants were observed.

Notable Flora and Fauna

The riparian corridor consisted of *Melaleuca* spp. and *Callistemon* spp.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

Recommendation

Overall this water crossing was observed to be in poor condition. This condition is the result of extensive pastoral activities adjacent the drainage line. This creek line is expected to provide limited aquatic habitat in its current degraded condition.

This creek line is expected to provide poor quality habitat. However, the following recommended mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible;
- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion;
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line; and
- Snags present within the watercourse should be removed and stored for later reinstatement.

The proposed trenching of this drainage line is not expected to result in any adverse impacts on MNES species.

5.14 Alarm Creek at KP 296.9

Alarm Creek at KP 296.9 along the EP is a Major watercourse crossing. This crossing is within the Calliope River catchment and is therefore outside of the known distribution of both the Fitzroy River Turtle and Murray Cod. Boggomoss Snail was targeted as a precaution due to the relatively dense riparian vegetation present and preferred RE's within close proximity to the site. While the site is outside of the known distribution of Fitzroy River Turtle, the species was also targeted as a precaution.

Survey Techniques

General observation of water quality (form, turbidity, colour, vegetation and flow) and habitat availability was undertaken for a period of 15 minutes prior to in stream activities. Despite being outside of the known distribution for the species, observations were also made for sandy areas within which Fitzroy River Turtle are known to breed

Lure fishing was undertaken for a period of 30 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats.

A search of the drainage line banks was undertaken for Boggomoss Snail, involving wading survey, the turning and inspection of debris and litter, and searching the base of riparian vegetation. This technique was employed for 15 minutes at this site.

Description

The creek was characterised by a clear flowing channel, approximately 3m wide and pools up to 1m deep. Riffles were also present within the site. There was a large amount of overhanging vegetation adjoining the creek which had the potential to provide habitat for fish species. The water quality was good and there were water plants and large logs/snags evident on the streambed. There were no aquatic plants observed.

An image of the Alarm Creek crossing at KP 296.9 is provided within **Appendix B** (Figure 19).

Notable Flora and Fauna

Corymbia tessellaris, *Callistemon* spp., *Melaleuca* spp and *Allocasuarina cunninghamiana* were identified within the riparian margin of the river.

Two (2) small un-identified fish were observed within the pool.

The Fitzroy River Turtle may potentially utilise this location for breeding purposes due to the presence of riffle zones, however it is considered unlikely to be present as the species has not been recorded in the Calliope River Catchment.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

Recommendation

Overall this water crossing was observed to be in poor condition. This condition is the result of extensive pastoral activities adjacent the drainage line. This creek line is expected to provide limited aquatic habitat in its current degraded condition.

This creek line is expected to provide poor quality habitat. However, the following recommended mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible;
- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion;
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line; and
- Snags present within the watercourse should be removed and stored for later reinstatement.

The proposed trenching of this drainage line is not expected to result in any adverse impacts on MNES species.

5.15 Unnamed Tributary at KP 304.2

This un-named drainage line at KP 304.2 along the EP is a major watercourse crossing. This crossing is within the Calliope River catchment. No aquatic MNES species were specifically targeted at this crossing due to the lack of habitat for Murray Cod, Fitzroy River Turtle and Boggomoss Snail. However, general techniques were employed to sample the drainage line.

Survey Techniques

General observations of water quality, and habitat availability was undertaken for a period of 15 minutes prior to in stream activities.

Lure fishing was undertaken for a period of 30 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats.

Description

This stream crossing location appeared to be a man-made drain and waterhole. The waterhole was approximately 5m wide by 5m long and had a depth of up to 2m. The drain was not flowing with poor water quality. The surrounding area had been cleared for farming and there was no riparian margin. There were no aquatic plants observed.

An image of the Unnamed Creek crossing at KP 304.2 is provided within **Appendix B** (Figure 20).

Notable Flora and Fauna

The only tree within close proximity was a single Queensland Blue Gum.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

Recommendation

Overall this water crossing was observed to be in poor condition. This condition is the result of extensive pastoral activities adjacent the drainage line. This creek line is expected to provide limited aquatic habitat in its current degraded condition.

This creek line is expected to provide poor quality habitat. However, the following recommended mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible;
- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion;
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line; and
- Snags present within the watercourse should be removed and stored for later reinstatement.

The proposed trenching of this drainage line is not expected to result in any adverse impacts on MNES species.

5.16 Larcom Creek at KP 306.6

Larcom Creek at KP 306.9 along the EP is a Major watercourse crossing within the Calliope River catchment and is therefore outside of the known distribution of both the Fitzroy River Turtle and Murray Cod. While the site is outside of the known distribution of Fitzroy River Turtle, the species was targeted as a precaution. Boggomoss Snail was also targeted as a precaution due to the relatively dense riparian vegetation present and RE's within close proximity to the site.

Survey Techniques

General observation of water quality (form, turbidity, colour, vegetation and flow) and habitat availability was undertaken for a period of 15 minutes prior to in stream activities. Observations were made for sandy areas within which Fitzroy River Turtle are known to breed.

Lure fishing was undertaken for a period of 30 minutes within 50m of the centre line of the proposed pipeline crossing point. Wading surveys of this area were also undertaken for a period of 30 minutes to determine the extent of suitable microhabitats.

A search of the drainage line banks was undertaken for Boggomoss Snail, involving turning and inspection of debris and litter, and searching the base of riparian vegetation. This technique was employed for 15 minutes at each site.

Description

Larcom Creek was characterised as a fast-flowing creek with shallow pools and small riffle areas. Water in the pools was clear and ranged in depth between 0.3-1.0m. There was overhanging vegetation adjoining and within the creek which would provide habitat for fish species. Root systems that encroached into the streambed also provided habitat for small fish. There were no aquatic plants observed.

Apart from a thin strip of riparian vegetation, all of the land adjoining the creek had been cleared and was being grazed.

An image of the Larcom Creek crossing at KP 306.6 is provided within **Appendix B** (Figure 21).

Notable Flora and Fauna

Eucalyptus tereticornis, *Callistemon* spp. and *Allocasuarina cunninghamiana* were present.

A number of unidentified small fish (approximately 5cm in length) were observed near tree root systems that were located within the creek.

Fitzroy River Turtle was unlikely to utilise this area for breeding due to the high levels of cattle grazing adjacent to the creek line. Further to this, Larcom Creek occurs within the Calliope River catchment which is outside the known distribution of the Fitzroy River Turtle.

No migratory bird colonies or evidence of their occurrence was observed during the field survey.

No MNES species or potential MNES breeding locations were observed at this crossing.

Recommendation

Overall this water crossing was observed to be in poor condition. This condition is the result of extensive pastoral activities adjacent the drainage line. This creek line is expected to provide limited aquatic habitat in its current degraded condition.

This creek line is expected to provide poor quality habitat. However, the following recommended mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible;
- Where the banks cannot be reinstated to a stable and self-sustaining state through restoring the soil profile, appropriate armouring should be installed following trenching activities to ensure high flows do not result in erosion;

- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line; and
- Snags present within the watercourse should be removed and stored for later reinstatement.

The proposed trenching of this drainage line is not expected to result in any adverse impacts on MNES species.

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6 Potential Impacts to MNES

6.1 Murray Cod and Fitzroy River Turtle

Table 1 below presents the MNES significant impact criteria prepared by SEWPaC for the vulnerable species Murray Cod and Fitzroy River Turtle, and an assessment of the potential for a significant impact to occur as a result of Pipeline construction. An activity is considered likely to have a significant impact if there is a real chance or possibility that it will meet the criteria.

Table 1 Assessment of Potential Impacts on Murray Cod and Fitzroy River Turtle

MNES Impact Criteria	Comment
<p><i>There is a real chance or possibility to lead to a long-term decrease in the size of an important population of a species.</i></p> <p><i>An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:</i></p> <ul style="list-style-type: none"> <i>• Key source populations either for breeding or dispersal;</i> <i>• Populations that are necessary for maintaining genetic diversity; and/or</i> <i>• Populations that are near the limit of the species range.</i> 	<p>No Murray Cod were observed at any of the watercourse crossings during the aquatic ecology field survey.</p> <p>The Murray Cod may potentially occur at seven of the 25 watercourse crossings identified as possibly containing flowing or standing water. Of these crossings the Condamine and Columbula Rivers are the most likely potential habitats due to the water levels at these crossing locations. It is likely that these watercourses will be transected by HDD which passes under the watercourse. Therefore, any impacts to the most likely aquatic habitats of this species will be minimal.</p> <p>None of the surveyed tributaries of the Condamine River which may be potential habitat (Wambo, Dogwood, L Tree and Bottle Tree Creekss), contained sufficient water, or water quality, to be consistent with the preferred habitat of Murray Cod.</p> <p>However to ensure that any potential impacts to the Murray Cod and its habitat are minimised, a range of mitigation measures as identified within this document and the AVMP shall be implemented at all watercourse crossings.</p> <p>There are not expected to be any impacts to an important population of Murray Cod as a consequence of the proposed construction activities.</p>
	<p>No Fitzroy River Turtles were observed at any of the watercourse crossings during the aquatic ecology field survey.</p> <p>Although the majority of watercourses within the area of potential habitat for the Fitzroy River Turtle are dry and as such a standard open cut trenching technique is highly unlikely to have any impact on the species, eight surveyed crossings within the Dawson River Catchment (Juandah, Wooleebie, Grevillia, Kariboe, Kroombit, Callide, Rainbow and Bell Creeks) may still be considered as potential habitat.</p> <p>As such, mitigation measures as identified within this document and the AVMP shall be implemented at these watercourse crossings to minimise the potential for impact to the Fitzroy River Turtle and its habitat.</p> <p>In particular, at the two of the flowing creek lines, Kroombit Creek and Callide Creek, which are within the potential habitat area for the Fitzroy River Turtle and have been identified as having a higher quality of aquatic values with greater potential as habitat for significant species, construction techniques shall be utilised which eliminate or minimise impacts on important habitat</p>

MNES Impact Criteria	Comment
	<p>values.</p> <p>There are not expected to be any impacts to an important population of the Fitzroy River Turtle as a consequence of the proposed construction activities.</p>
<p><i>There is a real chance or possibility to reduce the area of occupancy of an important population.</i></p>	<p>No Murray Cod were identified as part of the aquatic surveys.</p> <p>The Murray Cod may potentially occur at seven of the 25 watercourse crossings identified as possibly containing flowing or standing water. Of these crossings the Condamine and Columbula Rivers are the most likely potential habitats due to the water levels at these crossing locations. It is likely that these watercourses will be transected by HDD which passes under the watercourse. Therefore, any impacts to the most likely aquatic habitats of this species will be minimal.</p> <p>None of the surveyed tributaries of the Condamine, which may be potential habitat (Wambo, Dogwood, Bottle Tree and L Tree Creeks), did not contain sufficient water, or water quality, to be consistent with the preferred habitat of Murray Cod.</p> <p>Mitigation measures identified in the AVMP will be implemented to further ensure that any potential impacts are minimised. Therefore, the proposed construction is not expected to reduce the area of occupancy of this species.</p> <p>No Fitzroy River Turtles were observed during the field survey.</p> <p>Although the majority of watercourses within the area of potential habitat for the Fitzroy River Turtle are dry and as such a standard open cut trenching technique is highly unlikely to have any impact on the species, eight surveyed crossings within the Dawson River Catchment may still be considered as potential habitat.</p> <p>Mitigation measures identified in the AVMP will be implemented to further ensure that any potential impacts are minimised. Therefore, the proposed construction is not expected to reduce the area of occupancy of this species.</p>
<p><i>There is a real chance or possibility to fragment an existing important population into two or more populations.</i></p>	<p>No Murray Cod were identified as part of the aquatic surveys.</p> <p>The Murray Cod may potentially occur at seven of the 25 watercourse crossings identified as possibly containing flowing or standing water. Of these crossings the Condamine and Columbula Rivers are the most likely potential habitats due to the water levels at these crossing locations. It is likely that these watercourses will be transected by HDD which passes under the watercourse. Therefore, any impacts to the most likely aquatic habitats of this species will be minimal.</p> <p>None of the surveyed tributaries of the Condamine, which may be potential habitat (Wambo, Dogwood, L Tree and Bottle Tree Creeks), did not contain sufficient water, or water quality, to be consistent with the preferred habitat of Murray Cod.</p> <p>Mitigation measures including clearing minimization, sedimentation and erosion control measures identified in the AVMP will be implemented to further ensure that any potential</p>

MNES Impact Criteria	Comment
	<p>impacts are minimised. It is therefore considered unlikely that the proposed works will fragment any existing populations of Murray Cod.</p> <p>No Fitzroy River Turtles were observed during the field survey.</p> <p>Although the majority of watercourses within the area of potential habitat for the Fitzroy River Turtle are dry and as such a standard open cut trenching technique is highly unlikely to have any impact on the species, the eight surveyed crossings within the Dawson River Catchment may still be considered as potential habitat.</p> <p>In particular, at the two of the flowing creek lines, Kroombit Creek and Callide Creek, which are within the potential habitat area for the Fitzroy River Turtle and have been identified as having a higher quality of aquatic values with greater potential as habitat for significant species, construction techniques shall be utilised which eliminate or minimise impacts on important habitat values.</p> <p>Mitigation measures identified in the AVMP will be implemented to further ensure that any potential impacts are minimised. It is therefore considered unlikely that the proposed works will fragment any existing populations of Fitzroy River Turtle.</p>
<p><i>There is a real chance or possibility to adversely affect habitat critical to the survival of a species.</i></p>	<p>No Murray Cod were identified as part of the aquatic surveys.</p> <p>The Murray Cod may potentially occur at seven of the 25 watercourse crossings identified as possibly containing flowing or standing water. Of these crossings the Condamine and Columbola Rivers are the most likely potential habitats due to the water levels at these crossing locations. It is likely that these watercourses will be transected by HDD which passes under the watercourse. Therefore, any impacts to the most likely aquatic habitats of this species will be minimal.</p> <p>None of the surveyed tributaries of the Condamine, which may be potential habitat (Wambo, Dogwood, L Tree and Bottle Tree Creeks), contained sufficient water, or water quality, to be consistent with the preferred habitat of Murray Cod.</p> <p>Mitigation measures identified in the AVMP will be implemented to further ensure that any impacts on the habitats critical to the survival of this species are minimised. On this basis the proposed construction techniques are not expected to adversely affect habitats critical to the survival of the Murray Cod.</p>

MNES Impact Criteria	Comment
	<p>No Fitzroy River Turtles were observed during the field survey.</p> <p>Although the majority of watercourses within the area of potential habitat for the Fitzroy River Turtle are dry and as such a standard open cut trenching technique is highly unlikely to have any impact on the species, the eight surveyed crossings within the Dawson River Catchment may still be considered as potential habitat.</p> <p>Mitigation measures identified in the AVMP will be implemented to further ensure that any potential impacts are minimised. On this basis, the proposed construction techniques are not expected to adversely affect habitats critical to the survival of Fitzroy River Turtle.</p>
<p><i>There is a real chance or possibility to disrupt the breeding cycle of an important population.</i></p>	<p>No Murray Cod were identified as part of the aquatic surveys.</p> <p>The Murray Cod may potentially occur at seven of the 25 watercourse crossings identified as possibly containing flowing or standing water. Of these crossings the Condamine and Columbula Rivers are the most likely potential habitats due to the water levels at these crossing locations. It is likely that these watercourses will be transected by HDD which passes under the watercourse. Therefore, any impacts to the most likely aquatic habitats of this species will be minimal.</p> <p>None of the surveyed tributaries of the Condamine which may be potential habitat (Wambo, Dogwood, L Tree and Bottle Tree Creeks), contained sufficient water, or water quality, to be consistent with the preferred habitat of Murray Cod.</p> <p>Mitigation measures identified in the AVMP will be implemented to further ensure that any potential impacts are minimised. It is not anticipated that the proposed construction techniques will result in any impacts upon the breeding cycles of the Murray Cod.</p> <p>No Fitzroy River Turtles were observed during the field survey. Only three of the surveyed crossings, Callide Creek at KP 241.3, Kroombit Creek at KP 230 of the EP and Juandah Creek at KP 154.6 on the GCH contain habitat which may be a potential breeding location for this species.</p> <p>Although the majority of watercourses within the area of potential habitat for the Fitzroy River Turtle are dry and as such a standard open cut trenching technique is highly unlikely to have any impact on the species, the eight surveyed crossings within the Dawson River Catchment may still be considered as potential habitat.</p> <p>Mitigation measures identified in the AVMP will be implemented to ensure that any potential impacts are minimised. The key mitigation measure is to ensure that works are not undertaken during the breeding season at these eight locations and specifically Callide Creek, Kroombit Creek and Juandah Creek. Given the adoption of the defined mitigation measures it is not anticipated that the proposed construction techniques will result in any impacts upon the breeding cycles of Fitzroy River Turtle.</p>

MNES Impact Criteria	Comment
<p><i>There is a real chance or possibility to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</i></p>	<p>No Murray Cod were identified as part of the aquatic surveys.</p> <p>The Murray Cod may potentially occur at seven of the 25 watercourse crossings identified as possibly containing flowing or standing water. Of these crossings the Condamine and Columbula Rivers are the most likely potential habitats due to the water levels at these crossing locations. It is likely that these watercourses will be transected by HDD which passes under the watercourse. Therefore, any impacts to the most likely aquatic habitats of this species will be minimal.</p> <p>None of the surveyed tributaries of the Condamine which may be potential habitat (Wambo, Dogwood, L Tree and Bottle Tree Creeks), contained sufficient water, or water quality, to be consistent with the preferred habitat of Murray Cod.</p> <p>Mitigation measures identified in the AVMP will be implemented to further ensure that any potential impacts are minimised. The proposed construction techniques to be implemented are not expected to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p>No Fitzroy River Turtles were observed during the field survey.</p> <p>Although the majority of watercourses within the area of potential habitat for the Fitzroy River Turtle are dry and as such a standard open cut trenching technique is highly unlikely to have any impact on the species, the eight surveyed crossings within the Dawson River Catchment may still be considered as potential habitat.</p> <p>Mitigation measures identified in the AVMP will be implemented to further ensure that any potential impacts are minimised. The proposed construction techniques to be implemented are not expected to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p>
<p><i>There is a real chance or possibility to result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</i></p>	<p>No Murray Cod were identified as part of the aquatic surveys.</p> <p>The Murray Cod may potentially occur at seven of the 25 watercourse crossings identified as possibly containing flowing or standing water. Of these crossings the Condamine and Columbula Rivers are the most likely potential habitats due to the water levels at these crossing locations. It is likely that these watercourses will be transected by HDD which passes under the watercourse. Therefore, any impacts to the most likely aquatic habitats of this species will be minimal.</p> <p>None of the surveyed tributaries of the Condamine which may be potential habitat (Wambo, Dogwood, L Tree and Bottle Tree Creeks), contained sufficient water, or water quality, to be consistent with the preferred habitat of Murray Cod.</p> <p>Mitigation measures identified in the AVMP will be implemented to further ensure that potential impacts from invasive species are minimised. The implementation of management procedures for weed and pest species is expected to minimise or eliminate</p>

MNES Impact Criteria	Comment
	impacts upon the Murray Cod.
	<p>No Fitzroy River Turtles were observed during the field survey.</p> <p>Although the majority of watercourses within the area of potential habitat for the Fitzroy River Turtle are dry and as such a standard open cut trenching technique is highly unlikely to have any impact on the species, the eight surveyed crossings within the Dawson River Catchment may still be considered as potential habitat.</p> <p>Mitigation measures identified in the AVMP will be implemented to further ensure that potential impacts from invasive species are minimised. The proposed implementation of management procedures for weed and pest species and feral animals are expected to minimise or eliminate impacts upon the Fitzroy River Turtle.</p>
<p><i>There is a real chance or possibility to introduce disease that may cause the species to decline</i></p>	<p>No Murray Cod were identified as part of the aquatic surveys.</p> <p>The Murray Cod may potentially occur at seven of the 25 watercourse crossings identified as possibly containing flowing or standing water. Of these crossings the Condamine and Columbula Rivers are the most likely potential habitats due to the water levels at these crossing locations. It is likely that these watercourses will be transected by HDD which passes under the watercourse. Therefore, any impacts to the most likely aquatic habitats of this species will be minimal.</p> <p>None of the surveyed tributaries of the Condamine which may be potential habitat (Wambo, Dogwood, L Tree and Bottle Tree Creeks), contained sufficient water, or water quality, to be consistent with the preferred habitat of Murray Cod.</p> <p>Mitigation measures identified in the AVMP will be implemented to further ensure that no introduced disease that may cause the species to decline occurs as a result of the proposed works.</p> <p>No Fitzroy River Turtles were observed during the field survey.</p> <p>Although the majority of watercourses within the area of potential habitat for the Fitzroy River Turtle are dry and as such a standard open cut trenching technique is highly unlikely to have any impact on the species, the eight surveyed crossings within the Dawson River Catchment may still be considered as potential habitat.</p> <p>Mitigation measures identified in the AVMP will be implemented to further ensure that no introduced disease that may cause the species to decline occurs as a result of the proposed works.</p>
<p><i>There is a real chance or possibility to interfere substantially with the recovery of the species</i></p>	<p>No Murray Cod were identified as part of the aquatic surveys.</p> <p>The Murray Cod may potentially occur at seven of the 25 watercourse crossings identified as possibly containing flowing or standing water. Of these crossings the Condamine and Columbula Rivers are the most likely potential habitats due to the water levels at these crossing locations. It is likely that these watercourses will be transected by HDD which passes under the</p>

MNES Impact Criteria	Comment
	<p>watercourse. Therefore, any impacts to the most likely aquatic habitats of this species will be minimal.</p> <p>None of the surveyed tributaries of the Condamine, which may be potential habitat (Wambo, Dogwood, L Tree and Bottle Tree Creeks), did not contain sufficient water, or water quality, to be consistent with the preferred habitat of Murray Cod.</p> <p>The proposed construction techniques are not expected to hinder any recovery of the Murray River Cod. Mitigation measures identified in the AVMP will be implemented to further ensure that no interference will affect the recovery of this species.</p> <p>No Fitzroy River Turtles were observed during the field survey.</p> <p>Although the majority of watercourses within the area of potential habitat for the Fitzroy River Turtle are dry and as such a standard open cut trenching technique is highly unlikely to have any impact on the species, the eight surveyed crossings within the Dawson River Catchment may still be considered as potential habitat.</p> <p>The proposed construction techniques are not expected to hinder any recovery of the Fitzroy River Turtle. Mitigation measures identified in the AVMP will be implemented to further ensure that no interference will affect the recovery of this species</p>

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6.2 Boggomoss Snail

The table below presents the MNES significant impact criteria for Critically Endangered species, and an assessment of the potential for a significant impact to occur as a result of construction of the pipeline. An activity is considered likely to have a significant impact if there is a possibility that it will meet the criteria.

Table 2 below assesses the potential impact on the Boggomoss Snail which is listed as Critically Endangered under the EPBC Act.

Table 2 Assessment of Potential Impacts on Boggomoss Snail

MNES Impact Criteria	Comment
<i>There is a real chance or possibility to reduce the extent of an ecological community.</i>	Despite targeted searches for this species or the habitat of this species, none were detected along the banks of drainage lines likely to be impacted by construction for the Pipeline. Where clearing of dense riparian vegetation may be required, the extent will be minimal and will not reduce the extent of an ecological community.
<i>There is a real chance or possibility to fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines.</i>	No Boggomoss Snails were detected during the field assessment. The literature review has identified two populations to the west of the proposed Pipeline RoW. Therefore the Project is not expected to result in fragmentation of the known habitat of this species.
<i>There is a real chance or possibility to adversely affect habitat critical to the survival of an ecological community.</i>	The two known areas inhabited by this species in the Taroom area will not be impacted by this Project. While impacts to riparian vegetation will result, this species was not detected in the areas proposed for works. Therefore it is unlikely that habitat critical to the survival of the species will be affected.
<i>There is a real chance or possibility to modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns</i>	The proposed works will involve short term disturbance to riparian areas. During works it is recommended that sedimentation and erosion control measures be implemented to ensure abiotic and biotic factors of these areas are not impacted. Upon completion, the waterways should be reinstated and armored as appropriate, to ensure long term impacts are avoided.
<i>There is a real chance or possibility to cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally</i>	As this species was not detected during targeted surveys of waterways along the alignment, this species is not expected to be impacted by the proposed works. Construction and post construction mitigation measures should be employed to ensure minimal impacts result.

MNES Impact Criteria	Comment
<i>important species, for example through regular burning or flora or fauna harvesting</i>	
<p><i>There is a real chance or possibility to cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:</i></p> <ul style="list-style-type: none"> <i>-- assisting invasive species, that are harmful to the listed ecological community, to become established, or</i> <i>-- causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or</i> 	<p>The proposed works will be undertaken in a highly modified landscape subjected to historical agricultural practices. The proposed construction of a pipeline within this landscape is not expected to result in any additional reduction in the integrity of ecological communities beyond the impacts already being experienced.</p> <p>During construction all appropriate mitigation measures will be put in place to ensure invasive weed species are not introduced or spread. Chemical use will be in accordance with the sensitivity of the aquatic environment and relevant guidelines and regulations.</p>
<i>There is a real chance or possibility to interfere with the recovery of an ecological community.</i>	<p>The proposed works are proposed to be undertaken in a highly modified landscape subjected to historical agricultural practices. The proposed construction of a pipeline within this landscape is not expected to interfere with the recovery of any ecological communities used by the Boggomoss Snail.</p>

7 Conclusion

Results from the aquatic ecology survey indicate that:

- A large proportion of the watercourse crossings are heavily disturbed and degraded;
- No migratory bird breeding or roosting colonies were observed along the alignment;
- No MNES species were observed at any of the crossing locations;
- Only three watercourse crossings, Callide Creek (EP, KP 241.3), Kroombit Creek (EP, KP 230) and Juandah Creek (GCH KP, 154.6) contain habitat which may be a potential breeding location for the Fitzroy River Turtle;
- Three of the watercourse crossings along the EP, Kroombit Creek, Callide Creek and Harper Creek, have relatively good aquatic and riparian habitat values and appropriate construction mitigation measures should be implemented to ensure any impacts to these watercourses in particular are minimised. Two of these watercourses, the Kroombit Creek and Callide Creek are located within the known distribution of Fitzroy River Turtle, therefore particular care must be taken during construction of these crossings; and
- Provided the mitigation measures outlined within this document and **Table 1** of the AVMP are employed as part of the watercourse crossing construction, it is considered that the impacts to potential habitat will be minimal and any downstream impacts can be minimised.

The table below provides a summary of the key findings of the survey at each of the 23 crossings surveyed throughout the GCH and EP.

Table 3 Summary of Surveyed Crossings

Watercourse Crossing	Catchment	MNES Potentially Occurring	Water Present	Habitat Quality	Potential impact to MNES
Gas Collection Header					
Wambo Creek at KP 45.9	Condamine (Balonne Condamine Basin)	Murray Cod	Yes	Poor	Unlikely
Wambo Creek at KP 62.3	Condamine (Balonne Condamine Basin)	Murray Cod	Yes	Moderate	Unlikely
Dogwood Creek at KP 112.7	Balonne (Balonne Condamine Basin)	Murray Cod / Boggomoss Snail	Yes	Moderate	Unlikely
L Tree Creek at KP 128.9	Balonne (Balonne Condamine Basin)	Murray Cod	Yes	Moderate	Unlikely
Bottle Tree Creek at KP 133.8	Balonne (Balonne Condamine Basin)	Murray Cod	Yes	Moderate	Unlikely

Watercourse Crossing	Catchment	MNES Potentially Occurring	Water Present	Habitat Quality	Potential impact to MNES
Juandah Creek at KP 154.6	Dawson (Fitzroy Basin)	Fitzroy River Turtle	Yes	Poor	Unlikely
Woleebee Creek at KP 183.2	Dawson (Fitzroy Basin)	Fitzroy River Turtle	Yes	Poor	Unlikely
Export Pipeline					
Roche Creek at KP 24.3	Balonne (Balonne Condamine Basin)	Murray Cod / Boggomoss Snail	Yes	Poor	Unlikely
Fishy Creek at KP 73.4	Boyne and Auburn (Burnett Basin)	Nil	Yes	Moderate	Unlikely
Auburn River at KP 99.1	Boyne and Auburn (Burnett Basin)	Boggomoss Snail	Yes	Moderate	Unlikely
Grevillia Creek at KP 211.1	Dawson (Fitzroy Basin)	Fitzroy River Turtle / Boggomoss Snail	No	Poor	Unlikely
Kariboe Creek at KP 216.6	Dawson (Fitzroy Basin)	Fitzroy River Turtle / Boggomoss Snail	No	Poor	Unlikely
Kroombit Creek at KP 230.0	Dawson (Fitzroy Basin)	Fitzroy River Turtle / Boggomoss Snail	Yes	Good	Unlikely provided identified measures are implemented
Callide Creek at KP 241.3	Dawson (Fitzroy Basin)	Fitzroy River Turtle / Boggomoss Snail	Yes	Good	Unlikely provided identified measures are implemented
Rainbow Creek at KP 243.2	Dawson (Fitzroy Basin)	Fitzroy River Turtle	Yes	Moderate	Unlikely
Rainbow Creek at KP 244.8	Dawson (Fitzroy Basin)	Fitzroy River Turtle	Yes	Moderate	Unlikely
Bell Creek at KP 266.2	Dawson (Fitzroy Basin)	Fitzroy River Turtle	Yes	Moderate	Unlikely
Calliope River at KP 280.9	Calliope (Calliope Basin)	Boggomoss Snail	Yes	Moderate	Unlikely
Harper Creek at KP 288.8	Calliope (Calliope Basin)	Boggomoss Snail	Yes	Good	Unlikely provided identified measures are implemented
Un-named Drainage Channel at	Calliope (Calliope Basin)	Nil	Yes	Poor	Unlikely

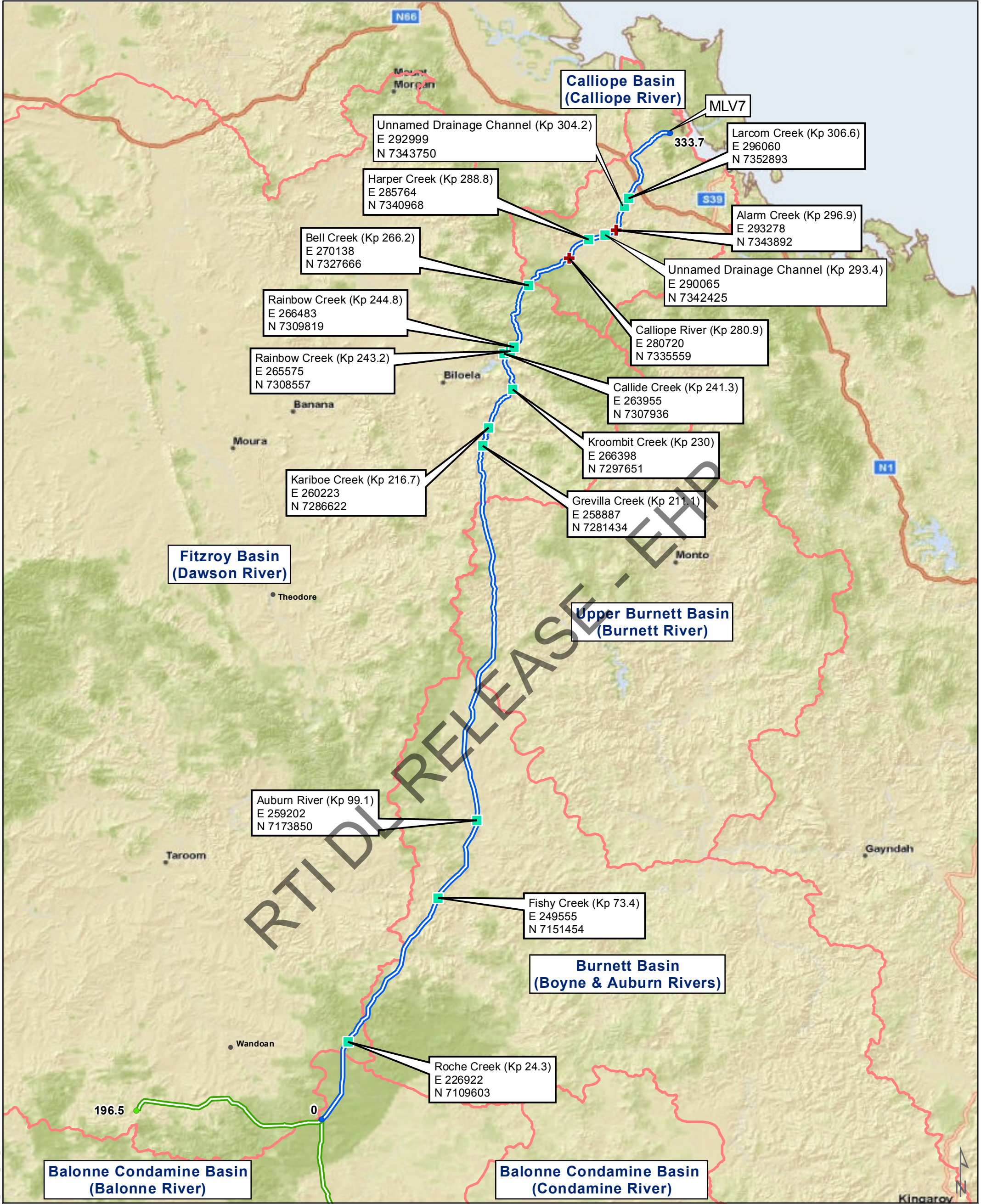
Watercourse Crossing	Catchment	MNES Potentially Occurring	Water Present	Habitat Quality	Potential impact to MNES
KP 293.4					
Alarm Creek at KP 296.9	Calliope (Calliope Basin)	Fitzroy River Turtle / Boggomoss Snail	Yes	Poor	Unlikely
Un-named Tributary at KP 304.2	Calliope (Calliope Basin)	Nil	Yes	Poor	Unlikely
Larcom Creek at KP 306.6	Calliope (Calliope Basin)	Boggomoss Snail	Yes	Poor	Unlikely

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8 Appendices

Appendix A: Location Maps

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QGC PTY LTD - Queensland Curtis LNG Project

TITLE:
QCLNG Pipeline Surveyed Watercourse Crossings
EP Study Area
Map 1

DOCUMENT NO: QCLNG-BG00-PL-000242-01

DATA SOURCE:
Bing © MapData Sciences Australia 2010
Drainage Basins Sub Area © State of Queensland
(Department of Environment and Resource Management) 2009

0

30

60

Kilometres

12516

1:500,000 (A3) GCS GDA 1994

DATE

18/07/2011

AUTHOR

NC

APPROVED

JG

REVISION

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NOTE

Issued for Use

REV.

0

PROPOSED PIPELINE ALIGNMENT

Export Pipeline

Collection Header

REVISION

Rev L

Rev K

DATE

19-04-2011

19-04-2011

SUPPLIED BY

Unidel

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LOCATION DIAGRAM

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Appendix B: Photographs

GCH Water Crossings

Figure 1 Wambo Creek at KP 45.9



Figure 2 Wambo Creek at KP 63.2



Figure 3 Dogwood Creek at KP 112.7



Figure 4 Bottle Tree Creek at KP 128.9



Figure 4 L Tree Creek at KP 133.8



Figure 6 Juandah Creek at KP 154.6



Figure 7 Woleebee Creek at KP 183.2



EP Water Crossings

Figure 8 Roche Creek at KP 24.3



Figure 9 Fishy Creek at KP 73.4



Figure 10 Auburn River at KP 99.1



Figure 11 Grevillia Creek at KP 211.1



Figure 12 Kariboe Creek at KP 216.7



Figure 13 Kroombit Creek at KP 230.0



Figure 14 Callide Creek at KP 241.3



Figure 15 Rainbow Creek at KP 243.2



Figure 16 Rainbow Creek at KP 244.8



Figure 17 Calliope River at KP 280.9



Figure 18 Harper Creek at KP 288.8

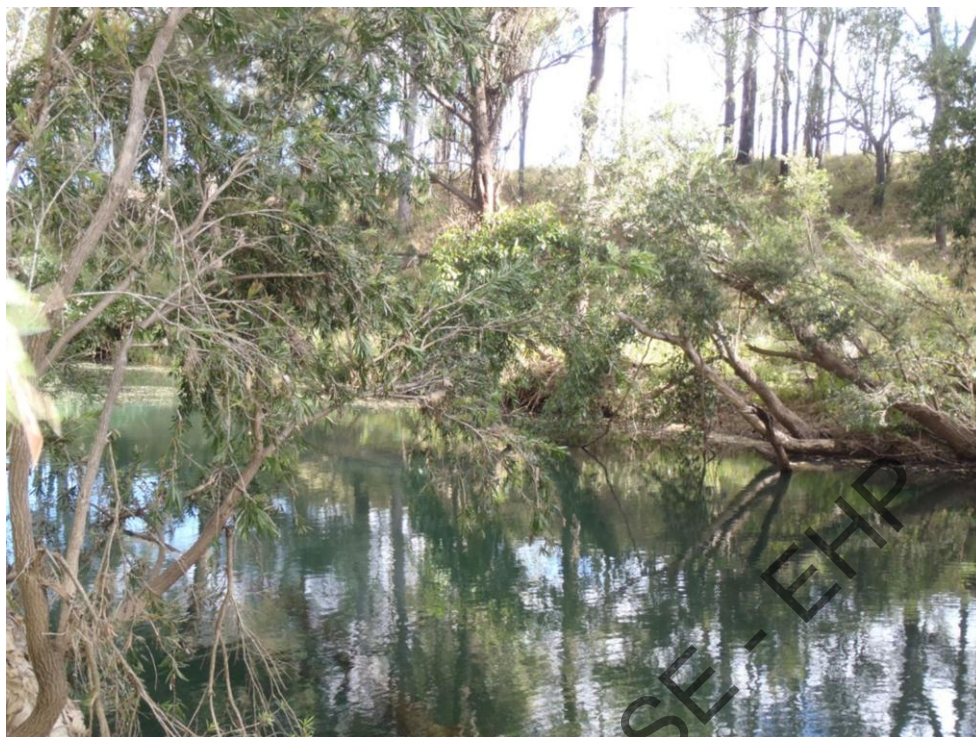


Figure 20 Alarm Creek at KP 296.9

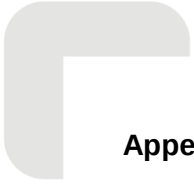


Figure 21 Unnamed Drainage Channel at KP 304.2



Figure 22 Larcom Creek at KP 306.6





Appendix C: Richard Floyd CV

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Richard Floyd

PRINCIPAL ECOLOGIST

Profile

Richard Floyd has more than 15 years experience undertaking and managing ecology studies. Richard's experience has primarily been with linear infrastructure such as roads, rail and pipelines. He has coordinated ecology studies for numerous major projects and is familiar with environmental legislation and approvals triggers at both the state and commonwealth level.

Richard has experience designing and undertaking flora and fauna surveys to assess potential impacts of infrastructure projects. He is familiar with current best practice methodologies and techniques and has experience developing practical mitigation measures for inclusion in Environmental Management Plans.

Qualifications

Bachelor of Science (Zoology/Ecology)

Graduate Diploma of Natural Resource Management

Career Summary

2011 – Present	Principal Environmental Scientist, Unidel
2009 – 2011	Principal Ecologist, Outback Ecology
2005 – 2009	Principal Ecologist, AECOM
2003 – 2006	Senior Environmental Scientist, ERM
1999 – 2003	Environmental Planner, Greater Taree City Council
1997 – 1999	Environment Officer, Maclean Shire Council
1996 – 1997	Scientist, Integrated Site Planning and Management
1995	Environmental Scientist, ERM

Industry Experience

Surat Gas Pipeline Network, Origin Energy. Richard was responsible for the developing the feasibility study and then the later assessment of the 4 gas pipeline alignments within the Surat gas pipeline network or Origin Energy. This process involved alignment selection, pre-feasibility studies and detailed alignment assessment against Commonwealth and Queensland ecological regulations.

Wheatstone Gas Hub, Chevron, Onslow/Perth. Richard led the team to undertake the pre-clearing surveys for conservation significant flora throughout the Phase 3 component of the Wheatstone project. Richard was responsible for 4 field botanists and was also involved in a number of the survey periods.

Wheatstone Amendment Area VCP, Chevron, Onslow/Perth. Richard led the team to prepare the Flora and Vegetation Assessment Report for the Amendment area for the Wheatstone Project. Richard organised, undertook field surveys and produced the report project.

Environmental Impact Statement for Moranbah and Nebo Power Stations Project, Transfield. The Moranbah and Nebo Power Stations Project will involve the construction of two gas-fired power stations connected by a 97km gas pipeline in central Queensland. Richard provided specialist environmental input to the ecological studies and assisted with the development approvals process.

Surat Basin Rail Project, SBR JV: Richard lead a team of 6 ecologists undertaking field survey and was responsible for the preparation of the required flora and fauna assessment of the proposed development.

Southern Freight Rail, QLD Department of Transport: Richard led a team of 6 ecologists during field survey and production of the required assessment. His responsibilities also included assistance with the community consultation process and liaison with the Department of Transport.

Ballarat West Future Arterial Road – Flora and Fauna Assessment (2008-2009): Richard was responsible for the developing the feasibility study and then the later assessment of the proposed roadway in line with Commonwealth Environment Protection and Biodiversity Conservation Act and Victorian legislation such as the Native Vegetation Framework, and the Flora and Fauna Guarantee Act and the ecological components contained within various local planning schemes. Richard led a team of 4 ecologists within this project to deliver the project.

Multi-Modal Transport Corridor – Petrie to Kippa Ring, Queensland transport (2007): Richard was responsible for the production of the ecological assessment for this project. He led a team of 6 ecologists in the preparation of the required components of the project.

Review of Environmental Factors of Cameron's Corner – Waterfall Way, Urunga: Flora and fauna survey and assessment of impact of the upgrade of the road on rare and threatened species. In particular the squirrel glider, glossy black cockatoo and koala were the focus of this study.

Proposed 110kV Overhead Powerlines, Caboolture to Toorbul Point, ENERGEX (2008): Richard prepared a detailed flora and fauna assessments addressing various environmental concerns associated with wetlands and significant remnant vegetation.

Proposed 110kV Overhead Powerlines and Substation, Port Drive, Brisbane, ENERGEX (2007): Richard prepared a detailed flora and fauna assessment addressing environmental concerns associated with the clearing of the site.

Environmental Impact Statement for Moranbah and Nebo Power Stations Project, Transfield (2007): The Moranbah and Nebo Power Stations Project will involve the construction of two gas-fired power stations connected by a 97km gas pipeline in central Queensland. Richard Floyd provided specialist environmental input to the ecological studies and assisted with the development approvals process.

Flora and Fauna Investigation for the Cooma to Bega 66kV Transmission Line Upgrade: Assessment of the proposed route in relation to threatened species and koala issues. Development of mitigation measures was a key component of this role.



Numerous Environmental Assessments, Energex: Richard was responsible for client management and conducted numerous environmental assessments for Energex including the proposed Birkdale Substation, Surfers Paradise Substation, and various feeder works including 11kV and 33kV underground cables in suburban Brisbane, Gold Coast, and the Sunshine Coast.

Lake Maitland Uranium Project, Mega Uranium Ltd, Perth (2010): Richard led the team to undertake the required Flora and Vegetation Assessment in support of the required clearing application for establishment of the mining facility. Richard was responsible for 4 field botanists and was instrumental in the production of the report.

Environmental Impact Statement, Warkworth Mine, Hunter Valley: Ecology team leader for surveys for the environmental impacts statement for the proposed Warkworth coal mine.

Victorian Desalination Plant Project (2008): Richard was involved in the review of sub-consultancy ecological reports and was responsible for the production of the required ecological chapter for inclusion within the Environmental Effects Study for this state significant project.

SEPP 44 Koala Habitat Assessments: Assessment of koala habitat value in accordance with SEPP44 in the Hunter Valley, Central Coast and Northern NSW. Assessment of developments in Port Stephens and Greater Taree Local Government Areas in accordance with each council's respective Comprehensive Koala Plan of Management.

Town House Development, Everton Park, Brisbane: Richard Managed field staff in the assessment of ecological risks associated with future development of the site. This survey involved terrestrial and aquatic ecology including vegetation and fauna assessments and development of a Weed Management Plan for the site.

Twin Waters Resort Expansion, Sunshine Coast: Richard conducted the assessment of ecological risks associated with future development of the site. This survey involved multi-season surveys to assist with the future planning of the development.

Hérons Creek Timber Mill Redevelopment, Herons Creek: Flora and fauna assessment for the expansion of timber mill operations onto adjacent lands. Threatened species of primary concern were the wallum frog-let, koala, glossy black cockatoo and squirrel glider.

APPENDIX II – MAPS AND FULL LIST OF WATERCOURSES INTERSECTED

APPENDIX IIA – GAS COLLECTION HEADER WATERCOURSE CROSSING LOCATIONS

Map 1: QCLNG Pipeline Surveyed Watercourse Crossings – GCH Study Area

Map 2: KP0 – KP50

Map 3: KP50 – KP95

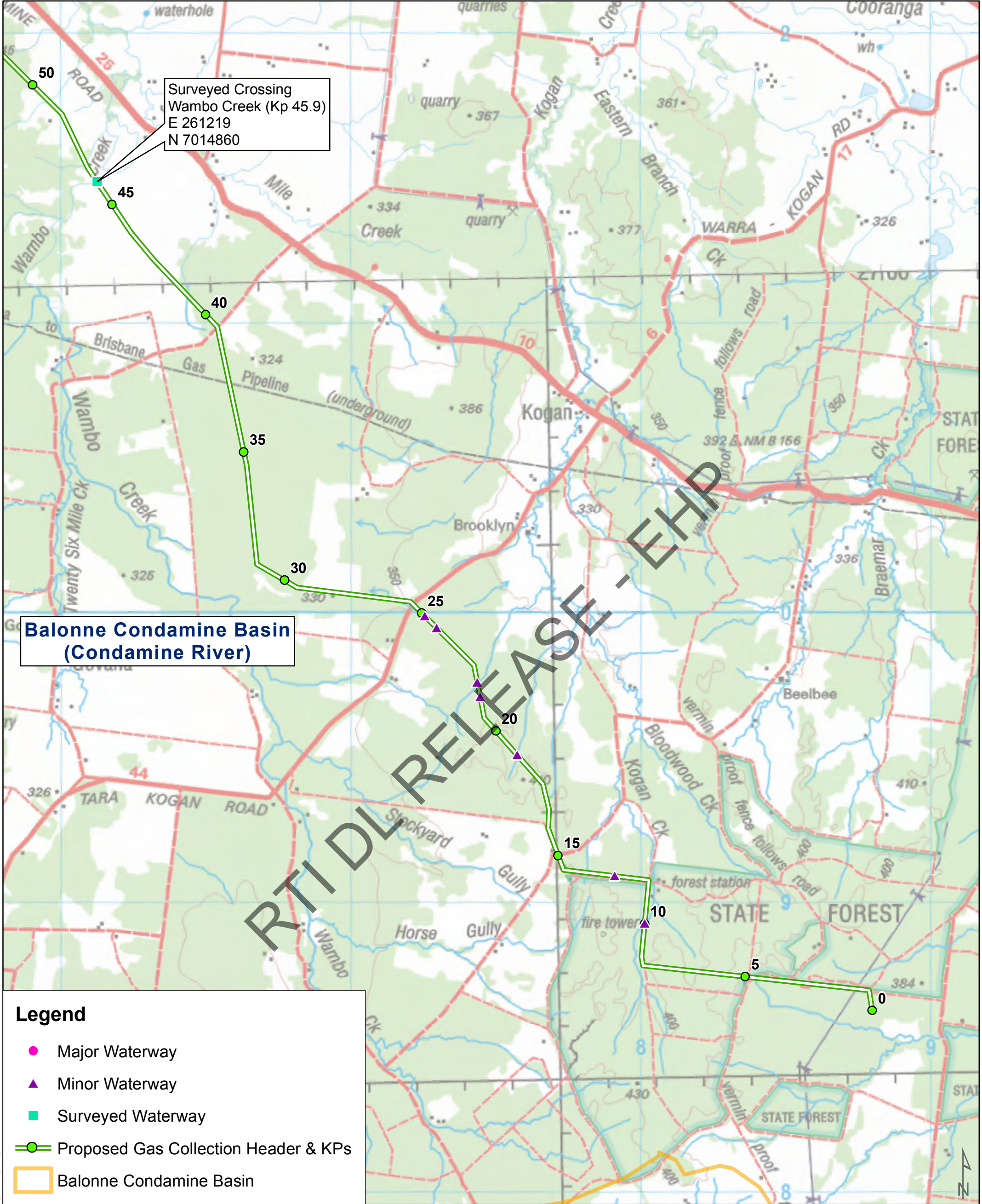
Map 4: KP90 – KP135

Map 5: KP125 – KP165

Map 6: KP170 – KP195

Table 1: Gas Collection Header Watercourse Crossing List

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**Balonne Condamine Basin
(Condamine River)**

Legend

- Major Waterway
- Minor Waterway
- Surveyed Waterway
- Proposed Gas Collection Header & KPs
- Balonne Condamine Basin

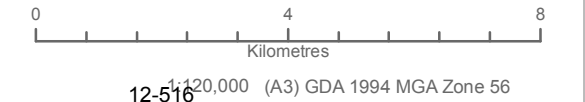
QGC PTY LTD - Queensland Curtis LNG Project

LOCATION DIAGRAM

TITLE: QCLNG Pipeline Watercourse Crossings
GCH
Map 2: Kp 0 - 50

DOCUMENT NO: QCLNG-BX00-PLE-MAP-000310-02

DATA SOURCE:
Drainage Basins Sub Area © State of Queensland
(Department of Environment and Resource Management) 2009
Topographic Raster 1:250,000 © Commonwealth of Australia
(Geoscience Australia) 2003



DATE	AUTHOR	APPROVED	REVISION NOTE	REV.
08/07/2011	NC	JG	Issued for Review	A
13/07/2011	NC	JG	Issued for Use	0

PROPOSED PIPELINE ALIGNMENT	REVISION	DATE	SUPPLIED BY
Export Pipeline & KP's	Rev L	19-04-2011	Unidel
Collection Header & KP's	Rev K	19-04-2011	Unidel

DL Documents



A BG Group business

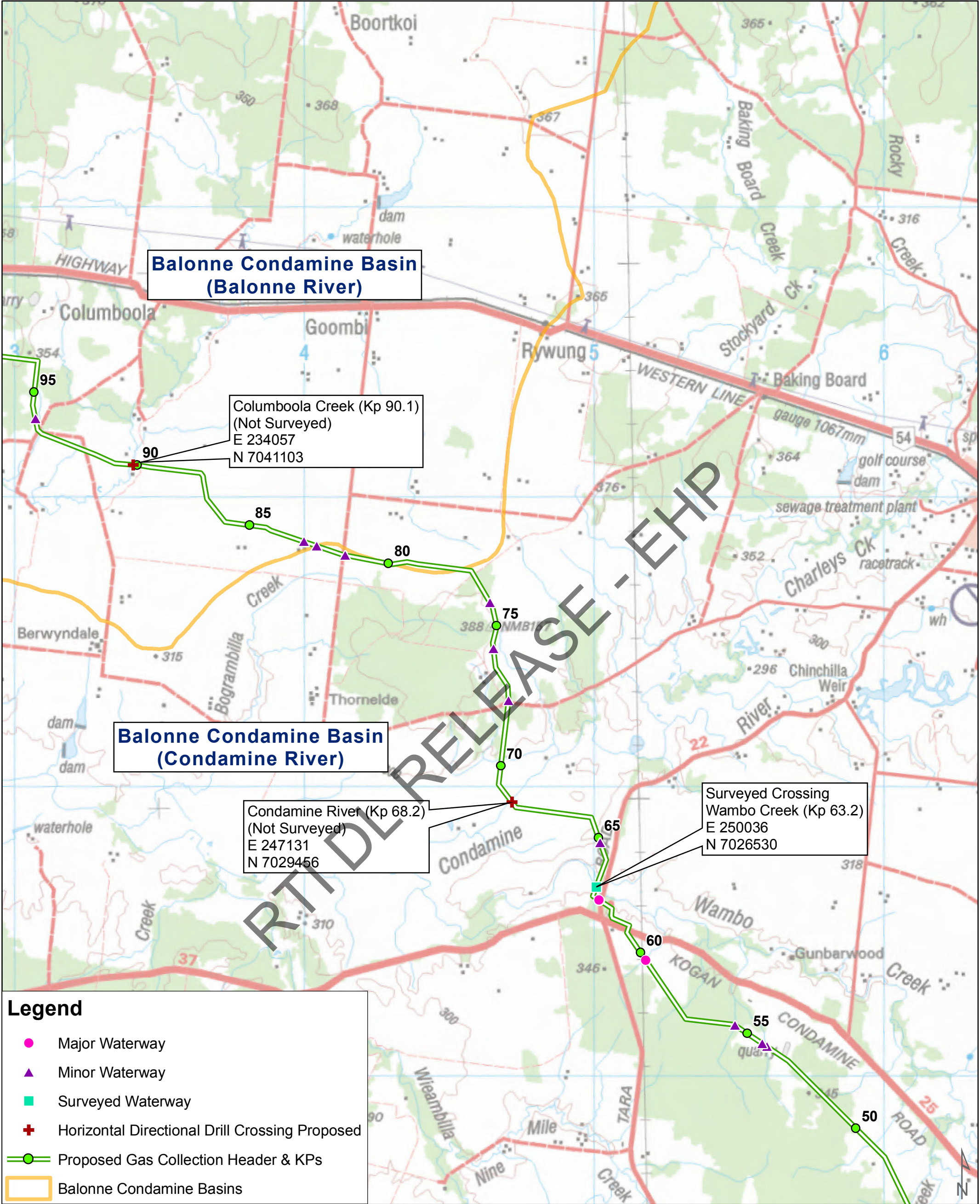
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Legend

- Major Waterway
- Minor Waterway
- Surveyed Waterway
- Horizontal Directional Drill Crossing Proposed
- Proposed Gas Collection Header & KPs
- Balonne Condamine Basins

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TITLE: QCLNG Pipeline Watercourse Crossings
GCH
Map 3: Kp 50 - 95

DOCUMENT NO: QCLNG-BX00-PLE-MAP-000310-03

DATA SOURCE:
Drainage Basins Sub Area © State of Queensland
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04 Kilometres8

04 Kilometres8

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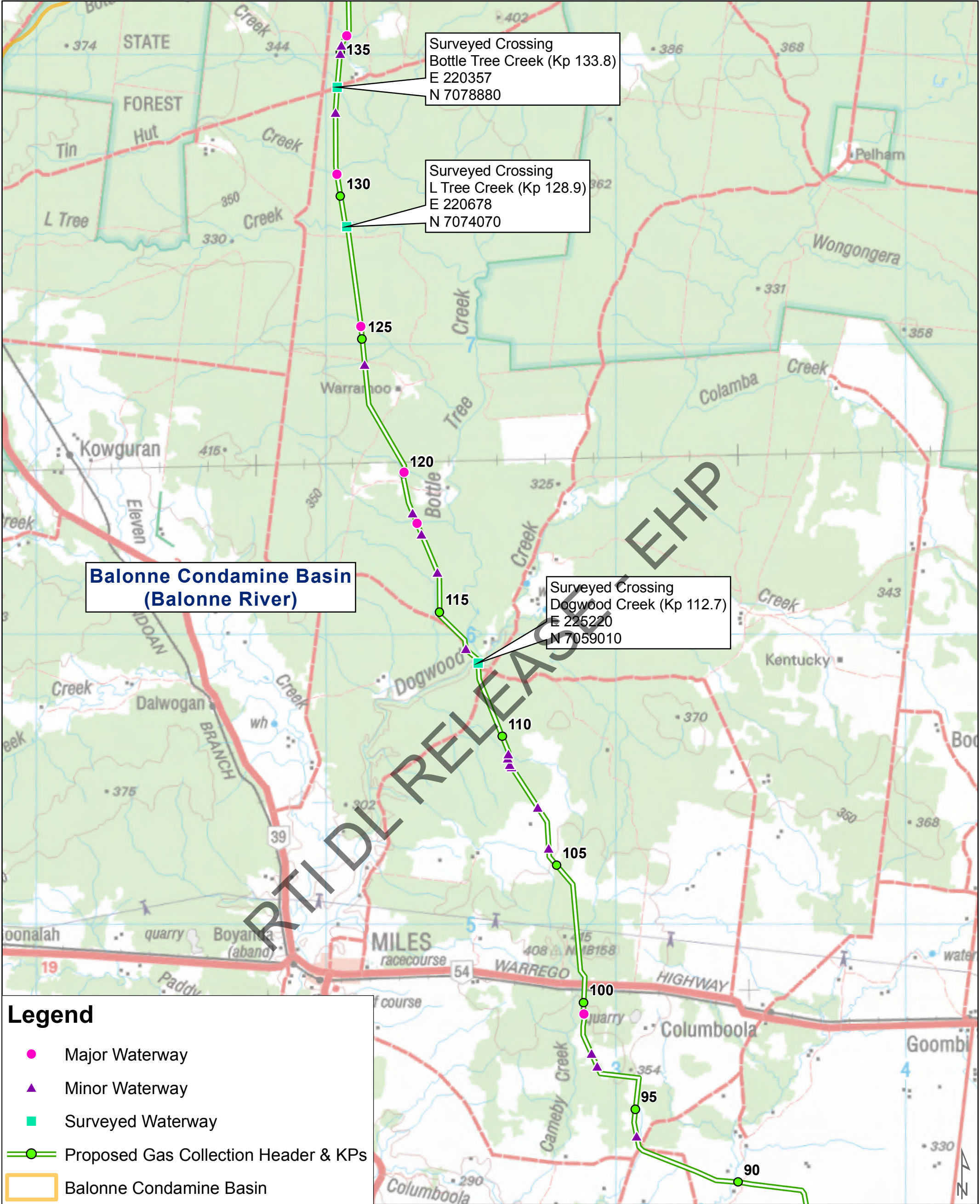
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**Balonne Condamine Basin
(Balonne River)**

Legend

- Major Waterway
- Minor Waterway
- Surveyed Waterway
- Proposed Gas Collection Header & KPs
- Balonne Condamine Basin

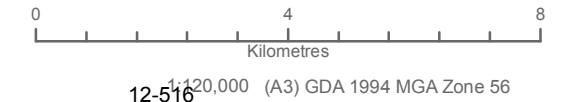
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LOCATION DIAGRAM

TITLE: QCLNG Pipeline Watercourse Crossings
GCH
Map 4: Kp 90 - 135

DOCUMENT NO: QCLNG-BX00-PLE-MAP-000310-04

DATA SOURCE:
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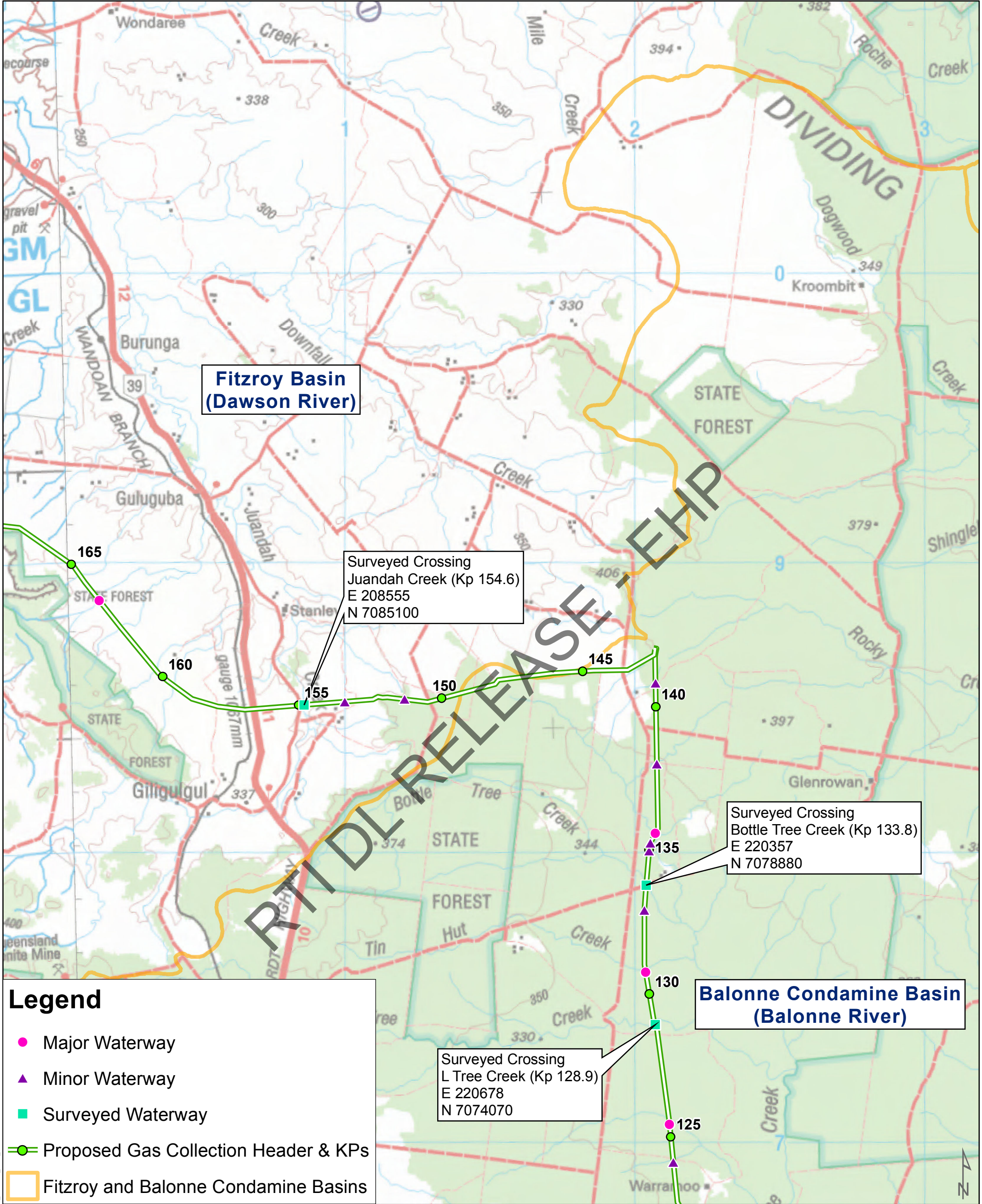
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Legend

- Major Waterway
- Minor Waterway
- Surveyed Waterway
- Proposed Gas Collection Header & KPs
- Fitzroy and Balonne Condamine Basins

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TITLE: QCLNG Pipeline Watercourse Crossings
GCH
Map 5: Kp 125 - 165

DOCUMENT NO: QCLNG-BX00-PLE-MAP-000310-05

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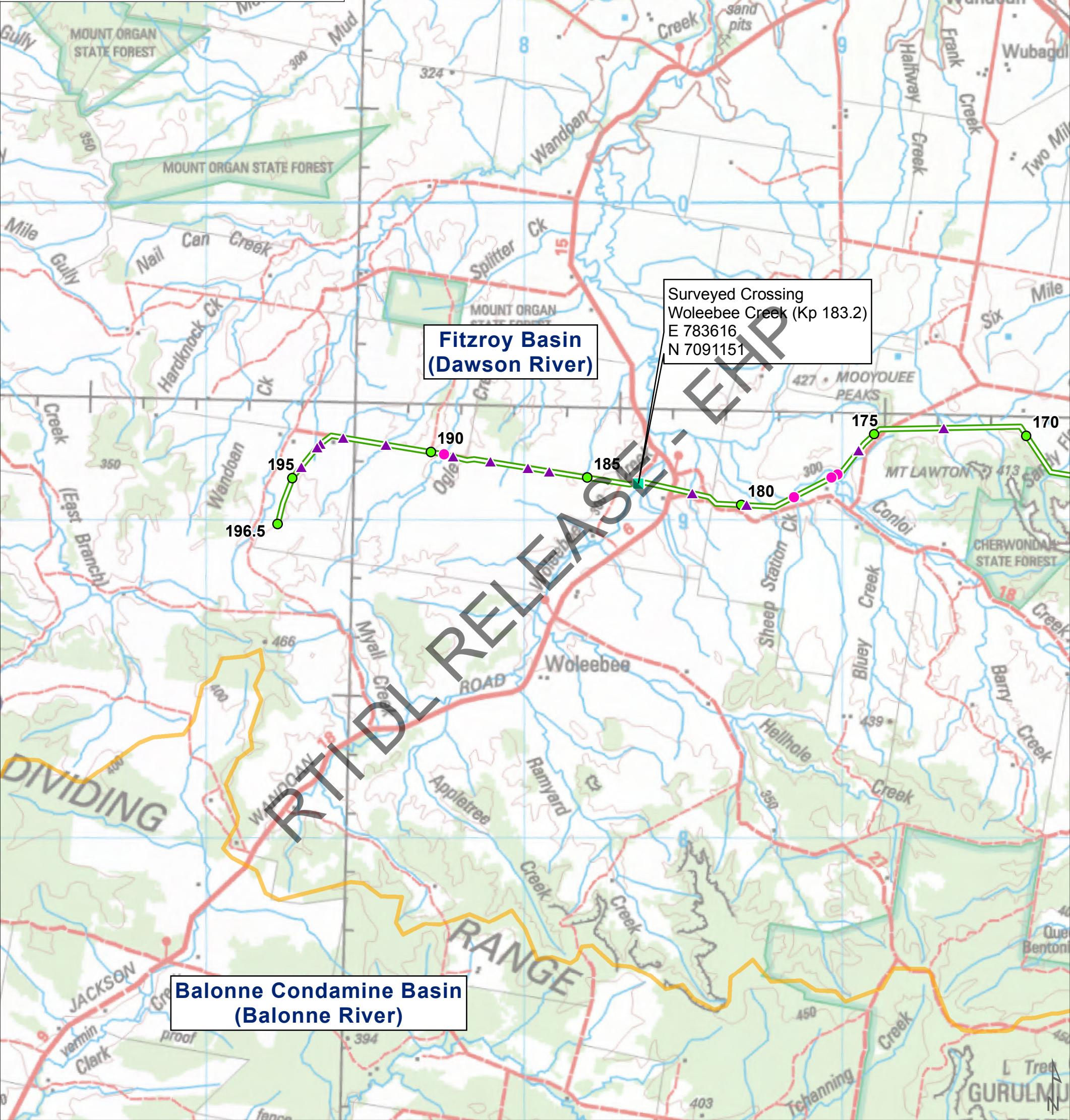
Major Waterway

Minor Waterway

Surveyed Waterway

Proposed Gas Collection Header & KPs

Fitzroy and Balonne Condamine Basins



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TITLE: QCLNG Pipeline Watercourse Crossings
GCH
Map 6: Kp 170 - 195

DOCUMENT NO: QCLNG-BX00-PLE-MAP-000310-06

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Table 1: GCH Water Crossings

KP Start	Description	Easting	Northing
10.032	WATC-1: Minor Water Crossing	280115.0647	6989280.961
12.705	WATC-1: Minor Water Crossing	279075.2745	6990902.313
18.898	WATC-1: Minor Water Crossing	275715.1387	6995079.76
21.355	WATC-1: Minor Water Crossing	274434.7746	6997089.661
21.855	WATC-1: Minor Water Crossing	274339.1313	6997581.115
24.282	WATC-1: Minor Water Crossing	272937.6629	6999463.906
24.866	WATC-1: Minor Water Crossing	272524.7853	6999876.779
45.945	WATC-3: Wambo Creek	261218.7077	7014862.207
54.147	WATC-1: Minor Water Crossing	255960.738	7021003.111
54.184	WATC-1: Minor Water Crossing	255930.0269	7021023.641
54.379	WATC-1: Minor Water Crossing	255767.8439	7021132.058
55.512	WATC-1: Minor Water Crossing	254826.3976	7021761.4
59.685	WATC-3: Major Water Crossing	251746.2189	7024006.622
62.605	WATC-3: Major Water Crossing	250138.3487	7026080.331
62.614	WATC-3: Major Water Crossing	250130.1547	7026085.681
63.192	WATC-3: Wambo Creek	250036.3194	7026529.277
64.834	WATC-1: Minor Water Crossing	250173.6994	7028070.82
68.592	WATC-4: Condamine River	250173.6994	7029455.607
72.272	WATC-1: Minor Water Crossing	247008.2036	7032960.96
74.189	WATC-1: Minor Water Crossing	246492.4976	7034748.375
75.839	WATC-1: Minor Water Crossing	246372.7964	7036341.927
81.527	WATC-1: Minor Water Crossing	241371.6969	7037983.212
82.563	WATC-1: Minor Water Crossing	240387.7148	7038301.726
83.027	WATC-1: Minor Water Crossing	239947.6948	7038451.012
90.135	WATC-4: Columboola Creek	234057.3775	7041103.035
94.073	WATC-1: Minor Water Crossing	230684.9784	7042690.8
97.703	WATC-1: Minor Water Crossing	229324.3911	7045095.094
98.179	WATC-1: Minor Water Crossing	229127.6576	7045528.621
99.614	WATC-3: Major Water Crossing	228864.0472	7046896.91
105.701	WATC-1: Minor Water Crossing	227652.2882	7052624.332
107.211	WATC-1: Minor Water Crossing	227270.7583	7054034.233
108.872	WATC-1: Minor Water Crossing	226364.5511	7055426.493
108.974	WATC-1: Minor Water Crossing	226309.05	7055511.763
109.217	WATC-1: Minor Water Crossing	226238.09	7055729.508
109.357	WATC-1: Minor Water Crossing	226254.825	7055868.88
112.694	WATC-3: Dogwood Creek	225219.5024	7059010.325
113.385	WATC-1: Minor Water Crossing	224791.5168	7059506.165
116.391	WATC-1: Minor Water Crossing	223810.6464	7062138.946
117.815	WATC-1: Minor Water Crossing	223262.5217	7063453.348
118.217	WATC-3: Major Water Crossing	223107.7498	7063824.491
118.612	WATC-1: Minor Water Crossing	222955.5659	7064189.427
120.059	WATC-3: Major Water Crossing	222658.1849	7065590.761
124.123	WATC-1: Minor Water Crossing	221298.5507	7069312.142

125.435	WATC-3: Major Water Crossing	221167.2853	7070617.794
128.925	WATC-3: L Tree Creek	220677.9054	7074066.704
130.769	WATC-3: Tin Hut Creek	220343.6221	7075873.146
132.906	WATC-1: Minor Water Crossing	220296.4837	7078006.682
133.782	WATC-3: Bottle Tree Creek	220356.7402	7078880.928
134.958	WATC-1: Minor Water Crossing	220459.6682	7080051.283
135.245	WATC-1: Minor Water Crossing	220501.6978	7080332.686
135.617	WATC-3: Major Water Crossing	220675.477	7080661.378
138.043	WATC-1: Minor Water Crossing	220727.3403	7083064.657
140.827	WATC-1: Minor Water Crossing	220681.8089	7085848.796
151.096	WATC-1: Minor Water Crossing	212023.3213	7085290.571
153.189	WATC-1: Minor Water Crossing	209960.9684	7085209.865
154.598	WATC-3: Juandah Creek	208555.3731	7085097.866
163.214	WATC-3: Major Water Crossing	201485.6563	7088703.95
172.539	WATC-1: Minor Water Crossing	193883.1468	7092595.918
175.472	WATC-1: Minor Water Crossing	191255.7441	7091786.678
175.491	WATC-1: Minor Water Crossing	191244.7144	7091771.357
176.506	WATC-3: Major Water Crossing	190617.9802	7090985.058
176.721	WATC-1: Conloi Creek	190431.6065	7090878.162
178.054	WATC-3: Conloi Creek	189274.5451	7090214.525
179.622	WATC-1: Minor Water Crossing	187795.4552	7089884.43
181.426	WATC-1: Minor Water Crossing	186073.8679	7090178.844
183.159	WATC-3: Woleebie Creek	184367.2800	7090408.148
186.000	WATC-1: Minor Water Crossing	181545.5608	7090660.895
186.675	WATC-1: Minor Water Crossing	180875.5759	7090738.516
187.878	WATC-1: Minor Water Crossing	179680.8144	7090876.935
189.072	WATC-1: Minor Water Crossing	178503.0177	7090984.581
189.368	WATC-1: Ogle Creek	178212.6278	7091043.665
191.225	WATC-1: Minor Water Crossing	176368.4903	7091260.579
192.576	WATC-1: Minor Water Crossing	175026.2936	7091416.086
193.392	WATC-1: Minor Water Crossing	174311.8565	7091186.889
193.547	WATC-1: Minor Water Crossing	174210.445	7091071.276
194.332	WATC-1: Minor Water Crossing	173743.0408	7090439.911

APPENDIX IIB – EXPORT PIPELINE WATERCOURSE CROSSING LOCATIONS

Map 1: QCLNG Pipeline Surveyed Watercourse Crossings – EP Study Area

Map 2: KP0 – 45

Map 3: KP45 – KP90

Map 4: KP90 – KP130

Map 5: KP130 – KP170

Map 6: KP170 – KP215

Map 7: KP215 – KP260

Map 8: KP260 – KP310

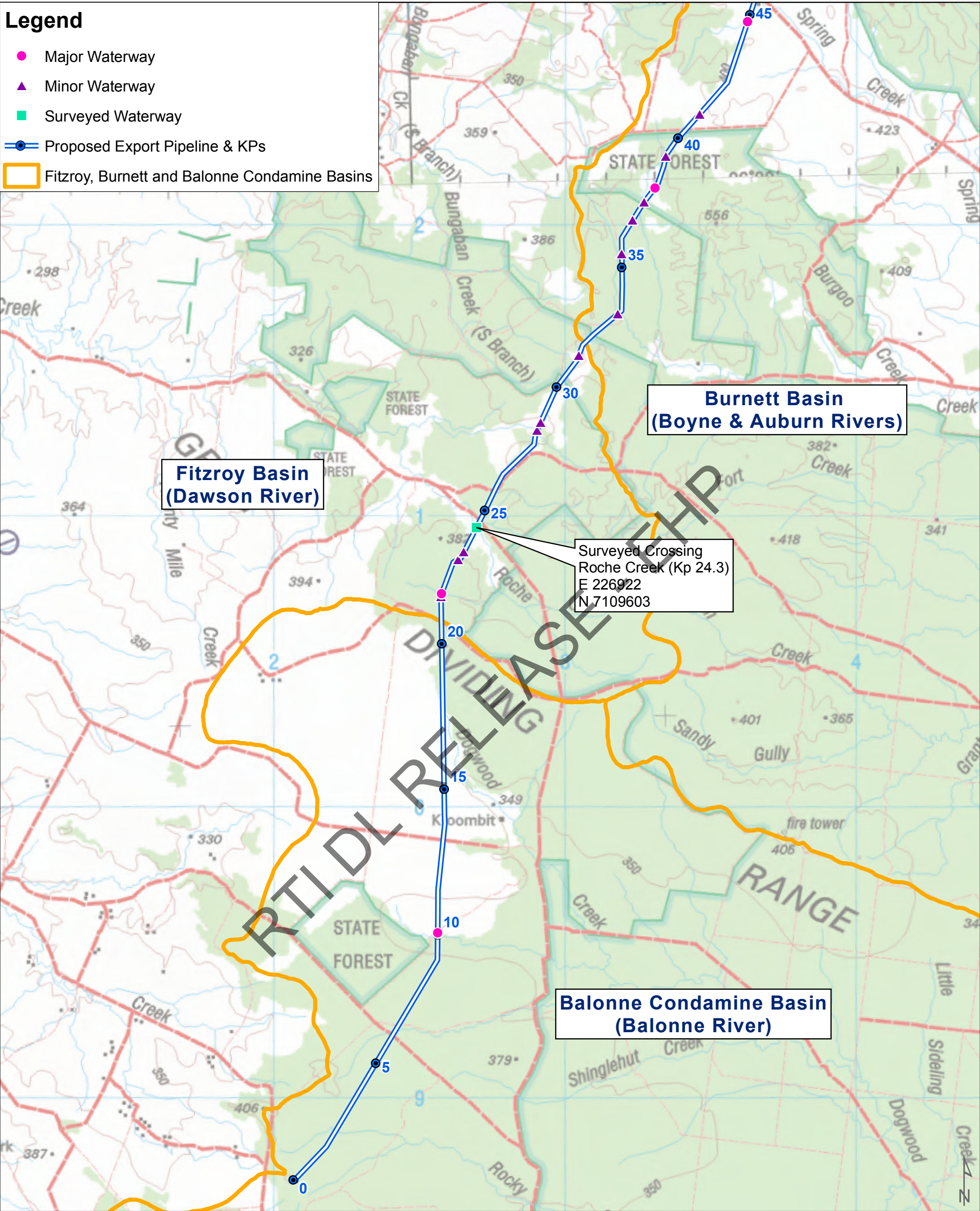
Map 9: KP310 – KP333.7

Table 1: Export Pipeline Watercourse Crossing List

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Legend

- Major Waterway
- Minor Waterway
- Surveyed Waterway
- Proposed Export Pipeline & KPs
- Fitzroy, Burnett and Balonne Condamine Basins



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LOCATION DIAGRAM

TITLE: QCLNG Pipeline Watercourse Crossings
EP
Map 2: Kp 0 - 45

DOCUMENT NO: QCLNG-BG00-PLE-MAP-000242-02

DATA SOURCE:
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0 4 8
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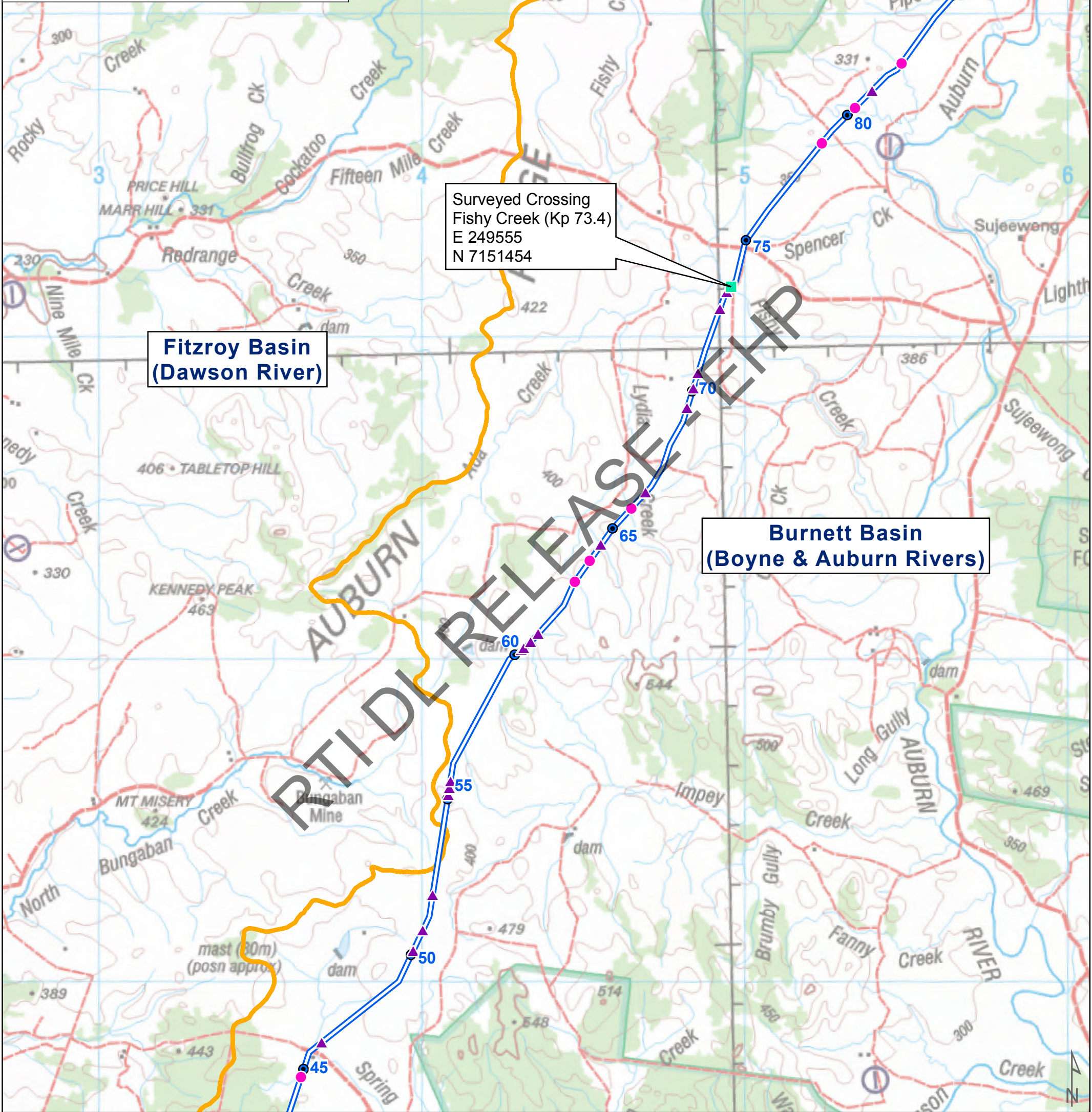
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Legend

- Major Waterway
- ▲ Minor Waterway
- Surveyed Waterway
- Proposed Export Pipeline & KPs
- ▭ Fitzroy and Burnett Basins



TITLE: QCLNG Pipeline Watercourse Crossings
EP
Map 3: Kp 45 - 90

DOCUMENT NO: QCLNG-BG00-PLE-MAP-000242-03

DATA SOURCE:
Drainage Basins Sub Area © State of Queensland
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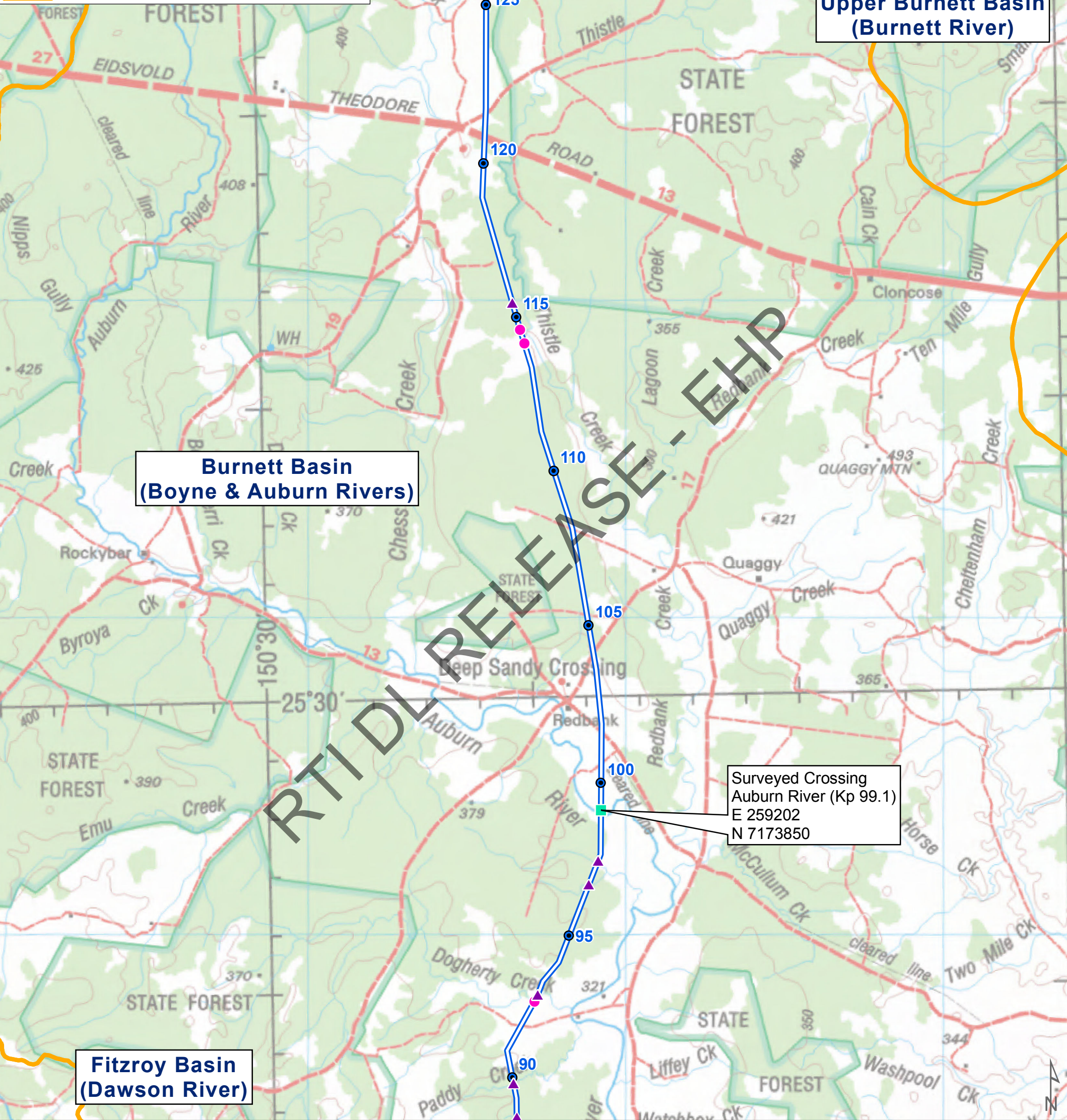
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Legend

- Major Waterway
- Minor Waterway
- Surveyed Waterway
- Proposed Export Pipeline & KPs
- Burnett, Upper Burnett and Fitzroy Basins



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LOCATION DIAGRAM

TITLE: QCLNG Pipeline Watercourse Crossings
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Map 4: Kp 90 - 130

DOCUMENT NO: QCLNG-BG00-PLE-MAP-000242-04

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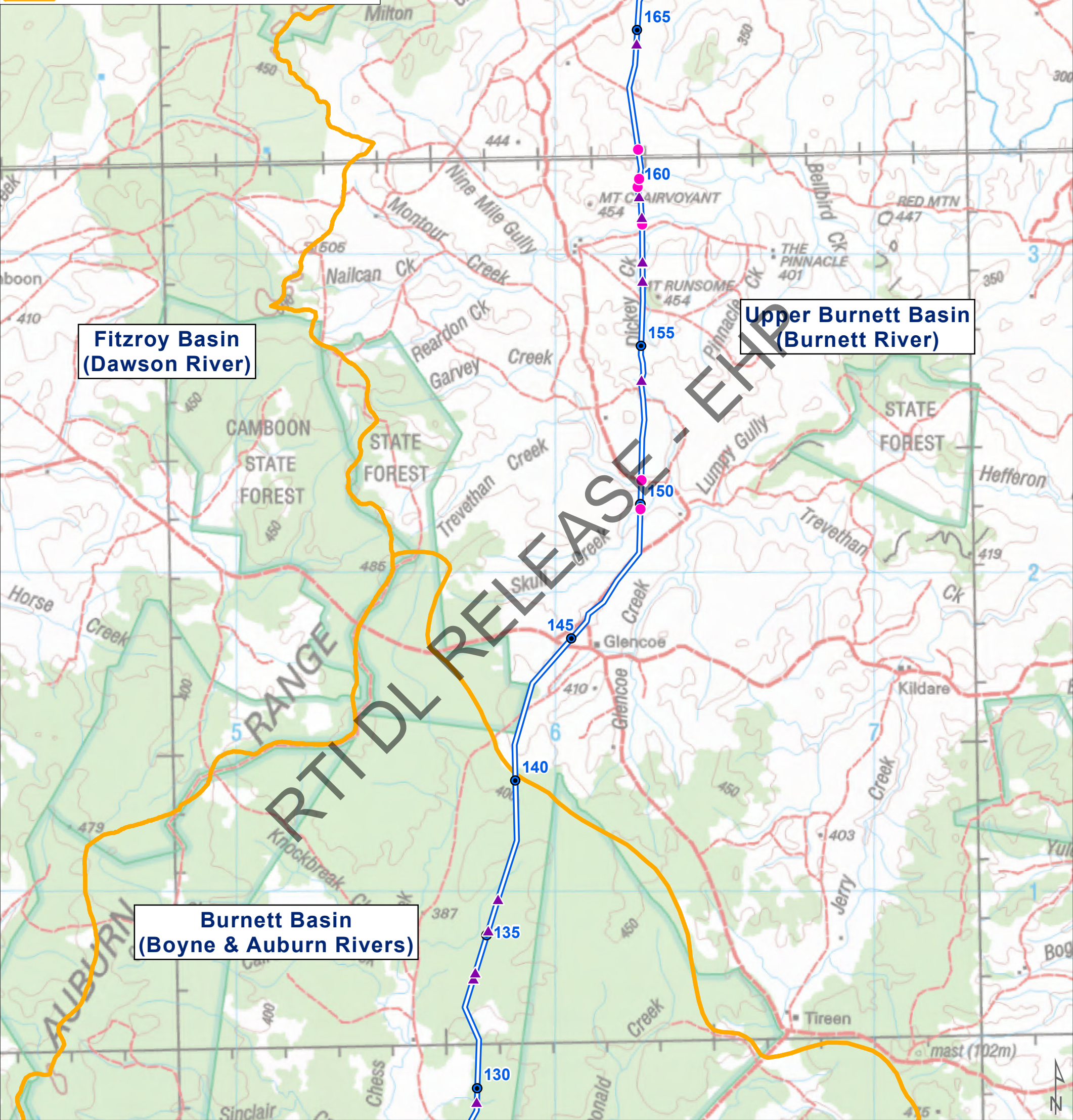
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- Minor Waterway
- Surveyed Waterway
- Proposed Export Pipeline & KPs
- Fitzroy, Burnett and Upper Burnett Basins



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TITLE: QCLNG Pipeline Watercourse Crossings
EP
Map 5: Kp 130 - 170

DOCUMENT NO: QCLNG-BG00-PLE-MAP-000242-05

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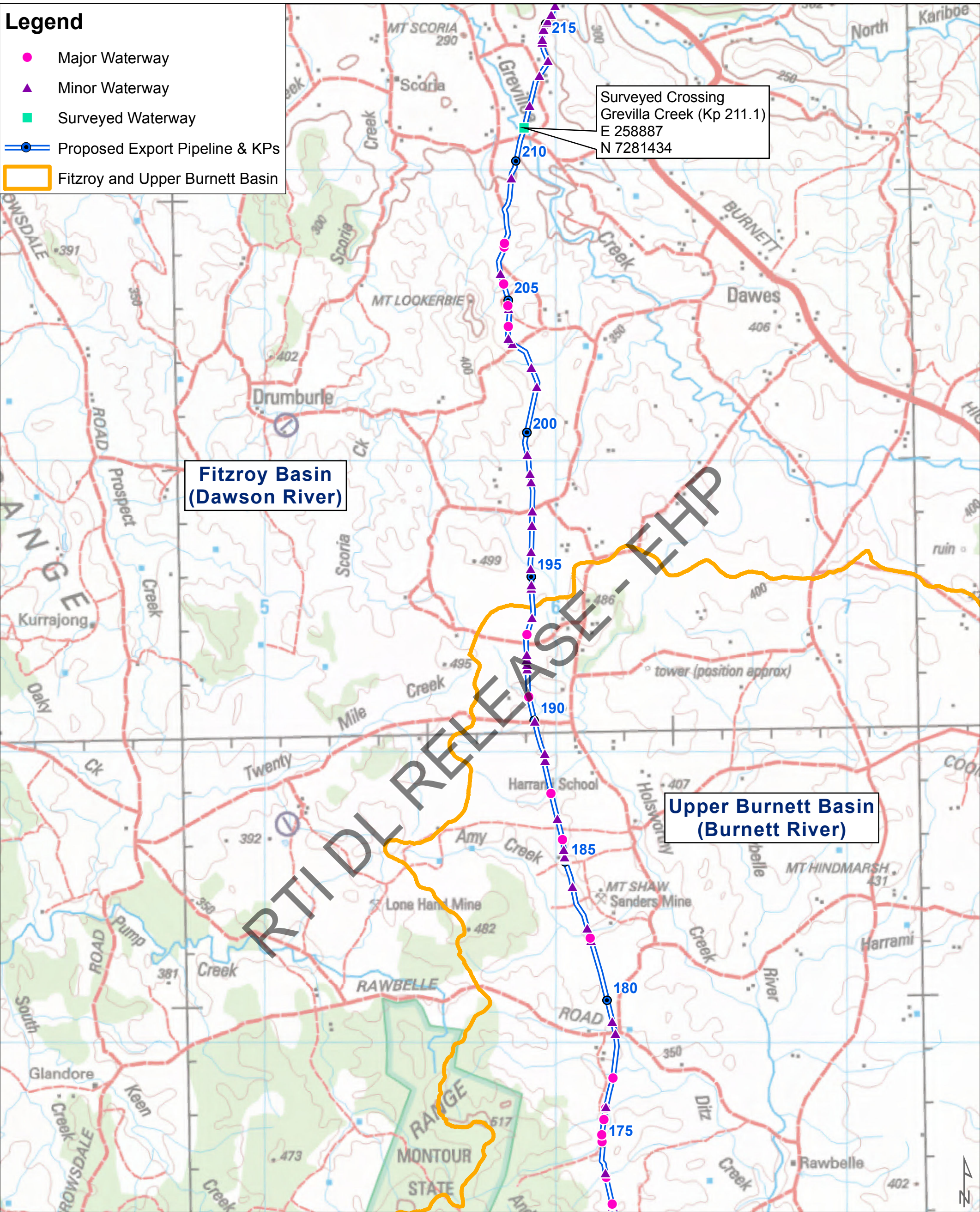
LOCATION DIAGRAM

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Legend

- Major Waterway
- Minor Waterway
- Surveyed Waterway
- Proposed Export Pipeline & KPs
- Fitzroy and Upper Burnett Basin

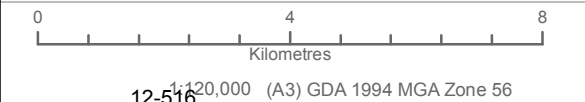


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TITLE: QCLNG Pipeline Watercourse Crossings
EP
Map 6: Kp 175 - 215

DOCUMENT NO: QCLNG-BG00-PLE-MAP-000242-06

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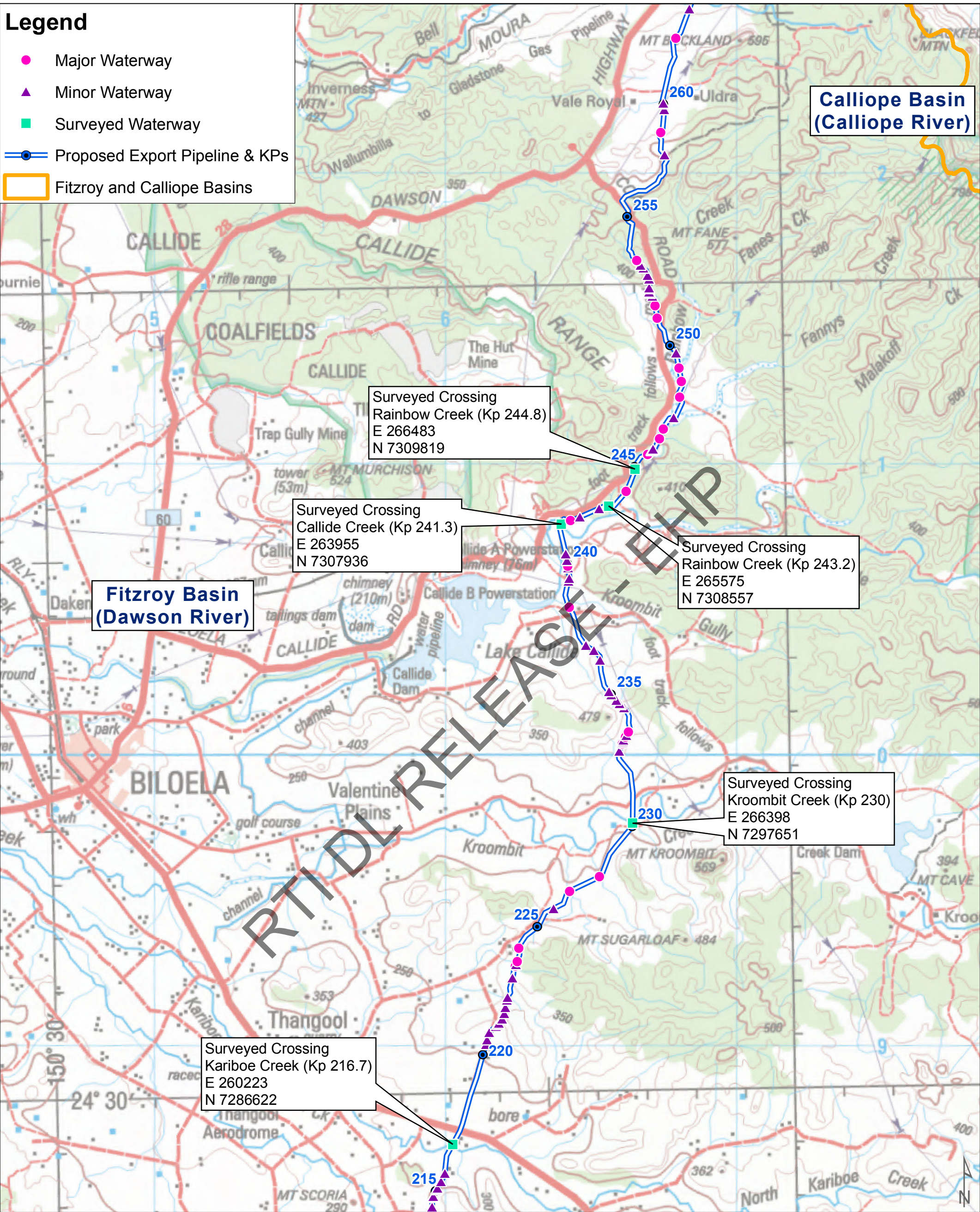


INFRASTRUCTURE ENERGY RESULTS



Legend

- Major Waterway
- Minor Waterway
- Surveyed Waterway
- Proposed Export Pipeline & KPs
- Fitzroy and Calliope Basins



QGC PTY LTD - Queensland Curtis LNG Project

LOCATION DIAGRAM

TITLE: QCLNG Pipeline Watercourse Crossings
EP
Map 7: Kp 215 - 260

DOCUMENT NO: QCLNG-BG00-PLE-MAP-000242-07

DATA SOURCE:
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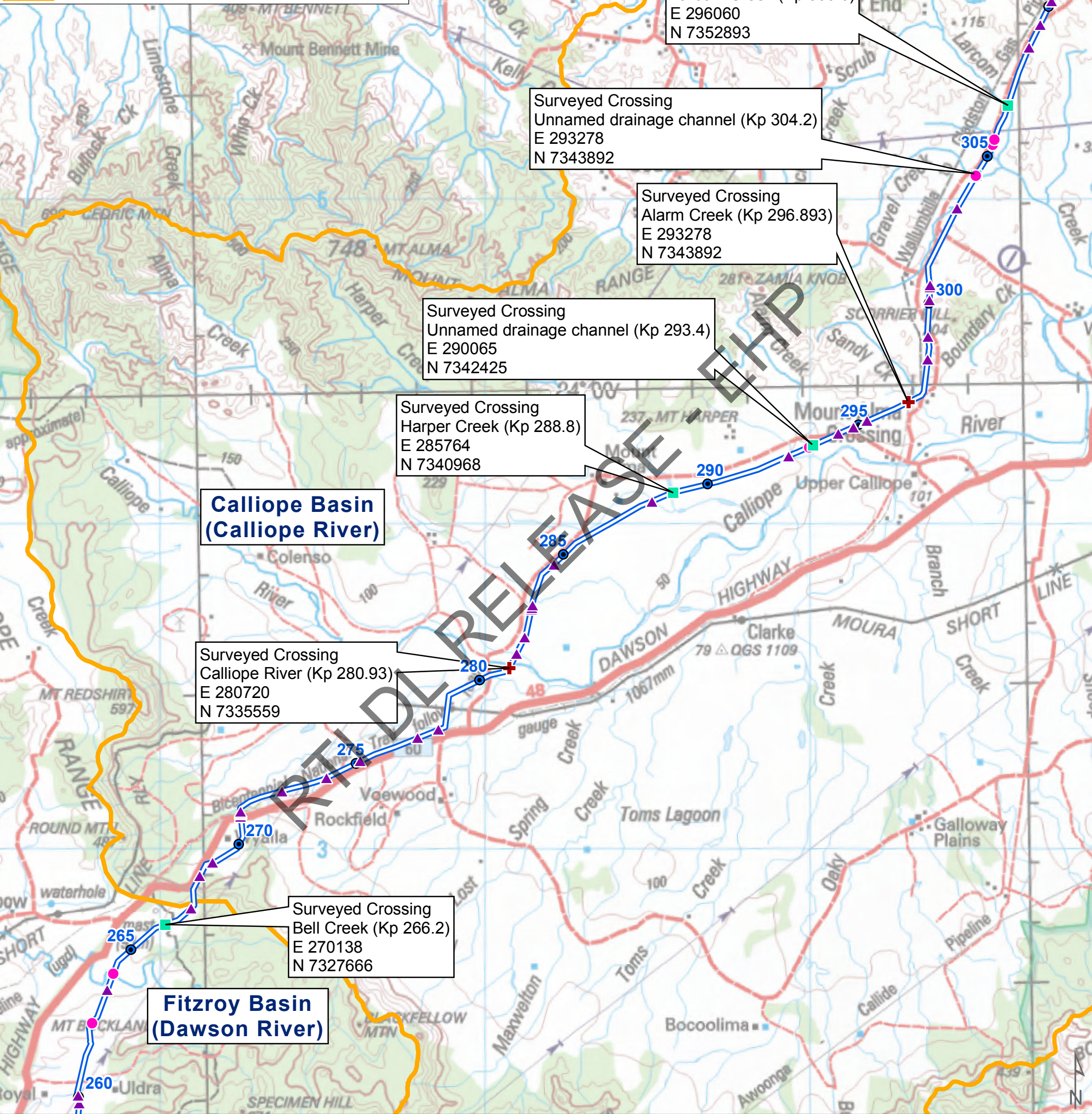
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Legend

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- Surveyed Waterway
- Horizontal Directional Drill Crossing Proposed
- Proposed Export Pipeline & KPs
- Fitzroy and Calliope Basin



QGC PTY LTD - Queensland Curtis LNG Project

LOCATION DIAGRAM

TITLE: QCLNG Pipeline Watercourse Crossings
EP
Map 8: Kp 260 - 310

DOCUMENT NO: QCLNG-BG00-PLE-MAP-000242-08

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Legend

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- Proposed Export Pipeline & KPs
- Calliope Basin



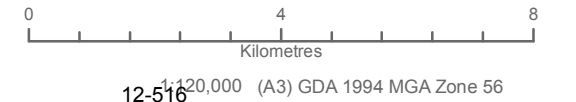
QGC PTY LTD - Queensland Curtis LNG Project

LOCATION DIAGRAM

TITLE: QCLNG Pipeline Watercourse Crossings
EP
Map 9: Kp 305 - 333.7

DOCUMENT NO: QCLNG-BG00-PLE-MAP-000242-09

DATA SOURCE:
Drainage Basins Sub Area © State of Queensland
(Department of Environment and Resource Management) 2009
Topographic Raster 1:250,000 © Commonwealth of Australia
(Geoscience Australia) 2003



DATE	AUTHOR	APPROVED	REVISION NOTE	REV.
08/07/2011	NC	JG	Issued for Review	A
13/07/2011	NC	JG	Issued for Use	0

PROPOSED PIPELINE ALIGNMENT	REVISION	DATE	SUPPLIED BY
Export Pipeline & KP's	Rev L	19-04-2011	Unidel
Collection Header & KP's	Rev K	19-04-2011	Unidel

DL Documents



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INFRASTRUCTURE ENERGY RESOLUTES



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Table 1: EP Water Crossings

KP Start	Description	Easting	Northing
9.965	WATC-3: Major Water Crossing	225590.2479	7095666.272
21.534	WATC-1: Minor Water Crossing	225704.9844	7107222.848
21.633	WATC-3: Major Water Crossing	225722.4059	7107318.932
22.972	WATC-1: Minor Water Crossing	226287.4783	7108489.139
22.980	WATC-1: Minor Water Crossing	226294.4221	7108492.843
23.314	WATC-1: Minor Water Crossing	226488.085	7108749.997
24.272	WATC-1: Roche Creek	226922.22	7109603.091
28.290	WATC-1: Minor Water Crossing	229007.4937	7112932.259
28.586	WATC-1: Minor Water Crossing	229128.9456	7113202.635
31.247	WATC-1: Minor Water Crossing	230437.0568	7115499.344
33.256	WATC-1: Minor Water Crossing	231782.5161	7116937.35
35.382	WATC-1: Minor Water Crossing	231914.3787	7119001.733
36.645	WATC-1: Minor Water Crossing	232288.4556	7120156.221
37.384	WATC-1: Minor Water Crossing	232683.6963	7120779.864
37.994	WATC-3: Major Water Crossing	233054.4188	7121264.413
39.150	WATC-1: Minor Water Crossing	233424.4361	7122348.385
41.019	WATC-1: Minor Water Crossing	234589.3239	7123798.785
44.668	WATC-3: Major Water Crossing	236239.8106	7126975.161
45.965	WATC-1: Minor Water Crossing	236882.3171	7128042.096
50.054	WATC-1: Minor Water Crossing	239713.8603	7130875.853
50.757	WATC-1: Minor Water Crossing	240012.7044	7131511.584
51.899	WATC-1: Minor Water Crossing	240317.6471	7132600.543
55.028	WATC-1: Minor Water Crossing	240798.5736	7135692.742
55.234	WATC-1: Minor Water Crossing	240830.1626	7135895.849
55.256	WATC-1: Minor Water Crossing	240833.6477	7135918.258
55.476	WATC-1: Minor Water Crossing	240867.4166	7136135.38
60.172	WATC-1: Minor Water Crossing	243065.9892	7140199.303
60.262	WATC-1: Minor Water Crossing	243138.0848	7140253.571
60.542	WATC-1: Minor Water Crossing	243347.0631	7140438.366
60.900	WATC-1: Minor Water Crossing	243586.8222	7140703.803
62.890	WATC-3: Major Water Crossing	244717.4041	7142313.896
63.691	WATC-3: Major Water Crossing	245181.0914	7142966.849
64.291	WATC-1: Minor Water Crossing	245528.5317	7143456.106
65.766	WATC-3: Lydia Creek	246467.9047	7144588.938
66.418	WATC-1: Minor Water Crossing	246909.3266	7145068.349
69.366	WATC-1: Minor Water Crossing	248195.0893	7147692.213
70.004	WATC-1: Minor Water Crossing	248383.8195	7148300.981
70.508	WATC-1: Minor Water Crossing	248533.29	7148783.113
72.599	WATC-1: Minor Water Crossing	249210.4647	7150760.504
73.178	WATC-1: Minor Water Crossing	249425.0973	7151294.426
73.383	WATC-3: Fishy Creek	249554.5747	7151454.353
78.734	WATC-3: Major Water Crossing	252372.9814	7155896.892

80.242	WATC-3: Major Water Crossing	253399.06	7156999.528
80.952	WATC-1: Minor Water Crossing	253900.092	7157503.71
80.982	WATC-1: Minor Water Crossing	253920.7258	7157524.474
82.251	WATC-3: Major Water Crossing	254840.5157	7158378.257
84.988	WATC-3: Major Water Crossing	256515.0614	7160539.729
85.019	WATC-1: Minor Water Crossing	256535.2934	7160562.685
86.269	WATC-3: Major Water Crossing	256585.9672	7161787.185
87.879	WATC-3: Major Water Crossing	256563.2069	7163397.644
88.651	WATC-1: Minor Water Crossing	256552.299	7164169.46
89.734	WATC-1: Minor Water Crossing	256450.9142	7165243.142
92.556	WATC-3: Major Water Crossing	257108.6384	7167822.193
92.783	WATC-1: Minor Water Crossing	257212.6805	7168023.733
92.783	WATC-1: Minor Water Crossing	257212.8249	7168024.103
96.644	WATC-1: Minor Water Crossing	258822.0116	7171498.414
97.447	WATC-1: Minor Water Crossing	259111.871	7172247.095
99.065	WATC-3: Auburn River	259202.3874	7173850.188
114.048	WATC-3: Thistle Creek	256792.5354	7188551.745
114.504	WATC-3: Thistle Creek	256659.4673	7188987.515
115.389	WATC-1: Minor Water Crossing	256413.6584	7189838.235
126.575	WATC-3: Major Water Crossing	256246.2368	7200720.661
127.972	WATC-1: Minor Water Crossing	256916.6518	7201947.048
129.479	WATC-1: Minor Water Crossing	257522.1008	7203301.078
133.486	WATC-1: Minor Water Crossing	257417.037	7207172.711
133.704	WATC-1: Minor Water Crossing	257480.8419	7207380.748
135.067	WATC-1: Minor Water Crossing	257880.5947	7208684.151
136.106	WATC-1: Minor Water Crossing	258185.2741	7209677.564
149.761	WATC-3: Skull Creek	262657.8256	7221912.65
150.677	WATC-3: Trevethen Creek	262683.6631	7222828.424
153.838	WATC-1: Minor Water Crossing	262685.5408	7225974.718
156.967	WATC-1: Minor Water Crossing	262723.221	7229085.136
157.549	WATC-1: Minor Water Crossing	262718.9161	7229667.092
157.566	WATC-1: Minor Water Crossing	262718.7932	7229683.709
158.741	WATC-3: Major Water Crossing	262706.4229	7230858.64
158.959	WATC-1: Minor Water Crossing	262695.0156	7231076.618
159.621	WATC-1: Minor Water Crossing	262619.5233	7231731.106
159.929	WATC-3: Major Water Crossing	262568.4962	7232030.165
160.185	WATC-3: Major Water Crossing	262616.6792	7232281.302
161.114	WATC-3: Major Water Crossing	262583.0177	7233198.129
164.495	WATC-1: Minor Water Crossing	262530.5765	7236532.034
166.920	WATC-3: Major Water Crossing	262545.9907	7238929.139
167.699	WATC-1: Minor Water Crossing	262574.7045	7239707.877
169.339	WATC-1: Minor Water Crossing	262359.8344	7241170.868
170.377	WATC-3: One Mile Creek	262212.8521	7242148.675
170.457	WATC-3: Major Water Crossing	262231.8184	7242225.976

170.659	WATC-3: Major Water Crossing	262279.8618	7242421.789
171.947	WATC-1: Minor Water Crossing	262168.5275	7243693.484
172.111	WATC-1: Minor Water Crossing	262123.5065	7243851.101
172.685	WATC-1: Minor Water Crossing	261930.7874	7244386.367
172.706	WATC-3: Major Water Crossing	261926.0275	7244406.749
172.748	WATC-3: Major Water Crossing	261916.5427	7244447.363
173.696	WATC-3: Major Water Crossing	261705.2368	7245371.768
173.854	WATC-1: Minor Water Crossing	261679.5544	7245527.463
174.959	WATC-3: Major Water Crossing	261564.7743	7246589.468
175.217	WATC-3: Major Water Crossing	261558.2557	7246841.892
175.742	WATC-3: Major Water Crossing	261632.045	7247361.646
176.126	WATC-3: Major Water Crossing	261692.9831	7247740.666
176.176	WATC-1: Minor Water Crossing	261703.2262	7247789.137
177.202	WATC-3: Ditz Creek	261939.0099	7248787.574
178.744	WATC-1: Minor Water Crossing	262020.5304	7250317.38
179.183	WATC-1: Minor Water Crossing	261916.898	7250743.466
182.044	WATC-1: Minor Water Crossing	261188.8074	7253509.739
182.146	WATC-3: Amy Creek	261160.0169	7253607.633
182.488	WATC-1: Minor Water Crossing	261063.5626	7253935.597
184.029	WATC-1: Minor Water Crossing	260555.3874	7255367.314
185.023	WATC-1: Minor Water Crossing	260279.6377	7256318.885
185.084	WATC-1: Minor Water Crossing	260274.194	7256379.911
185.340	WATC-1: Minor Water Crossing	260251.4415	7256634.97
185.695	WATC-3: Major Water Crossing	260208.7166	7256986.628
185.695	WATC-3: Major Water Crossing	260208.71	7256986.654
186.425	WATC-1: Minor Water Crossing	260030.3316	7257694.367
187.327	WATC-3: Major Water Crossing	259814.6469	7258570.324
188.479	WATC-1: Minor Water Crossing	259607.4479	7259698.162
188.713	WATC-1: Minor Water Crossing	259593.2335	7259928.178
189.885	WATC-1: Minor Water Crossing	259248.2978	7261044.268
190.752	WATC-3: Brumby Creek	259048.0107	7261887.863
191.702	WATC-1: Minor Water Crossing	258995.4739	7262835.038
191.871	WATC-1: Minor Water Crossing	258988.0322	7263004.116
192.035	WATC-1: Minor Water Crossing	258980.7977	7263168.486
192.204	WATC-1: Minor Water Crossing	258973.4036	7263336.483
192.903	WATC-3: Major Water Crossing	258988.6795	7264029.733
193.471	WATC-1: Minor Water Crossing	259149.1246	7264574.695
193.505	WATC-1: Minor Water Crossing	259158.6024	7264606.887
194.522	WATC-1: Minor Water Crossing	259136.4437	7265615.837
194.641	WATC-1: Minor Water Crossing	259137.0318	7265734.977
195.200	WATC-1: Minor Water Crossing	259112.4675	7266291.199
195.785	WATC-1: Minor Water Crossing	259134.8554	7266873.735
196.700	WATC-1: Minor Water Crossing	259159.8743	7267787.935
197.183	WATC-1: Minor Water Crossing	259169.2121	7268271.145

198.192	WATC-1: Minor Water Crossing	259134.883	7269276.143
198.486	WATC-1: Minor Water Crossing	259089.4018	7269566.443
199.130	WATC-1: Minor Water Crossing	258995.8509	7270203.75
201.513	WATC-1: Minor Water Crossing	259320.2097	7272533.292
202.226	WATC-1: Minor Water Crossing	259144.9518	7273203.928
203.319	WATC-1: Minor Water Crossing	258492.829	7274009.044
203.598	WATC-1: Minor Water Crossing	258343.705	7274217.35
203.992	WATC-3: Major Water Crossing	258348.6768	7274608.568
204.621	WATC-1: Minor Water Crossing	258354.0543	7275232.154
204.714	WATC-3: Major Water Crossing	258329.3007	7275322.487
205.498	WATC-3: Major Water Crossing	258181.9102	7276068.86
205.877	WATC-1: Minor Water Crossing	258074.7848	7276432.309
206.836	WATC-3: Major Water Crossing	258204.5705	7277343.354
206.969	WATC-3: Major Water Crossing	258210.9245	7277476.409
209.301	WATC-1: Minor Water Crossing	258448.4238	7279708.843
211.093	WATC-3: Grevillia Creek	258887.4174	7281434.419
211.882	WATC-1: Minor Water Crossing	259075.3507	7282200.763
212.981	WATC-1: Minor Water Crossing	259412.2734	7283235.403
213.600	WATC-1: Minor Water Crossing	259709.9446	7283756.175
214.262	WATC-1: Minor Water Crossing	259519.2794	7284382.618
214.349	WATC-1: Minor Water Crossing	259517.1488	7284469.01
214.677	WATC-1: Minor Water Crossing	259533.8205	7284791.757
214.721	WATC-1: Minor Water Crossing	259552.3044	7284831.775
214.969	WATC-1: Minor Water Crossing	259662.7241	7285053.483
215.036	WATC-1: Minor Water Crossing	259695.1769	7285112.624
215.297	WATC-1: Minor Water Crossing	259820.6169	7285341.223
215.617	WATC-1: Minor Water Crossing	259950.6219	7285629.133
216.665	WATC-3: Kariboe Creek	260223.0225	7286622.24
220.287	WATC-1: Minor Water Crossing	261361.0326	7290049.417
220.448	WATC-1: Minor Water Crossing	261404.0352	7290204.222
220.710	WATC-1: Minor Water Crossing	261474.1842	7290456.752
221.024	WATC-1: Minor Water Crossing	261709.8875	7290661.709
221.128	WATC-1: Minor Water Crossing	261782.5418	7290734.982
221.130	WATC-1: Minor Water Crossing	261783.7608	7290736.499
221.179	WATC-1: Minor Water Crossing	261814.2262	7290774.395
221.358	WATC-1: Minor Water Crossing	261926.438	7290913.976
221.568	WATC-1: Minor Water Crossing	261993.1145	7291108.009
221.786	WATC-1: Minor Water Crossing	262036.3684	7291321.766
222.033	WATC-1: Minor Water Crossing	262085.4139	7291564.145
222.129	WATC-1: Minor Water Crossing	262104.389	7291657.919
222.852	WATC-1: Minor Water Crossing	262276.913	7292340.74
223.272	WATC-3: Major Water Crossing	262378.6423	7292745.737
223.321	WATC-1: Minor Water Crossing	262395.5103	7292792.233
223.440	WATC-3: Major Water Crossing	262436.0629	7292904.017

223.914	WATC-3: Major Water Crossing	262491.471	7293361.848
225.796	WATC-1: Minor Water Crossing	263686.3254	7294721.309
226.673	WATC-3: Major Water Crossing	264240.0299	7295317.58
227.808	WATC-3: Major Water Crossing	265263.0903	7295810.219
230.020	WATC-3: Kroombit Creek	266397.9905	7297650.971
232.642	WATC-1: Minor Water Crossing	265947.0327	7300122.793
232.914	WATC-3: Major Water Crossing	266042.1971	7300377.443
232.953	WATC-1: Minor Water Crossing	266055.7266	7300413.647
232.997	WATC-1: Minor Water Crossing	266071.3406	7300455.428
233.054	WATC-1: Minor Water Crossing	266091.1751	7300508.504
233.179	WATC-3: Major Water Crossing	266152.5876	7300617.573
233.247	WATC-1: Minor Water Crossing	266186.6772	7300675.729
233.382	WATC-3: Major Water Crossing	266255.1027	7300792.462
234.278	WATC-1: Minor Water Crossing	266106.3346	7301614.764
234.441	WATC-1: Minor Water Crossing	265991.1046	7301730.887
234.500	WATC-1: Minor Water Crossing	265949.6499	7301772.663
234.652	WATC-1: Minor Water Crossing	265842.9322	7301880.208
234.902	WATC-1: Minor Water Crossing	265674.428	7302065.132
235.042	WATC-1: Minor Water Crossing	265587.7476	7302175.098
236.188	WATC-1: Minor Water Crossing	265284.095	7303251.306
236.610	WATC-1: Minor Water Crossing	265066.1951	7303582.775
236.938	WATC-1: Minor Water Crossing	264799.1345	7303769.072
238.392	WATC-3: Major Water Crossing	264223.9014	7305082.179
239.324	WATC-1: Minor Water Crossing	264201.7274	7305975.923
239.419	WATC-1: Minor Water Crossing	264227.5902	7306067.372
239.780	WATC-1: Minor Water Crossing	264184.025	7306423.97
239.849	WATC-3: Major Water Crossing	264173.9735	7306492.535
240.036	WATC-1: Minor Water Crossing	264144.1624	7306677.13
240.273	WATC-1: Minor Water Crossing	264104.3176	7306910.112
241.341	WATC-3: Callide Creek	263954.6732	7307935.916
241.770	WATC-3: Major Water Crossing	264266.4181	7308059.186
242.122	WATC-1: Minor Water Crossing	264597.8671	7308177.527
242.836	WATC-1: Minor Water Crossing	265250.6506	7308465.483
243.178	WATC-3: Rainbow Creek	265574.8178	7308556.758
244.017	WATC-3: Major Water Crossing	266177.1491	7309059.049
244.838	WATC-3: Rainbow Creek	266482.8392	7309819.476
245.557	WATC-3: Rainbow Creek	266914.8146	7310326.078
245.746	WATC-1: Minor Water Crossing	267052.8007	7310454.851
245.779	WATC-1: Minor Water Crossing	267077.4695	7310476.761
245.818	WATC-1: Minor Water Crossing	267107.023	7310503.009
246.251	WATC-3: Rainbow Creek	267324.332	7310872.051
246.601	WATC-3: Rainbow Creek	267456.3423	7311194.265
247.179	WATC-1: Minor Water Crossing	267813.4392	7311591.685
248.021	WATC-3: Rainbow Creek	268011.7827	7312303.661

248.590	WATC-3: Rainbow Creek	268077.5234	7312834.063
249.064	WATC-3: Major Water Crossing	267993.8232	7313300.669
249.580	WATC-1: Minor Water Crossing	267893.3045	7313805.946
250.998	WATC-3: Major Water Crossing	267241.3161	7315005.305
251.447	WATC-3: Major Water Crossing	267172.0658	7315444.558
251.795	WATC-1: Minor Water Crossing	267079.6574	7315763.881
251.920	WATC-1: Minor Water Crossing	267001.9674	7315860.792
251.970	WATC-1: Minor Water Crossing	266973.979	7315902.486
252.091	WATC-1: Minor Water Crossing	266968.5921	7316019.401
252.123	WATC-1: Minor Water Crossing	266971.1663	7316051.64
252.417	WATC-1: Minor Water Crossing	266966.1806	7316343.495
252.553	WATC-1: Minor Water Crossing	266922.903	7316472.622
252.853	WATC-1: Minor Water Crossing	266776.6839	7316724.605
252.996	WATC-1: Minor Water Crossing	266670.6801	7316820.293
253.209	WATC-3: Major Water Crossing	266539.5588	7316985.625
258.060	WATC-1: Minor Water Crossing	267500.2979	7320626.198
258.908	WATC-3: Major Water Crossing	267371.1278	7321382.236
259.709	WATC-1: Minor Water Crossing	267488.062	7322160.825
259.923	WATC-1: Minor Water Crossing	267460.1056	7322369.913
259.948	WATC-1: Minor Water Crossing	267453.0393	7322394.255
262.303	WATC-3: Major Water Crossing	267885.7723	7324633.513
263.424	WATC-1: Minor Water Crossing	268346.7495	7325643.243
263.967	WATC-3: Bell Creek	268535.5488	7326152.8
266.241	WATC-1: Minor Water Crossing	270138.2346	7327665.641
267.193	WATC-1: Minor Water Crossing	270928.4119	7328164.614
268.272	WATC-1: Minor Water Crossing	271197.502	7329156.616
268.891	WATC-1: Minor Water Crossing	271585.698	7329567.99
270.794	WATC-1: Minor Water Crossing	272455.5617	7330982.057
270.878	WATC-1: Minor Water Crossing	272447.9155	7331064.838
270.912	WATC-1: Minor Water Crossing	272447.7308	7331098.97
270.950	WATC-1: Minor Water Crossing	272447.5239	7331137.221
272.454	WATC-1: Minor Water Crossing	273719.6382	7331767.704
273.885	WATC-1: Minor Water Crossing	275090.2656	7332171.706
275.046	WATC-1: Minor Water Crossing	276128.7965	7332691.233
276.952	WATC-1: Minor Water Crossing	277894.4991	7333403.154
277.647	WATC-1: Minor Water Crossing	278541.4061	7333657.697
280.930	WATC-4: Calliope River	280719.6854	7335559.303
281.424	WATC-1: Minor Water Crossing	280940.5935	7336000.602
281.982	WATC-1: Minor Water Crossing	281191.9462	7336499.448
282.881	WATC-1: Minor Water Crossing	281403.3186	7337370.235
282.935	WATC-1: Minor Water Crossing	281414.6381	7337423.254
283.008	WATC-1: Minor Water Crossing	281429.8574	7337494.539
284.477	WATC-1: Minor Water Crossing	282092.9932	7338744.442
288.093	WATC-1: Minor Water Crossing	285108.5919	7340690.65

288.806	WATC-3: Harper Creek	285763.8314	7340968.181
292.476	WATC-1: Minor Water Crossing	289259.5023	7342058.369
292.532	WATC-1: Minor Water Crossing	289310.7563	7342081.415
293.226	WATC-4: Major Water Crossing	289943.9268	7342366.121
294.205	WATC-1: Minor Water Crossing	290836.6754	7342767.547
294.722	WATC-1: Minor Water Crossing	291307.8074	7342979.393
295.127	WATC-1: Minor Water Crossing	291677.4803	7343145.617
295.144	WATC-1: Minor Water Crossing	291692.9504	7343152.573
295.176	WATC-1: Minor Water Crossing	291722.5345	7343165.875
296.836	WATC-1: Minor Water Crossing	293226.3451	7343866.538
296.893	WATC-3: Major Water Crossing	293278.2713	7343892.107
298.174	WATC-1: Minor Water Crossing	293592.88	7345070.06
298.870	WATC-1: Minor Water Crossing	293604.6189	7345760.916
299.992	WATC-1: Minor Water Crossing	293645.7032	7346881.201
300.377	WATC-1: Minor Water Crossing	293667.7676	7347265.354
300.400	WATC-1: Minor Water Crossing	293665.7499	7347288.289
300.464	WATC-1: Minor Water Crossing	293660.1614	7347351.815
303.033	WATC-1: Minor Water Crossing	294493.1511	7349711.97
304.188	WATC-3: Major Water Crossing	295071.0345	7350712.017
305.273	WATC-3: Major Water Crossing	295584.5634	7351662.282
305.295	WATC-3: Major Water Crossing	295591.6659	7351682.791
305.456	WATC-3: Major Water Crossing	295644.3905	7351835.033
306.595	WATC-3: Larcom Creek	296060.1319	7352892.596
308.486	WATC-1: Minor Water Crossing	296712.8264	7354665.056
309.270	WATC-1: Minor Water Crossing	297053.3413	7355370.784
310.061	WATC-1: Minor Water Crossing	297396.0945	7356084.53
311.112	WATC-3: Major Water Crossing	297920.0051	7356992.371
313.403	WATC-3: Major Water Crossing	299164.3422	7358621.444
314.013	WATC-1: Minor Water Crossing	299253.7929	7359224.943
315.869	WATC-1: Minor Water Crossing	298974.3957	7360974.383
322.366	WATC-3: Major Water Crossing	298167.4719	7366110.478
323.721	WATC-1: Minor Water Crossing	299129.4113	7367016.685
324.104	WATC-1: Minor Water Crossing	299385.1215	7367301.307
324.137	WATC-1: Minor Water Crossing	299407.1042	7367325.776
324.179	WATC-1: Minor Water Crossing	299435.444	7367357.32
324.191	WATC-1: Minor Water Crossing	299443.1213	7367365.865
325.225	WATC-1: Minor Water Crossing	300214.5605	7368049.683
325.873	WATC-1: Minor Water Crossing	300654.9804	7368524.41
326.280	WATC-1: Minor Water Crossing	301014.66	7368706.179
326.844	WATC-1: Minor Water Crossing	301499.3993	7368980.22
327.088	WATC-1: Minor Water Crossing	301652.7315	7369168.691
327.334	WATC-1: Minor Water Crossing	301748.8382	7369392.388
327.535	WATC-1: Minor Water Crossing	301880.7169	7369544.461
327.798	WATC-1: Minor Water Crossing	302057.9401	7369732.838

327.821	WATC-1: Minor Water Crossing	302061.2703	7369756.477
328.214	WATC-1: Minor Water Crossing	302268.3721	7370069.412
328.445	WATC-1: Minor Water Crossing	302480.9756	7370155.835
328.646	WATC-1: Minor Water Crossing	302645.3772	7370256.029
328.901	WATC-1: Minor Water Crossing	302784.9015	7370469.221
329.268	WATC-1: Minor Water Crossing	302986.1436	7370776.717
329.382	WATC-1: Minor Water Crossing	303067.2642	7370854.981
329.577	WATC-1: Minor Water Crossing	303217.2878	7370978.918
329.722	WATC-1: Minor Water Crossing	303349.7467	7371036.821
330.607	WATC-1: Minor Water Crossing	304079.6469	7371477.657
331.234	WATC-1: Minor Water Crossing	304614.8753	7371769.531
332.436	WATC-1: Minor Water Crossing	305758.0243	7371942.15
332.459	WATC-1: Minor Water Crossing	305781.0909	7371939.445
333.418	WATC-1: Minor Water Crossing	306721.402	7371829.339

RTI DL RELEASE - EHP

APPENDIX III – SIGNIFICANT SPECIES MANAGEMENT PLANS

RTI DL RELEASE - EHP

Appendix III – A: *Maccullochella peelii peelii* (Murray Cod)

Significant Species Management Plan			
Maccullochella peelii peelii (Murray Cod)			
EPBC Act Conservation Status	Vulnerable		 © Gunther Schmida and © Jean-Paul Ferrero/AUSCAPE
NC Act Conservation Status	Not Listed		
Known Distribution	Formerly widespread throughout the Murray-Darling system and originally found in virtually all waterways of that system, including small streams (TSSC 2003). In the Project area, it occurs in the Condamine and Balonne River catchments, including smaller streams in large permanent or sometimes semi-permanent waterholes and weirs. Refer to the back of this section for a detailed illustration of the potential habitat of the Murray Cod in relation to the QCLNG Pipeline alignment.		
Potential Distribution within Project area	GCH ✓	EP ✓	
	KP0 to KP150	KP0 to KP20	
Biology and Reproduction	The Murray Cod is a long-lived predatory fish that can live between 75 to 114 years (Rowland 1988). Longevity is thought to be a survival strategy for many native fish, and particularly the Murray Cod, in enabling them to outlast prolonged periods of drought, so as to capitalise on exceptional conditions for spawning and recruitment when they do occur. The species has relatively low fecundity (fertility) compared to many other freshwater fish. Egg counts range from <10,000 eggs for a barely mature female to approximately 90,000 for females around 22		

Department of Sustainability and Environment,
Melbourne

	<p>kg. Older fish appear to be the most successful breeders as they display more optimal breeding behaviours in comparison to younger fish.</p> <p>The species will breed with or without spring-floods, including in low flow conditions in lightly regulated rivers; they will spawn in reservoirs and farm dams (although survival of larvae is very poor in these situations). Contrary to earlier opinions, the Murray Cod have been shown to be adaptable breeders, able to recruit under a variety of natural river flow conditions and habitats, including low flow and upland habitats, although waters need to be in reasonable health and not heavily regulated. Impoundments can hinder breeding success, and it appears essential that river environments are allowed to flood so that fish can migrate throughout the river system. Fish are known to make upstream spawning migrations of up to 120 km when conditions are favourable.</p>
Preferred Habitat and Microhabitat	<p>This species occupies a diverse range of habitats, from small, clear, rocky, upland streams with riffle and pool structure on the upper western slopes of the Great Dividing Range to large, meandering, slow-flowing, often silty rivers in the alluvial lowland reaches of the Murray-Darling Basin.</p> <p>The Murray Cod prefers deep holes with cover in the form of large rocks, fallen trees, stumps, clay banks and overhanging vegetation.</p> <p>It is highly dependent on in stream woody structures for habitat, is highly territorial and very aggressive (Crook and Robertson 1999).</p>
Threats	<p>Over-fishing has historically played a major role in the decline of the Murray Cod. Both recreational and commercial fishing severely depleted populations in the latter half of the nineteenth century.</p> <p>River regulation has also been an important factor. The construction of dams and weirs has interfered with the natural flow of many streams. In particular dams and weirs curtail or halt completely, the spring floods in lowland rivers that create the zooplankton-rich conditions which are one of the conditions under which the strongest recruitment occurs. With no spring floods, the Murray Cod is unable to recruit in large numbers in many lowland rivers and opportunities for migration and colonisation are also lost.</p> <p>Dams and weirs also alter water temperatures by releasing from the base of the wall into downstream environments. Lower temperatures can severely limit the survival and growth of larvae and juvenile fish.</p> <p>River-de-snagging has removed critical habitat in many areas, particularly where rivers were opened up for boat access, such as the Darling River, as far upstream as Bourke. Snags are critical habitat for Murray Cod of all sizes, vital spawning sites, and in the silty alluvial lowland rivers of the Murray-Darling system, one of the few hard substrates available and thus critical sites for algae, bacteria, fungi and aquatic invertebrates.</p> <p>Yet another significant problem, particular for upland rivers or smaller lowland rivers holding has been siltation of the streams through clearing of native riparian (river-bank) vegetation and the effects of introduced large, hard-hooved animals such as cattle which trample the river banks. Erosion has led to increased deposits of silt and the loss of deep holes and stream bed diversity. Cattle and sheep grazing also contribute considerably to the removal of vegetation and breaking up of riparian soil and are considered to be a major cause of siltation.</p> <p>Competition between Murray Cod and introduced species such as Carp, has also had a significant impact on the health of Murray Cod populations.</p>
Potential Impacts from the QCLNG Pipeline	<p>Construction of the QCLNG Pipeline will involve disturbance of watercourses within the Balonne and Condamine River Catchments (Balonne Condamine Basin). Potential impacts to the Murray Cods habitat include (but are not limited too):</p> <ul style="list-style-type: none"> Impacts to habitat caused by construction process disturbing aquatic plants and riparian

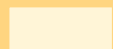
	<p>trees and vegetation that encroach into the stream channel providing important fish habitat in the form of snags and overhangs;</p> <ul style="list-style-type: none"> • Impediment to Murray Cod passage when temporary waterway barriers are created during the construction process and adequate provision is not made for stream flow; • A decline in water quality from: use of machinery in creek beds with flowing water or an accidental release of oil or other chemicals into the watercourse; and accidental discharge of hydrotest water to a watercourse. • Dispersion of weed species if vehicles are located within the stream environment and have not been subject to an appropriate 'washdown' after relocating from weed impacted areas; and • Erosion and sedimentation of watercourses if: <ul style="list-style-type: none"> - physical disturbance to the bed and banks of the watercourse occurs during construction and work areas are not adequately barricaded; - watercourse banks are not rehabilitated adequately or in an appropriate manner; - erosion of the RoW leads to surface water runoff into watercourses or if a heavy rainfall event occurs during or immediately after construction. • Impacts on watercourse depths and hydrology through altered topography of low and high flow banks as well as alluvial terraces.
Management Strategies	<p>There are inherent difficulties associated with the assessment of aquatic values, particularly the presence of MNES fauna species, below the water level of highly turbid watercourses such as those within the Project area.</p> <p>As the Murray Cod has not been identified in the field through detailed pre-construction Aquatic Values Surveys undertaken by Department of Sustainability Environment Water Population and Communities (SEWPaC) approved ecologists, the primary management strategy is to focus on the avoidance and protection of any individuals which may be encountered, and avoidance, protection and reinstatement of their habitat. Various mitigation measures outlining how this will be undertaken are detailed in the following section as well as in the QCLNG Pipeline Aquatic Values Management Plan (AVMP).</p> <p>If during construction the Murray Cod is positively identified, either within a dewatering area associated with construction activities or otherwise, this individual will be relocated in accordance with mitigation measures below. Reporting to the Department of Environment and Resource Management (DERM) and SEWPaC will be undertaken in accordance with project reporting requirements and this SSMP will be updated with details of the specific site where the Murray Cod was identified.</p> <p>No offsets for the Murray Cod are proposed at this stage as there has been no identification of impact, and post construction rehabilitation, particularly at locations of good quality aquatic habitat, will be undertaken in a manner which will restore the habitat of the Murray Cod and other aquatic fauna.</p> <p>However, should the Murray Cod be positively identified at a location which has been identified in the Aquatic Values Survey as having moderate or good quality aquatic habitat capable of supporting the species, and it is determined by the QCLNG Environmental Representative that there has been unavoidable impacts to this habitat, SeWPac shall be consulted regarding potential offset requirements. Off-set measures may include identification and restoration of</p>

	<p>degraded areas of Murray Cod habitat, or other actions to improve the viability of the species in the wild. Any offset requirements shall be incorporated into the QGC Offsets Program.</p>
Mitigation Measures	<p>Pipeline construction will comply with general mitigation measures and management actions outlined within the AVMP. To avoid further impacts to this species additional details relating specifically to the Murray Cod are as follows:</p> <ul style="list-style-type: none"> • Major watercourses have been avoided along the Pipeline alignment where possible, and the number of watercourse crossings have been minimised; • Where reasonably possible watercourses with good aquatic values within the habitat of the Murray Cod shall be traversed by HDD construction methodology, thus reducing potential impacts to hydrological patterns, topography and riparian vegetation. • If Murray Cod are identified in dewatering areas associated with construction activities, or in pools upstream or downstream that are impacted as a result of any temporary flow disruptions, they shall be managed as appropriate by a qualified fauna spotter/catcher and relocated to a suitable aquatic environment outside of the work area. • All recorded sightings and relocations of Murray Cod shall be reported to DERM and SEWPaC as part of the Project reporting. • In watercourses identified in the Aquatic Values Survey as having high potential habitat for the Murray Cod (namely the Condamine River, Columboola Creek, Wambo Creek and Dogwood Creek) construction works shall not be undertaken during the breeding season for this species (from mid-October to mid-December). • As part of routine pre-start meetings, work crews shall be briefed on any known and potential environmental constraints occurring in that work location, including any likely significant flora and fauna species such as the Murray Cod and good quality habitat areas which are to be avoided. • Wherever practicable, signage shall be erected to increase the general awareness amongst work crews of the presence of Murray Cod and their habitat; • Pipeline trenching shall transect the watercourses at right angles so as to preserve as much riverine vegetation as possible; • Clearing of large riverine trees and areas of good quality habitat shall be avoided where possible. Those areas to be retained shall be specifically marked as 'no go zones' with high visibility flagging or barricading. • RoW clearing width shall be reduced to 30 metres or less wherever possible in riverine areas to minimise impacts to the riparian and aquatic environment. • To minimise impacts to passage of the Murray Cod any diversion of water flows during the watercourse construction works shall be undertaken for the minimal possible time. • Details on bed level crossings contained within Table 1 of the AVMP shall be followed to ensure no impacts to the passage of the Murray Cod. • The existing contours of the riverine environment shall be maintained or reinstated following construction so that erosion and sedimentation of the watercourse is minimised and the opportunity for restoration of good quality aquatic habitat is maximised.

	<p>Watercourse banks shall be returned to a stable and self sustaining state post construction and vegetation re-established by seeding.</p> <ul style="list-style-type: none"> • Logs and debris shall be selectively replaced in water bodies after construction as shelter and breeding habitat. • Dust suppression measures shall be implemented during construction to minimise impacts to water quality and riparian vegetation. • Fire is considered to be of minor concern for the management of this species, although newly burnt riverine environments may be destabilised and contribute significantly to erosion and siltation, at least at a local scale. Fire management measures shall take into account the need to protect remnant vegetation from frequent and hot fires. On site fire management practices shall be in accordance with Contractor HSSE requirements, relevant construction permits and method statements and appropriate dedicated fire fighting equipment will be available at high risk construction sites to manage any fires that may start up and to avoid wildfires breaking out; and • Should non-compliance with the mitigation measures or management strategies outlined in this SSMP occur on site an investigation shall be undertaken by all responsible parties followed by corrective action procedures if required. Work in the area will cease at the time of the non-compliance if the incident is deemed significant by the QCLNG Environmental Representative.
Performance Measures	<p>Should impacts to the species occur, successful Project operation will be indicated by a net conservation benefit of identified Murray Cod habitat, in known areas of occurrence.</p> <p>Should impacts to this species be identified a revision to the overarching QGC Offsets Program offsets package shall be prepared to include specific measures for the offsetting of specific habitat.</p>
Monitoring	<p>An appropriate monitoring program shall be established in conjunction with the relevant authority once any impact to the Murray Cod is identified.</p>
References	<p>Rowland S. (1988). Murray Cod. Agfact F3.2.4, New South Wales Agriculture and Fisheries, Sydney.</p> <p>Crook, D.A. and Robertson A.I. (1999). Relationships between riverine fish and woody debris: implications for lowland rivers. <i>Marine and Freshwater Research</i> 50: 941-953.</p>



Legend

-  Proposed Export Pipeline & KPs
-  Proposed Gas Collection Header & KPs
-  Potential Distribution of Murray Cod

QGC PTY LTD - Queensland Curtis LNG Project

TITLE: Potential Distribution of Murray Cod within the Study Area

DOCUMENT NO: QCLNG-BX00-ENV-MAP-000066-02

DATA SOURCE:
Drainage Basins Sub Area © State of Queensland (Department of Environment and Resource Management) 2009
Topographic Raster 1:250,000 © Commonwealth of Australia (Geoscience Australia) 2003

DATE	AUTHOR	APPROVED	REVISION	NOTE	REV.
18/07/2011	KS	JG	Issued for Use		0

01020Kilometres

1251675,000 (A3) GCS GDA 1994

PROPOSED PIPELINE ALIGNMENT

 Export Pipeline & KP's

 Collection Header & KP's

REVISION

Rev L

Rev K

DL Documents

DATE

19-04-2011

19-04-2011

SUPPLIED BY

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INFRASTRUCTURE ENERGY RESULTS



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Appendix III – B: *Rheodytes leukops* (Fitzroy River Turtle)

Significant Species Management Plan <i>Rheodytes leukops</i> (Fitzroy River Turtle)		
EPBC Act Conservation Status	Vulnerable	
NC Act Conservation Status	Vulnerable	
Known Distribution	<p>The Fitzroy River Turtle is only found in the drainage system of the Fitzroy River in Queensland. Known sites include Boolburra, Gainsford, Glenroy Crossing, Theodore, Baralaba, the Mackenzie River, the Connors River, Duaringa, Marlborough Creek, and Gogango (J. Cann cited in Cogger et al. 1993; Covacevich et al. 1996; Tucker et al. 2001; Venz 2002).</p> <p>Refer to the back of this section for a detailed illustration of the QCLNG Pipeline in relation to the Fitzroy River Catchment.</p>	
Potential Distribution within Project area	<div><div>GCH</div><div>✓</div></div> <div>KP 150 to end</div>	<div><div>EP</div><div>✓</div></div> <div>KP 0 to KP 32 and KP 194 to KP 267</div>
Biology and Reproduction	<p>The Fitzroy River Turtle reaches sexual maturity between 15-20 years (Limpus 2007).</p> <p>Nesting occurs between September and October (Legler 1985). Females lay between 46-59 eggs on river sandbanks 1-4 m above water level (Cann 1998; Cogger et al. 1993) and it takes between 47 (Cann 1998) and up to 90 days (Legler 1985) to hatch.</p>	
Preferred Habitat and Microhabitat	<p>This species is mostly found in rivers with large deep pools with rocky, gravelly or sandy substrates, connected by shallow riffles. Its preferred areas have high water clarity, and are often associated with Ribbon weed (<i>Vallisneria</i> sp.) beds (Cogger et al. 1993). Common riparian vegetation associated with the Fitzroy River turtle includes Blue Gums (<i>Eucalyptus tereticornis</i>), River Oaks (<i>Casuarina cunninghamiana</i>), Weeping Bottlebrushes (<i>Callistemon viminalis</i>) and Paperbarks (<i>Melaleuca linariifolia</i>) (Tucker et al. 2001).</p>	
Threats	<p>The main threats faced by the Fitzroy River turtle include:</p>	

	<ul style="list-style-type: none"> • Egg predation; and • Habitat modification such as; <ul style="list-style-type: none"> - The construction of weirs and dams; - Erosion of banks from cattle; and - Clearing of riparian vegetation leading to erosion and bank instability.
Potential Impacts from the QCLNG Pipeline	<p>The Project will involve the disturbance of minor and major watercourses within the Fitzroy River Catchment. Potential impacts to the Fitzroy River Turtle habitat include (but are not limited too):</p> <ul style="list-style-type: none"> • Impacts to habitat caused by construction process disturbing aquatic plants (i.e. Ribbon weed) and riparian trees and vegetation that offer habitat structure, bank stability and foraging resources; • Disturbance to nesting sites through trenching activities or machinery compaction; • A decline in water quality from: use of machinery in creek beds with flowing water or an accidental release of oil or other chemicals into the watercourse; and accidental discharge of hydrotest water to a watercourse; • A decline in water quality through sedimentation caused by physical disturbance to the bed and banks of the watercourse; • Impacts on watercourse depths and hydrology through altered topography of low and high flow banks as well as alluvial terraces; • Dispersion of weed species if vehicles are located within the stream environment and have not been subject to an appropriate 'washdown' after relocating from weed impacted areas; and • Erosion and sedimentation of watercourses if: <ul style="list-style-type: none"> - physical disturbance to the bed and banks of the watercourse occurs during construction and work areas are not adequately barricaded; - watercourse banks are not rehabilitated adequately or in an appropriate manner; - erosion of the RoW leads to surface water runoff into watercourses; or if a heavy rainfall event occurs during or immediately after construction.
Management Strategies	<p>There are inherent difficulties associated with the assessment of aquatic values, particularly the presence of MNES fauna species, below the water level of highly turbid watercourses such as those within the Project area.</p> <p>As the Fitzroy River Turtle has not been identified in the field through detailed pre-construction Aquatic Values Surveys undertaken by Department of Sustainability Environment Water Population and Communities (SEWPaC) approved ecologists, the primary management strategy is to focus on the avoidance and protection of any individuals which may be encountered, and avoidance, protection and reinstatement of their habitat. Various mitigation measures outlining how this will be undertaken are detailed in the following</p>

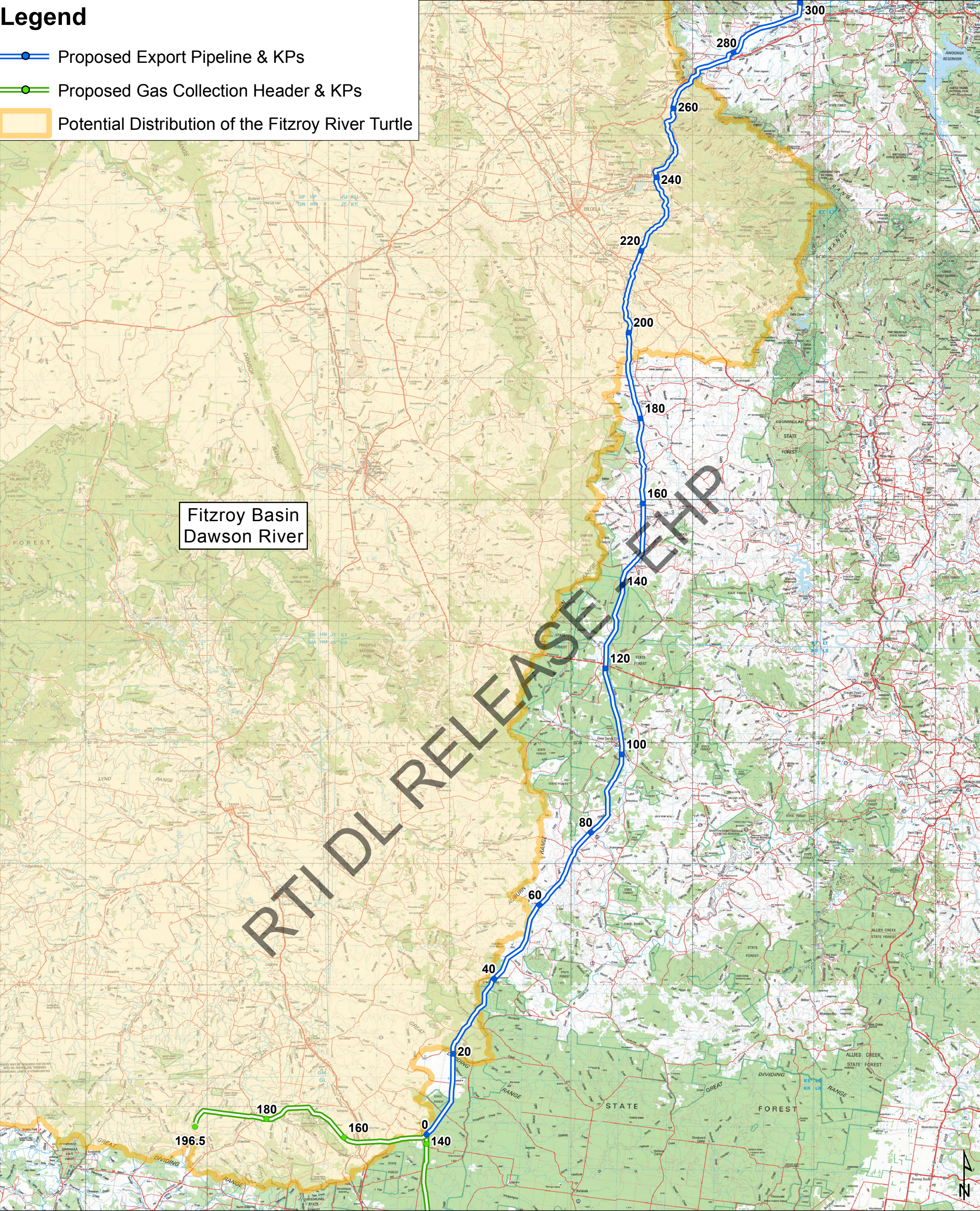
	<p>section as well as in the QCLNG Pipeline Aquatic Values Management Plan (AVMP).</p> <p>If during construction the Fitzroy River Turtle is positively identified, either within the banks or in a dewatering area associated with construction activities or otherwise, this individual will be relocated in accordance with mitigation measures below. Reporting to the Department of Environment and Resource Management (DERM) and SEWPac will be undertaken in accordance with project reporting requirements and this SSMP will be updated with details of the specific site where the Fitzroy River Turtle was identified.</p> <p>No offsets for the Fitzroy River Turtle are proposed at this stage as there has been no identification of impact, and post construction rehabilitation, particularly at locations of good quality aquatic habitat, will be undertaken in a manner which will restore the habitat of the Murray Cod and other aquatic fauna.</p> <p>However, should the Fitzroy River Turtle be positively identified at a location which has been identified in the Aquatic Values Survey as having moderate or good quality aquatic habitat capable of supporting the species, and it is determined by the QCLNG Environmental Representative that there has been unavoidable impacts to this habitat, SeWPac shall be consulted regarding potential offset requirements. Off-set measures may include identification and restoration of degraded areas of Fitzroy River Turtle habitat, or other actions to improve the viability of the species in the wild. Any offset requirements shall be incorporated into the QGC Offsets Program.</p> <p>Should a Fitzroy River Turtle breeding place (i.e. nest) be identified and it is determined that disturbance or tampering to the breeding site is unavoidable the management strategy will be to follow the procedures outlined in the <i>QCLNG Pipeline Species Management Program: Tampering with the Breeding Place of a Protected Animal Species</i> as approved by DERM. However this situation is unlikely to occur as construction work will not be occurring at locations of potential habitat during the breeding and nesting season of the Fitzroy River Turtle in accordance with the Conditions of EPBC Approval 2008/4399.</p>
Mitigation Measures	<p>Pipeline construction will comply with general mitigation measures and management actions outlined within the AVMP. To avoid further impacts to this species additional details relating specifically to the Fitzroy River Turtle are as follows:</p> <ul style="list-style-type: none"> • Major watercourses have been avoided along the Pipeline alignment where possible, and the number of watercourse crossings have been minimised; • Where reasonably possible watercourses with good aquatic values within the habitat of the Fitzroy River Turtle shall be traversed by HDD construction methodology, thus reducing potential impacts to hydrological patterns, topography and riparian vegetation. • A pre clear and grade walkthrough shall be undertaken by suitably qualified, experienced and licenced fauna spotter/handlers prior to any work activities being undertaken. Any Fitzroy River Turtle which are identified shall be relocated to a suitable aquatic environment outside of the work area. • Fauna spotter/handlers shall check water bodies and trenches regularly to ensure no Fitzroy River Turtles are harmed. If Fitzroy River Turtle are identified in trenches or dewatering areas associated with construction activities, or in pools upstream or downstream that are impacted as a result of any temporary flow disruptions, they shall be managed as appropriate by a qualified fauna spotter/catcher and relocated to a suitable aquatic environment outside of the work area. • Any injured Fitzroy River Turtles shall be transported to a veterinarian or recognised

	<p>wildlife carer immediately for treatment.</p> <ul style="list-style-type: none"> • Clearing shall be carried out in a sequential manner and in a way that directs escaping wildlife and aquatic fauna away from clearing and into adjacent sections of the watercourse. • Regular monitoring of trenches to be undertaken in accordance with the monitoring section of this SSMP to ensure no impacts to the Fitzroy River Turtle. • All recorded sightings and relocation of the Fitzroy River Turtle shall be reported to DERM and SEWPaC as part of the Project reporting. • In watercourses identified in the Aquatic Values Survey as having high potential habitat for the Fitzroy River Turtle (namely Kroombit Creek and Callide Creek) construction works shall not be undertaken during the breeding and nesting season for this species (from the start of September to the end of October). • As part of routine pre-start meetings, work crews shall be briefed on any known and potential environmental constraints occurring in that work location, including any likely significant flora and fauna species such as the Fitzroy River Turtle and good quality habitat areas which are to be avoided. • Wherever practicable, signage shall be erected to increase the general awareness amongst work crews of the presence of Fitzroy River Turtle and their habitat. • Vehicle activities shall be restricted to roads, access tracks and hardened surfaces where practicable to reduce potential impacts to the Fitzroy River Turtle. • Pipeline trenching shall transect the watercourses at right angles so as to preserve as much riverine vegetation as possible. • Clearing of large riverine trees and areas of good quality habitat shall be avoided where possible. Those areas to be retained shall be specifically marked as 'no go zones' with high visibility flagging or barricading. • RoW clearing width shall be reduced to 30 metres or less wherever possible in riverine areas to minimise impacts to the riparian and aquatic environment. • The existing contours of the riverine environment shall be maintained or reinstated following construction so that erosion and sedimentation of the watercourse is minimised and the opportunity for restoration of good quality aquatic habitat is maximised. Watercourse banks shall be returned to a stable and self sustaining state post construction and vegetation re-established by seeding. • Logs and debris shall be selectively replaced in water bodies after construction as shelter and breeding habitat. • Dust suppression measures shall be implemented during construction to minimise impacts to water quality and riparian vegetation. • Fire is considered to be of minor concern for the management of this species, although newly burnt riverine environments may be destabilised and contribute significantly to erosion and siltation, at least at a local scale. Fire management measures shall take into account the need to protect remnant vegetation from frequent and hot fires. On site fire management practices shall be in accordance with Contractor HSSE requirements,
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	<p>relevant construction permits and method statements and appropriate dedicated fire fighting equipment will be available at high risk construction sites to manage any fires that may start up and to avoid wildfires breaking out.</p> <ul style="list-style-type: none"> Should non-compliance with the mitigation measures or management strategies outlined in this SSMP occur on site an investigation shall be undertaken by all responsible parties followed by corrective action procedures if required. Work in the area will cease at the time of the non-compliance if the incident is deemed significant by the QCLNG Environmental Representative.
Rehabilitation and Recovery	<p>Immediately after construction works have ceased, restoration activities shall commence. This includes remediating the creek banks back to a pre-construction profile, ensuring flows are not impeded and commencing rehabilitation with local native species appropriate to the riparian zone to stabilise banks and restore habitat. Details will be provided as per site specific rehabilitation plans.</p> <p>Sediment and erosion control measures shall be installed as required on watercourse approaches and banks to prevent any runoff from entering watercourses.</p> <p>In-stream structures removed during construction shall be replaced to maintain habitat complexity and mitigate environmental flows and erosion.</p>
Performance Measures	<p>Should impacts to the species occur, successful Project operation will be indicated by a net conservation benefit and continued presence of the species in known areas of occurrence.</p> <p>Should impacts to this species be identified as per the Management Strategies section of this SSMP a revision to the overarching QGC Offsets Program shall be prepared to include measures for the offsetting of specific habitat for the Fitzroy River Turtle.</p>
Monitoring	<p>An appropriate monitoring program, incorporating the monitoring of any offset site where applicable, shall be established in conjunction with the relevant authority once any impact to the Fitzroy Turtle is identified.</p> <p>In areas where the Fitzroy River Turtle is likely to be present, fauna spotters/handlers must monitor pipeline trenches twice daily (early morning and late afternoon) every day while the trenches are open and have access to the site in all weather. In all other areas fauna spotters/handlers shall monitor trenches at least once daily.</p>
References	<p>Cann, J. (1998). <i>Australian Freshwater Turtles</i>. Singapore: Beaumont Publishing Pty Ltd.</p> <p>Legler, J.M. (1985). Australian chelid turtles: reproductive patterns in wide-ranging taxa. In: Grigg, G., R. Shine and H. Ehmann, eds. <i>Biology of Australasian Frogs and Reptiles</i>. Page(s) 117-123. Sydney: Royal Zoological Society of NSW.</p> <p>Limpus, C. (2007). <i>Conservation Management Profile: Fitzroy River turtle - Rheodytes leukops</i>. [Online]. Queensland: Environmental Protection Agency. Available from: http://www.epa.qld.gov.au/publications/p02331aa.pdf/Fitzroy_River_turtle_emRheodytes_leukops/em.pdf. [Accessed: 16-Oct-2008].</p> <p>Tucker, A.D., Limpus, C.J. Priest, T.E. Cay, J. Glen, C. and Guarino E. (2001). Home ranges of Fitzroy River turtles (<i>Rheodytes leukops</i>) overlap riffle zones: potential concerns related to river regulation. <i>Biological Conservation</i> 102(2):171-181.</p>

Legend

- Proposed Export Pipeline & KPs
- Proposed Gas Collection Header & KPs
- Potential Distribution of the Fitzroy River Turtle



QGC PTY LTD - Queensland Curtis LNG Project

LOCATION DIAGRAM

TITLE: Potential Distribution of Fitzroy River Turtle within the Study Area

DOCUMENT NO: QCLNG-BX00-ENV-MAP-000066-01

DATA SOURCE:
Drainage Basins Sub Area © State of Queensland
(Department of Environment and Resource Management) 2009
Topographic Raster 1:250,000 © Commonwealth of Australia
(Geoscience Australia) 2003

0 25 50
Kilometres

1:250,000 (A3) GCS GDA 1994

DATE	AUTHOR	APPROVED	REVISION	NOTE	REV.
18/07/2011	KS	JG		Issued for Use	0

PROPOSED PIPELINE ALIGNMENT	REVISION	DATE	SUPPLIED BY
Export Pipeline & KP's	Rev L	19-04-2011	Unidel
Collection Header & KP's	Rev K	19-04-2011	Unidel
	DL Documents		

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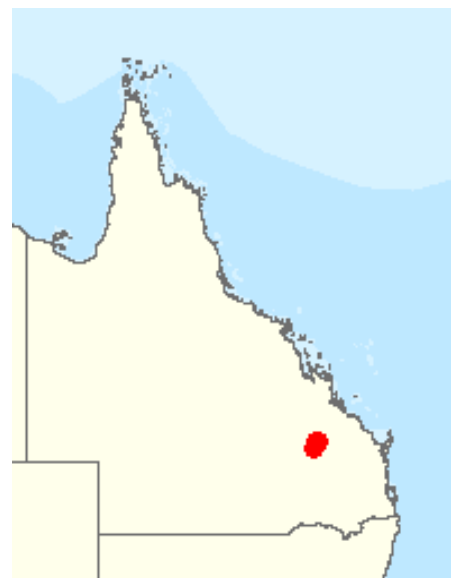
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Appendix III – C: *Adclarkia dawsonensis* (Boggomoss Snail)

Significant Species Management Plan <i>Adclarkia dawsonensis</i> (Boggomoss Snail)		
EPBC Act Conservation Status	Critically Endangered	
NC Act Conservation Status	Not Listed	
Known Distribution	<p>Living populations of <i>Adclarkia dawsonensis</i> are currently documented from only two localities in the Greater Taroom area. One is situated adjacent to a boggomoss (artesian spring) on Mt Rose Station. A second and seemingly more robust population is present on a camping and water reserve on the Isla-Delusion crossing of the Dawson River approximately halfway between Taroom and Theodore (Stanisic 2008).</p> <p>The total destruction of its preferred habitat (riparian on alluvial flats in the Dawson River Valley) led to the suggestion that the Boggomoss Snail has undergone a severe reduction in numbers. In the past, it is suspected that the snail was much more widely spread on these flats (Stanisic 2008).</p> <p>SunWater are proposing the construction of the Nathan Dam on the Dawson River - 70 kilometres downstream of Taroom. In early 2009 the Boggomoss Snail population within the dam area was estimated at 850.</p> <p>SunWater undertook snail surveys in 2010 to search previously unexamined locations within the vicinity of the proposed Nathan Dam, located on the Dawson River approximately 70 km downstream of Taroom. The surveys were successful and resulted in the discovery of an estimated 18,000 individuals.</p> <p>Refer to the back of this section for a detailed illustration of the potential habitat derived from Regional Ecosystems known to be associated with the Boggomoss Snail and their relation to the QCLNG Pipeline alignment.</p>	
Potential Distribution within Project area	<p>GCH</p> <p>x</p>	<p>EP</p> <p>✓</p> <p>West of KP 95</p>



Image: Stanisic (2008)



DSEWPC 2011

Biology and Reproduction	<p>There is nothing known of the life history of the Boggomoss Snail (Stanisic 2008).</p> <p>The snail is a free sealer (i.e. it lies free in the litter or soil under logs, sealing its aperture with a calcified mucous covering called an epiphragm) while it hibernates during very dry periods. In semi-arid and arid areas snails aestivate through many months of dry while they await the return of the wet season.</p>
Preferred Habitat and Microhabitat	<p>Based on knowledge of the species' current distribution in the Taroom area the Boggomoss Snail appears to prefer grassy eucalypt woodland (Speck 1968) on alluvial flats along drainage lines (Stanisic 1996).</p> <p>This landscape equates to Regional Ecosystems (REs) 11.3.3 and 11.3.4 of Sattler and Williams (1999). These are described as forests and grassy woodland to open woodland of <i>Eucalyptus tereticornis</i>, <i>E. camaldulensis</i> and <i>E. coolabah</i> on Cainozoic alluvial plains. Closer to the drainage line, the same species occur with a distinct mid and lower storey of sandpaper figs and the 'Rare' Carnavon fan palm <i>Livistona nitida</i>. This community is best described as RE 11.3.25.</p> <p>Key habitat requirements for the Boggomoss Snail are a well-developed leaf litter layer for food, shelter and breeding sites, and a good coverage of vegetation to support the leaf litter environment and maintain a moist microclimate (Stanisic 2008).</p>
Threats	<p>Major threats faced by the Boggomoss Snail include:</p> <ul style="list-style-type: none"> • Land clearing; • Fire. Fire affects both the snail directly (incineration, dehydration) and indirectly through the destruction of microhabitat (litter and logs); • Grazing. Cattle grazing (through compression of litter and direct trampling of snails) and quarrying cause habitat destruction and ultimately will cause a decline in snail numbers; • Weed infestation. Weeds have the potential to alter both the lower shrub layer and consequent litter as well as contributing to an increased fuel load; • Earthworks. Earthworks, such as quarrying or smaller scale earthmoving associated with roadworks, have the potential to affect the snail habitat either directly by removal or by associated run-off from operations; and • Changes to hydrology. Construction activities such as dam or weir can cause inundation of the snail's boggomoss habitat. Interruption of normal river flows also has the potential to dry the riparian vegetation community.
Potential Impacts from the QCLNG Pipeline	<p>The Project will involve the disturbance of Regional Ecosystems known to support potential habitat for the Boggomoss Snail. Potential impacts to the Boggomoss Snail's habitat include (but are not limited too):</p> <ul style="list-style-type: none"> • The destruction of habitat, including removal of trees and disturbance of leaf litter; • Immediate severance of habitat patches potentially separating populations, increasing edge impacts and potential for predation; and • Changes to the frequency and intensity of fires as a result of project activities or the introduction of environmental weeds which may increase fuel loads and combustibility in riverine habitats.
Management	<p>As the Boggomoss Snail has not been identified in the field through the Aquatic Values Survey or the terrestrial pre-clearance surveys, the primary management strategy is to focus on the</p>

Strategies	<p>identification and avoidance of individuals and their habitat.</p> <p>Various mitigation measures outlining how this will occur are detailed in the following section.</p> <p>Should Boggomoss Snail be identified, the area of habitat with appropriate buffer zone, as defined by a licensed fauna spotter/handler, will be clearly flagged and identified as a “no go” zone with appropriate flagging material as determined by the site Environment Representative. Works shall not occur within this ‘no go’ zone until the appropriate steps have been undertaken and approval has been provided by the site Environment Representative. Appropriate steps include identifying the potential for relocation and other mitigation measures if direct harm is expected to occur to the Boggomoss Snail.</p> <p>Reporting to the Department of Environment and Resource Management (DERM) and SEWPaC will be undertaken in accordance with project reporting requirements and this SSMP will be updated with details of the specific site where the Boggomoss Snail was identified.</p> <p>No offsets for the Boggomoss Snail are proposed at this stage as there has been no identification of impact, and post construction rehabilitation, particularly at locations of good quality riparian habitat, will be undertaken in a manner which is will restore the habitat.</p> <p>However if it is identified that there will be unavoidable impacts to the Boggomoss Snail, off-set measures will be proposed and necessary discussions will be undertaken with SEWPaC to confirm requirements. Off-set measures may include identifying degraded areas of their habitat and restoring them, or other actions to improve their viability in the wild. Any offset requirements shall be incorporated into the QGC Offsets Program.</p>
Mitigation Measures	<p>Pipeline construction shall comply with general mitigation measures and management actions outlined within the AVMP. To avoid further impacts to this species additional details relating specifically to the Boggomoss Snail are as follows:</p> <ul style="list-style-type: none"> • Pipeline trenching shall transect the watercourses at right angles, so as to preserve as much riverine vegetation as possible; • Large riverine trees shall be specifically marked and avoided where possible; • The existing contours of the riverine environment shall be maintained or reinstated following construction so that erosion and scouring is minimised; • Where reasonably possible watercourses with good aquatic values and within Regional Ecosystems (REs) 11.3.3, 11.3.4 and 11.3.25 shall be traversed by HDD construction methodology, thus reducing potential impacts to hydrological patterns, topography and riparian vegetation; • In situations where erosion might occur, the banks shall be returned to stable state post construction and vegetation re-established by seeding; • As part of routine pre-start meetings, work crews shall be briefed on any known and potential environmental constraints occurring in that work location, including any likely significant flora and fauna species, populations and TEC they may encounter; • As Boggomoss Snail occurs in riverine environments within REs 11.3.3, 11.3.4 and 11.3.25 these areas will be incorporated into the field Environmental Constraints Maps so that these high risk areas can be subject to closer scrutiny by suitably qualified, experienced and licenced fauna spotters/handlers during a pre clear and grade walkthrough; • Where possible, clearing areas will be reduced to 30 m to minimise impacts within riverine areas and specific high risk micro habitat areas identified by fauna spotters/handlers;

	<ul style="list-style-type: none"> • All disturbance of vegetation related to the construction and on-going maintenance of the pipeline shall be limited to the RoW and associated sites, with the total clearing width of the RoW being no greater than 40 m; • If the Boggomoss Snail is identified within the clearance area or within close proximity to it, these sites shall be clearly marked out as a 'no go' zone with appropriate flagging material and/or barricade webbing as determined by the site Environment Representative. An appropriate buffer zone as determined by the licensed fauna spotter/handler shall also be applied and marked out around the area. These areas shall be recorded by GPS and mapped in the Environmental Constraints Mapping as temporary 'no go' zones until management actions are finalised; • Clearing activities shall carry on around the outside of any defined buffer zone until appropriate actions to manage the species have been determined in conjunction with the relevant regulatory authorities. Management procedures outlined above under 'Management Strategies' will be followed; • All recorded sightings of the Boggomoss Snail shall be reported to DERM and SEWPaC as part of the Project reporting; • Dust suppression measures shall be implemented to minimise dust deposition in habitat areas; • Vehicle activities shall be restricted to roads, access tracks and hardened surfaces to reduce potential impacts to threatened species including the Boggomoss Snail; • Fire management measures shall take into account the need to protect remnant vegetation from frequent and hot fires. On site fire management practices shall be in accordance with Contractor HSSE requirements, relevant construction permits and method statements and appropriate dedicated fire fighting equipment will be available at high risk construction sites to manage any fires that may start up and to avoid wildfires breaking out; and • Should non-compliance with the mitigation measures or management strategies outlined in this SSMP occur on site an investigation shall be undertaken by all responsible parties followed by corrective action procedures if required. Work in the area will cease at the time of the non-compliance if the incident is deemed significant by the site QCLNG Environmental Representative.
Performance Measures	<p>Should impacts to the species occur, successful Project operation will be indicated by a net conservation benefit of identified Boggomoss Snail habitat, in known areas of occurrence.</p> <p>Should impacts to this species be identified a revision to the overarching QGC Offsets Program will be prepared to include measures for the offsetting of specific habitat for the Boggomoss Snail.</p>
Monitoring	<p>An appropriate monitoring program, incorporating the monitoring of any offset site where applicable, will be established in conjunction with the relevant authority once any impact to the Boggomoss Snail is identified.</p> <p>In areas where the Boggomoss Snail are likely to be present, fauna spotters/handlers shall monitor pipeline trenches twice daily (early morning and late afternoon) every day while the trenches are open and have access to the site in all weather. In all other areas fauna spotters/handlers shall monitor trenches at least once daily.</p>

References	<p>Sattler P.S. and Williams, R.D. (eds.) (1999). 'The Conservation status of Queensland's Bioregional Ecosystems'. Environmental Protection Agency, Brisbane.</p> <p>Speck, N. H. (1968). Vegetation of the Dawson-Fitzroy area. Pp. 157-173. In 'Lands of the Dawson-Fitzroy Area, Queensland'. Land Research Series No. 21. CSIRO, Australia.</p> <p>Stanisic, J. (2008). <i>Recovery Plan for the boggomoss snail</i> <i>Adclarkia dawsonensis</i>. [Online]. Report to Department of the Environment and Water Resources, Canberra. Brisbane, Queensland: Parks and Wildlife Service. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/a-dawsonensis.html.</p>
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APPENDIX IV – CHECKLIST OF RELEVANT SEWPaC CONDITIONS

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Relevant Condition	Compliance	Comment
<p>35. Where reasonably possible, horizontal directional drilling must be used for major waterway crossings, including:</p> <p>a. those within the Dawson, Calliope and Condamine River catchments and any water crossings within the known distribution of the Fitzroy River Turtle (<i>Rheodytes leukops</i>) and Murray Cod (<i>Maccullochella peelii peelii</i>). Pipeline construction across waterways within the known distribution of the Fitzroy River Turtle must not take place during the nesting and breeding season;</p>	Yes	<ul style="list-style-type: none"> Refer to Section 2.2 for a description of watercourse crossing techniques and Section 2.2.2 regarding feasibility of the HDD construction technique. Refer to Section 7.2 and Table 1 for an explanation of the selected construction technique at Major watercourse crossings and key mitigation measures. Refer to the AVMAP at Table 2 for detailed construction mitigation measures, including commitments to undertaking work outside of the nesting and breeding season for the Fitzroy River Turtle.
<p>b. Humpie and Targine Creeks</p>	Yes	<ul style="list-style-type: none"> The Pipeline RoW does not traverse the Humpie or Targine Creeks. Refer to the scope of the Pipeline AVMP in Section 1.2.
<p>36. Trenchless techniques are not required in minor creek beds within the known distribution of the Fitzroy River Turtle (<i>Rheodytes leukops</i>) and Murray Cod (<i>Maccullochella peelii peelii</i>) where there is no water at the crossing site and the distance to the nearest water is sufficient to buffer any potential impacts resulting from the crossing technique.</p>	Yes	<ul style="list-style-type: none"> Refer to Section 2.2 for a description of watercourse crossing techniques and Section 2.2.1 regarding construction commitments to working in Minor watercourses. Refer to Section 7.1 for an explanation of the selected construction technique at Minor watercourse crossings and key mitigation measures including the commitment to the use of an appropriate buffer zone. Refer to the AVMAP at Table 2 for detailed construction mitigation measures, including commitments to undertaking work outside of the nesting and breeding season for the Fitzroy River Turtle and the Murray Cod.
<p>37. The proponent must prepare an Aquatic Values Management Plan. This plan must include:</p> <p>a. a detailed assessment of aquatic values, including animal breeding locations for listed threatened and migratory species within the RoW;</p>	Yes	<ul style="list-style-type: none"> Refer to the Aquatic Values Survey Report and Addendum (Appendix I and Appendix V) for a detailed assessment of aquatic values including animal breeding locations. Refer to Section 5 of the AVMP for a discussion of the Aquatic Values Survey Report.
<p>b. measures to minimise impacts on listed riparian, aquatic and water dependant flora and fauna;</p>	Yes	<ul style="list-style-type: none"> Refer to Section 7 for a discussion of key mitigation measures Refer to the AVMAP (Table 2), Part 2.2 Protection of Aquatic and Riparian Fauna and Part 2.3 Protection of Aquatic and Riparian Flora, for detailed construction mitigation measures.

Relevant Condition	Compliance	Comment
<i>c. measures to minimise erosion and sediment impacts to waterways;</i>	Yes	<ul style="list-style-type: none"> Refer to Part 2.6 of the AVMAP (Table 2), Erosion and Sediment Control, for detailed construction mitigation measures.
<i>d. measures to maintain water quality and water flow requirements, including treatment and disposal methods for hydrostatic test water;</i>	Yes	<ul style="list-style-type: none"> Refer to Part 2.5 of the AVMAP (Table 2), Protection of Water Quality, for detailed construction mitigation measures.
<i>e. site-specific mitigation measures for any potential impacts from construction and operation of the pipeline on listed threatened species, including but not limited to the Fitzroy River Turtle.</i>	Yes	<ul style="list-style-type: none"> Refer to site specific mitigation measures for each surveyed watercourse crossing identified within Sections 4 and 5 of the Aquatic Values Survey Report and Addendum (Appendix I and Appendix V) Refer to the AVMAP (Table 2), Part 2.2 Protection of Aquatic and Riparian Fauna and Part 2.3 Protection of Aquatic and Riparian Flora, for commitment to further development of site specific mitigation measures where applicable. Refer to the Significant Species Management Plans for the Fitzroy River Turtle, Murray Cod and Boggomoss Snail at Appendix III.
<i>The Aquatic Values Management Plan must be approved in writing by the Minister. Activities the subject of the Plan must not start without approval. The Plan must be implemented</i>	Yes	<ul style="list-style-type: none"> SEWPac Approval of the QCLNG Pipeline AVMP provided in writing to QGC on Friday 30th September 2011.

APPENDIX V – ADDENDUM TO AQUATIC VALUES SURVEY REPORT

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QCLNG Project

Addendum to Technical Report – Aquatic Values Survey

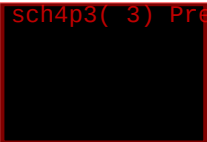
Survey of Condamine River and Columboola Creek

QGC020-ENV-RPT-0025

Rev 1

RTI DL RELEASE - EHP

Release authorisation

Originator	Sophie Cowie Ecologist
Reviewed	Leigh Knight Senior Environmental Planner
Approved	Richard Floyd Principal Ecologist Signed: 

Revision record

Rev	Date	Status	Originator	Reviewed	Approved
A	17 Oct 2011	Draft	SC	JG	RF
1	7 Dec 2011	Final	SC	LK	RF

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1 Introduction

1.1 Scope

This report is provided as an addendum to the Unidel Technical Report – Aquatic Values Survey: Gas Collection Header and Export Pipeline (Unidel document ref: QGC020-ENV-RPT-0014). It has been prepared as part of the Queensland Curtis Liquefied Natural Gas (QCLNG) project and details the findings of an aquatic ecology survey undertaken between 11th and 12th October 2011 that assessed the potential occurrence of matters of national significance (MNES) and general aquatic values of the Condamine River and Columboola Creek. This survey was undertaken to supplement an original survey of watercourses along the QCLNG Gas Collection Header (GCH) and Export Pipeline (EP) undertaken in June 2011.

The Condamine River and Columboola Creek are located at kilometre point (KP) 68.6 and KP 90.1 of the Gas Collection Header (GCH) respectively. The aquatic environment within the vicinity of these two crossing points is referred to as the Study area throughout the remainder of this addendum report.

1.2 Objectives

The purpose of the aquatic ecology survey, and the preparation of this report, is to identify the aquatic habitat values of the Condamine River and Columboola Creek at the proposed Pipeline Right of Way (RoW) crossing locations and provide an assessment of the potential impacts at these locations to inform and enable updating of the QCLNG Pipeline Aquatic Values Management Plan (AVMP) (QCLNG-BG00-ENV-RPT-000009). These water bodies are both within the gas collection header area (GCH) alignment. This addendum has been prepared to identify any potential MNES at these crossing locations and address potential impacts.

The overarching objective of the survey was to satisfy the SEWPaC Conditions relating to aquatic and riparian MNES as specified in EPBC Approval 2008/4399.

1.3 Definitions and abbreviations

In this document, the following definitions and abbreviations apply:

Term/abbreviation	Meaning
AVMP	Aquatic Values Management Plan
DERM	Department of Environment and Resource Management
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
EP	Export Pipeline
GCH	Gas Collection Header
HDD	Horizontal Directional Drilling
MNES	Matters of National Environmental Significance
QCLNG	Queensland Curtis Liquefied Natural Gas
RE	Regional Ecosystem

Term/abbreviation	Meaning
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities
TEC	Threatened Ecological Community

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1.4 References

In this document, the following documents are referenced:

Title
Kearney, R.E & M.A. Kildea (2001). <i>The Status of the Murray Cod in the Murray-Darling Basin</i> . Page(s) 66pp. [Online]. Environment Australia. Available from: http://www.environment.gov.au/water/publications/mdb/pubs/murray-cod.pdf .
Koehn, J. (1996). Habitats and movements of freshwater fish in the Murray-Darling Basin. In proc. <i>1995 Riverine Environment Research Forum</i> (Ed's. R.J. Banens and R. Lehan) pp. 27-37. October 1995. Attwood Victoria. Publ. Murray-Darling Basin Commission.
National Murray Cod Recovery Team (2009). <i>Draft National Recovery Plan for the Murray Cod <i>Maccullochella peelii peelii</i></i> . Melbourne: Department of Sustainability and Environment.
Native Fish Australia Incorporated (2004). <i>Murray Cod</i> . [Online]. Available from: http://www.nativefish.asn.au/cod.html .
Sattler, P. & Williams, R (Eds) (1999). <i>The conservation status of Queensland's bioregional ecosystems</i> . Environmental Protection Agency, Brisbane.
Speck, N. H. (1968). Vegetation of the Dawson-Fitzroy area. Pp. 157-173. In 'Lands of the Dawson-Fitzroy Area, Queensland'. <i>Land Research Series</i> No. 21. CSIRO, Australia.
Stanisic, J. (2008). <i>Recovery Plan for the boggomoss snail <i>Adclarkia dawsonensis</i></i> . [Online]. Report to Department of the Environment and Water Resources, Canberra. Brisbane, Queensland: Parks and Wildlife Service. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/a-dawsonensis.html .

2 Matters of National Environmental Significance

A preliminary desktop assessment was undertaken to determine which aquatic and riparian MNES species and communities may potentially occur within the Study area. This assessment consisted of a review of the following documents:

- Relevant published literature for the wider Study area;
- Department of Environment and Resource Management (DERM) Wildlife Online;
- Matters of National Environmental Significance (MNES) Online;
- Directory of Important Wetlands (Blackman et al. 1999);
- DERM's Biodiversity Planning Assessment which identifies ecological features and values of local, regional and state significance as recognised by the DERM and Queensland Museum;
- DERM's remnant vegetation and essential habitat mapping; and
- Unidel Technical Report – Aquatic Values Survey: Gas Collection Header and Export Pipeline (Unidel document ref: QGC020-ENV-RPT-0014).

Following the preliminary desktop assessment, two threatened species were identified as worthy of further investigation including Murray Cod (*Maccullochella peelii peelin*) and Boggomoss Snail (*Adclarkia dawsonensis*).

The findings of the desktop assessment are discussed below.

2.1 Species identified from Preliminary Desktop Assessment

2.1.1 Murray Cod

Habitat Preference

The Murray Cod (*Maccullochella peelii peelin*) is listed as Vulnerable under the EPBC Act.

The species occurs naturally in the waterways of the Murray Darling Basin in a wide range of warm water habitats from clear, rocky streams to slow-flowing turbid rivers and billabongs (McDowall 1996). Wood debris and overhanging banks are important for the species and sampling should focus on habitats for adults. Generally, the species is found in waters up to 5m deep and in sheltered areas with cover from rocks, timber or overhanging banks (Kearney & Kildea 2001). The species is highly dependent on wood debris for habitat, using it to shelter from fast flowing water (Koehn 1996).

Life Cycle and Range

Murray Cod migrate upstream prior to spawning when water temperatures increase, with spawning occurring around mid-October to mid-December (Humphries 2005; Koehn & Harrington 2005a; 2005b).

Spawning sites are usually sunken red gum logs or submerged rocks but occasionally Murray Cod will excavate and lay eggs in depressions in clay banks (Native Fish 2004). Hatching will generally occur 5-7 days after fertilisation, with a batch of eggs hatching over a 3-4 day period (Kearney & Kildea 2001). The species has a relatively low reproductive rate compared to many other freshwater fish (Native Fish 2004). The Murray Cod reaches sexual maturity at 4 to 5 years of age and at 2 to 3kg in weight.

Murray Cod are sedentary during late summer, autumn and winter (Koehn 1996), staying within their "territory" (Kearney & Kildea 2001), which they continually return to after each spawning (Koehn 1996). Migratory tendencies and distances travelled when migrating upstream prior to spawning vary considerably between individual fish but many travel 40 or 50km upstream, some travelling up to 120km upstream (Koehn 1996; Native Fish 2004).

Feeding

The diet of Murray Cod changes with age, with the typical adult diet consisting of spiny crayfish, yabbies and shrimps (National Murray Cod Recovery Team 2009). It also feeds on other fish species such as Bony Herring, Catfish, Golden Perch, Western Carp Gudgeon and other Cod species, as well as introduced species such as Common Carp, Goldfish and Redfin Perch. Other species found in their diet include ducks, cormorants, grebes, tortoises, water dragons, snakes, mice, frogs and mussels (Kearney & Kildea 2001; Native Fish 2004).

Potential distribution within the Study area

This species is widespread throughout the Murray-Darling system originally being found in virtually all waterways of that system, including some surprisingly small streams. The potential distribution of the Murray Cod within the Study area is identified within the Significant Species Management Plan for the Murray Cod (attached as Appendix 3 of the QCLNG Pipeline Aquatic Values Management Plan). Both the Condamine River and Columboola Creek are located within the known distribution of Murray Cod (**Appendix A**). Kearney and Kildea (2001) note that various dams and weirs within the Condamine River and Balonne River (which is fed by Columboola Creek) are regularly stocked with Murray Cod by the Queensland Fisheries Department.

2.1.2 Boggomoss Snail

Habitat Preference

The Boggomoss Snail (*Adclarkia dawsonensis*) is listed as Critically Endangered under the EPBC Act.

Based on knowledge of the species' current distribution in the Taroom area the Boggomoss Snail appears to prefer grassy eucalypt woodland (Speck 1968) on alluvial flats along drainage lines (Stanisic 1996).

The snail is a free sealer as in it lies free in the litter or soil under logs, sealing its aperture with a calcified mucous covering called an epiphragm (analogous to the operculum of marine species) while it aestivates (hibernates) during very dry periods. The epiphragm offers protection from desiccation. In semi-arid and arid areas, snails aestivate through many months of dry while they await the return of the wet season.

The preferred habitat for the Boggomoss Snail is found within Regional Ecosystems (REs) 11.3.3, 11.3.4 and 11.3.25 described by Sattler and Williams (1999). These are described as forests and grassy woodland to open woodland of *Eucalyptus tereticornis*, *E. camaldulensis* and *E. coolabah* on Cainozoic alluvial plains. Closer to the drainage line, the same species occur with a distinct mid and lower storey of sandpaper figs and the 'Rare' Carnarvon fan palm *Livistona nitida*. This community is best described as RE 11.3.25.

Key habitat requirements for the Boggomoss Snail are a well-developed leaf litter layer for food, shelter and breeding sites, and a good coverage of vegetation to support the leaf litter environment and maintain a moist microclimate (Stanisic 2008).

Life Cycle and Range

It is suggested that the species has a lifespan of 10–20 years (Stanisic 2008) and is active at night to avoid the dry environment. Living populations of *Adclarkia dawsonensis* are currently known from only two localities in the Greater Taroom area. One is situated adjacent to a boggomoss (artesian spring) on Mt Rose Station while a second, possibly more robust population is present on a camping and water reserve on the Isla-Delusion crossing of the Dawson River approximately halfway between Taroom and Theodore (Stanisic 2008). A third record of the species derives from a sub-adult dead shell found on the edges of Cockatoo Creek to the south of Taroom. The Study area for this assessment occurs in excess of 150km from these known populations.

Feeding

It is assumed that the Boggomoss Snail, like many other snails, feeds on decaying plant matter, bacteria and fungi (Bishop 1981, cited in Clarke & Spier-Ashcroft 2003).

Potential Distribution within the Study area

As outlined above, living populations of the Boggomoss Snail are currently documented from only two localities in the Greater Taroom area, both in excess of 150 km from the Study area. The total destruction of its preferred habitat (riparian on alluvial flats in the Dawson River Valley) led to the suggestion that the Boggomoss Snail has undergone a severe reduction in numbers. In the past, it is suspected that the snail was much more widely spread on these flats (Stanisic 2008).

SunWater are proposing the construction of the Nathan Dam on the Dawson River 70km downstream of Taroom. In early 2009, the Boggomoss Snail population within the dam area was estimated at 850. SunWater undertook further snail surveys in 2010 to search previously unexamined locations. The surveys were successful and resulted in the discovery of an estimated 18,000 individuals.

While it is considered unlikely that this species will be present in the vicinity of the Pipeline RoW, surveys were still conducted at the two water crossings, particularly where there was riparian vegetation present within, or within close proximity to RE's 11.3.3, 11.3.4 and 11.3.25. A map showing the preferred RE's of the Boggomoss Snail with respect to the Pipeline RoW is contained within the Significant Species Management Plan for the Boggomoss Snail (attached as Appendix 3 of the QCLNG Pipeline Aquatic Values Management Plan). The Boggomoss Snail's preferred REs occurring within close proximity to the Condamine River and Columboola Creek is shown in **Appendix A**.

3 Survey Methodology

Ecology field surveys were undertaken in the vicinity of the proposed RoW crossing locations for both the Condamine River and Columboola Creek.

As a result of the desktop assessment the threatened MNES species, Murray Cod and Boggomoss Snail were targeted as part of the surveys.

In addition, observations were undertaken at both surveyed crossings for any EPBC listed migratory bird species, or the breeding colonies of such species which may be present within the waterway or associated with riparian vegetation.

The survey approach included an overall habitat assessment to identify supported species as well as specific habitat features and values. The surveys involved a general assessment of the aquatic habitat values of each watercourse with flowing water (or pools of standing water), within the vicinity of the Pipeline RoW. The general assessment involved identification of (for example) significant riparian vegetation, presence of snags and presence of over-hanging vegetation. Following the general assessment of the crossing, specific survey techniques in accordance with the relevant EPBC Act Survey Guidelines were employed in order to identify threatened species.

Surveys were undertaken during the daytime and included the following techniques:

- Visual assessment and documentation of typical habitat features within the vicinity of the RoW;
- Lure fishing for Murray Cod in streams with pools over 0.5m deep where water conditions permitted;
- Wading through riffle areas and pools in areas that were up to 1.5m deep. This included undertaking visual surveys of the streambed, stream banks and around woody debris;
- Hand searches along banks of drainage lines for Boggomoss Snail where there was dense riverine vegetation present; and
- Observations (number and occurrence of roosting and/or breeding sites) of any migratory bird species present at each water crossing.

A description of the specific survey methods employed for the two threatened MNES species, as directed by the relevant EPBC Act survey guidelines, is provided below.

3.1 Murray Cod

The *Survey Guidelines for Australia's Threatened Fish* notes that the preferred survey period for the Murray Cod is March to August and surveys should not be conducted in September to December as the species generally migrates upstream prior to spawning in mid-October. Due to project timeframes and SEWPaC approval requirements it was necessary for these additional ecological surveys at the Condamine River and Columboola Creek to be undertaken between the 11th and 12th of October 2011. Although the surveys were therefore undertaken during a sub-optimum time, due to the ephemeral nature of the Condamine drainage basin and the many barriers which create a pooling effect within the system, there is potential for restriction of the upstream migration of the species. Therefore while it is possible that individuals may have migrated upstream particularly during times of higher water levels, there is the likelihood that they have been unable to move far and are still within the local area. To ensure a robust assessment of potential presence, the survey also incorporated a thorough assessment of habitat values for Murray Cod at both sites.

The following active survey techniques are recommended for identifying Murray Cod by the *Survey Guidelines for Australia's Threatened Fish*:

- Lure fishing using barbless hooks;
- Funnel netting to identify invertebrates that are part of Murray Cod diet;

- Wading through riffle areas and pools in areas that were up to 1.5m deep. This included undertaking visual surveys of the streambed, stream banks and around woody debris; and
- Daytime snorkelling.

It is noted that boat-based electrofishing is also recommended by the guidelines during the day in areas of low turbidity. To be effective, fish must be visible to be stunned. The electrocution zone is approximately 1m from the end of submersed electrode. To be effective, this technique requires the operator to see the fish and stun it quickly. If the water is turbid it is not possible for the operator to identify the fish in order to stun them. Should any fish be stunned in turbid water, it may not be possible to identify them as the stunned fish will not necessarily float or be found. Electrofishing was not undertaken as part of the surveys due to the high turbidity of both the Condamine River and Columboola Creek within the vicinity of the proposed pipeline.

Daytime snorkelling and funnel netting were not considered to be appropriate survey techniques for the Condamine River and Columboola Creek, due to high water levels and poor visibility within the vicinity of the RoW at both watercourses, and were therefore not conducted for this survey.

Columboola Creek contained large quantities of flood debris at the time of survey. Observations were undertaken along the watercourse banks of both Columboola Creek and the Condamine River for potential habitat such as overhanging vegetation and snags. Lure fishing was focused extensively around the proposed crossing point of the Condamine River. Lure fishing could not be undertaken in Columboola Creek due to excessive debris. Wading searches were undertaken throughout the riffle areas and pools of Columboola Creek but the depth of the Condamine River prohibited such a technique being undertaken at this water course. Columboola Creek is typically dry and was therefore considered unlikely to provide habitat for conservation significant fish species.

3.2 Boggomoss Snail

No survey guidelines are available for this species however hand searches and turning of fallen and decaying timber, or raking of other debris in dense riverine vegetation (grass) or semi-aquatic vegetation near springs, or other permanent water sources, have the potential to successfully recover dead shells or live individuals for identification (Stanisic 2008).

4 Habitat Assessment of Watercourse Crossings

4.1 Condamine River at KP 68.6

The Condamine River at KP 68.6 along the RoW has been defined by the QCLNG Project as a major watercourse crossing. Murray Cod was specifically targeted at this crossing as its presence is known within the Condamine River system. Boggomoss Snail was not targeted at this site due to the lack of favoured microhabitat resulting from the recent flooding and high disturbance of this area.

The Condamine River RoW crossing will be located within the aquatic ecology survey area, however at the time of survey the final alignment was yet to be confirmed by QGC. Any changes to the final RoW alignment would be within several hundred metres from the original crossing location. Regardless of the final crossing location, the survey results and field observations at this survey site indicate that the habitat values offered are consistent along the river in this vicinity. The landform and associated riparian communities are uniform within the river corridor offering the same foraging, sheltering and roosting habitat for aquatic and bird species. As this watercourse will be crossed by drilling underneath using the Horizontal Directional Drilling (HDD) technique, disturbance of the aquatic environment is not considered likely, regardless of the final location of the crossing.

Survey Techniques

General observations were made including water quality (form, turbidity, colour, vegetation and flow), habitat availability, and presence of fauna (as noted by bird calls and through visual observation), including the presence of roosting and breeding sites. These observations were undertaken for a period of 20 minutes prior to in stream activities.

Lure fishing was undertaken for a period of 2 hours within approximately 200m of the centre line of the proposed pipeline crossing point, with specific focus around areas with snags. Wading surveys of this area were not undertaken due to hazards posed by the depth of water and incline of the banks.

Flora survey in the form of a 25m² quadrat was undertaken to assess vegetation dynamics and to confirm both the Regional Ecosystem (RE) and Threatened Ecological Community (TEC) status of the site.

Description

This section of the Condamine River had a channel width of approximately 15m with a top of bank to water surface depth of approximately 18m. The water within the creek was moderately fast moving and a murky brown colour with high turbidity.

The riparian vegetation within the vicinity of the RoW had been heavily scoured by the December 2010 floods and as a result there were a number of uprooted trees and snags that were scattered adjacent to and within the river. The vegetation structure of the banks was characterised by open woodland, with no shrub layer, which adjoined the river at both the southern and northern bank. No live overhanging vegetation was present along the banks due to flood damage. No aquatic vegetation was present within this watercourse.

The survey identified the presence of 2 RE's at this site. The stream banks were consistent with 11.3.4 listed as 'Of Concern' while the associated floodplain was consistent with 11.3.3 (*Eucalyptus Coolabah* woodland on alluvial plains) listed as 'Of Concern' and which occurs in the Brigalow Belt South bioregion of the Interim Bio-geographical Regionalisation of Australia (IBRA), subregion BBS17. Commonwealth listing advice prepared for the Minister for SEWPaC effective as of 1st of March 2011 lists RE 11.3.3 as being consistent with the Coolibah – Black Box Woodlands Threatened Ecological Community (TEC) and which is listed as endangered under the EPBC Act. This RE occurs as riparian vegetation in a strip which extends approximately 68m in width on the southern bank and 160m in width on the northern bank. As the HDD entry and exit points are located outside of this riparian vegetation, within cleared grazing paddocks, it is unlikely that this community will be impacted.

Photographs of the Condamine River crossing at KP 68.6 are provided within **Appendix B** (Figure 1, Figure 2 and Figure 3).

Notable Flora and Fauna

The banks and adjoining terrestrial vegetation were characterised by a predominance of *Eucalyptus coolabah* (50% of quadrat sample area), along with *Eucalyptus tereticornis*, and *Corymbia tessellaris* on the upper banks. The site was devoid of a shrub layer with an understory dominated by weed species including *Tetragonia tetragonoides* and *Onopordum acanthium* as well as an assortment of grasses, suggesting a high level of recent disturbance at this site. The south bank was extensively scoured and eroded from flood activity in December 2010, while further away from the watercourse on both the north and south banks the landscape was characterised by grazing pasture.

Aquatic species observed included, *Chelodina longicollis* (Long-neck Tortoise), and *Macquaria ambigua* (Golden Perch), which is part of the Murray Cod diet.

Bird species present included, *Anas superciliosa* (Pacific Black Duck), *Rhipidura leucophrys* (Willie Wagtail), *Pardalotus striatus* (Striated Pardalote), *Manorina melanocephala* (Noisy Miner), *Melithreptus lunatus* (White-naped Honeyeater), *Psephotus haematonotus* (Red-rump Parrot), *Corvus orru* (Crow), *Cacatua galerita* (Sulphur-Crested Cockatoo) and *Struthidea cinerea* (Apostlebird). However, no indication of migratory and colonial birds, or evidence of their occurrence recently or historically was observed during the field survey. No indications of present or past roosting colonies, stick nests or nesting platforms were observed during the field survey. Based upon these observations, no colonial or nesting birds are expected to utilise the site beyond infrequent foraging activities.

No MNES species or potential MNES breeding locations were observed in the vicinity of this crossing location.

Recommendations

Overall this water crossing was observed to be significantly disturbed as a result of flood damage. The banks were eroded, however resulting snags and litter from recent floods does provide habitat resources for aquatic species. The location of the crossing point of the Condamine River is expected to provide aquatic habitat however it is unlikely to be disturbed by the proposed HDD of this crossing.

Though this River crossing is expected to provide aquatic habitat and is unlikely to be significantly affected by the proposed HDD, the following recommended mitigation measures are required to ensure the long term aquatic values of this river line are protected:

- No construction activities should occur at this watercourse during the breeding season of the Murray Cod (from mid-October to mid-December);
- Clearing of riparian vegetation for the crossing of this watercourse should be avoided wherever practicable; and
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line.

The proposed HDD of this river line is not expected to result in any adverse impacts on MNES species nor the present aquatic species more generally.

4.2 Columboola Creek at KP 90.1

Columboola Creek is located at KP 90.1 along the RoW. The MNES species Murray Cod and Boggomoss snail were targeted at this site.

Survey Techniques

General observations were made including water quality (form, turbidity, colour, vegetation and flow), habitat availability and presence of fauna (as noted by bird calls and through visual observation), including the presence of roosting and breeding sites. These observations were undertaken for a period of 20 minutes prior to in stream activities

A wading survey of this area was undertaken for a period of 30 minutes to determine the extent of suitable microhabitats and to uncover possible evidence to suggest the presence of Boggomoss Snail along the creek bank. Lure fishing was not undertaken at this site as the creek line is highly ephemeral and extremely narrow in the vicinity of the crossing point. Flora survey in the form of a 25m² quadrat was undertaken to assess vegetation dynamics and to confirm both the RE and TEC status of the site.

Description

Columboola Creek has a north/south orientation at the location where the proposed pipeline crosses. The western bank of this creek is undercut, while the eastern bank is relatively flat. The banks and bottom of the creek consist of fine sediments with little to no rock present. This creek is ephemeral and while a significant flow was observed during the field survey, this creek line is known to be predominantly dry.

The water within the creek was slow moving to stagnant and a murky brown colour due to high turbidity from a recent rainfall event.

Photographs of the Columboola crossing at KP90.4 are provided within **Appendix B** (Figure 4, Figure 5 and Figure 6).

Notable Flora and Fauna

The riparian vegetation was consistent with RE 11.3.25 (Least Concern), being dominated by *Eucalyptus tereticornis* (Queensland Blue Gum), with *E. populnea* (Poplar Box), *Angophora floribunda* (Rough-barked Apple), *Callitris glaucophylla* (Belah) and occasional *Corymbia tessellaris* (Morton Bay Ash) and *Allocasuarina*. The shrub layer consisted of juvenile upper canopy species and occasional *Eremophila mitchellii* (False Sandlewood). The ground layer was dominated by *Lomandra longifolia* (Spiny-headed Mat-rush).

Various weeds were present including *Opuntia tomentosa* (Velvety Tree Pear) and *Verbena tenuisecta* (Mayne's Pest). These pest species occurred occasionally throughout the site.

The only evidence of aquatic species was the shell of a *Cherax destructor* (Yabby) along the northern bank.

Several terrestrial bird species were detected during the field survey including; *Rhipidura leucophrys* (Willy Wagtail), *Platycercus adscitus* (Pale-headed Rosella), and *Malurus cyaneus* (Superb Fairy Wren).

No indication of migratory and colonial birds or evidence of their occurrence, recently or historically, was observed during the field survey. No indications of present or past roosting colonies, stick nests or nesting platforms were observed during the field survey. Based upon these observations, no colonial or nesting birds are expected to utilise the site beyond infrequent foraging activities.

No MNES species or potential MNES breeding locations were observed in the vicinity of this crossing location.

Recommendations

As this creek line is predominantly dry, it is expected to provide poor quality aquatic habitat. However, the following recommended mitigation measures are required to ensure the long term aquatic values of this creek line are protected:

- No construction activities should occur at this watercourse during the breeding season of the Murray Cod (from mid-October to mid-December);
- Clearing of riparian vegetation for the crossing of this watercourse should be minimised as much as possible;
- Snags present within the watercourse should be removed and stored for later reinstatement; and
- Appropriate sedimentation and erosion controls should be implemented throughout all construction activities to ensure minimal impacts upon water quality and habitats within this creek line.

The proposed construction of a pipeline crossing of this creek line using an open-cut trenching technique is not expected to result in any adverse impacts on MNES species with the adoption of these specified mitigation measures.

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5 Potential Impacts to MNES

5.1 Murray Cod

Table 1 below presents the MNES significant impact criteria prepared by SEWPaC for vulnerable species, and an assessment of the potential for a significant impact to occur as a result of Pipeline construction. An activity is considered likely to have a significant impact if there is a real chance or possibility that it will meet the criteria.

Table 1 Assessment of Potential Impacts on Murray Cod

MNES Impact Criteria	Comment
<p><i>There is a real chance or possibility to lead to a long-term decrease in the size of an important population of a species.</i></p> <p><i>An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:</i></p> <ul style="list-style-type: none"> <i>• Key source populations either for breeding or dispersal;</i> <i>• Populations that are necessary for maintaining genetic diversity; and/or</i> <i>• Populations that are near the limit of the species range.</i> 	<p>No Murray Cod were observed at any of the watercourse crossings during the aquatic ecology field survey.</p> <p>The Murray Cod may potentially occur at the Condamine River and Columboola Creek crossing as they both contain flowing or standing water. Of these crossings the Condamine River provides the most likely potential habitats due to the water levels at this crossing location. However, as this watercourse will be transected by HDD which passes under the watercourse, any impacts to the most likely aquatic habitats of this species will be minimal.</p> <p>To ensure that any potential impacts to the Murray Cod and its habitat are minimised, a range of mitigation measures as identified within this document and the AVMP shall be implemented at all watercourse crossings.</p> <p>There are not expected to be any impacts to an important population of Murray Cod as a consequence of the proposed construction activities.</p>
<p><i>There is a real chance or possibility to reduce the area of occupancy of an important population.</i></p>	<p>No Murray Cod were identified as part of the aquatic surveys.</p> <p>The Murray Cod may potentially occur at the Condamine River and Columboola Creek crossing as they both contain flowing or standing water. Of these crossings the Condamine River provides the most likely potential habitats due to the water levels at this crossing location however it is not considered likely to provide habitat for an important population of the species. As this watercourse will be transected by HDD which passes under the watercourse, any impacts to the most likely aquatic habitats of this species will be minimal.</p> <p>Mitigation measures identified in the AVMP will be implemented to further ensure that any potential impacts are minimised. Therefore, the proposed construction is not expected to reduce the area of occupancy of this species.</p>

MNES Impact Criteria	Comment
<p><i>There is a real chance or possibility to fragment an existing important population into two or more populations.</i></p>	<p>No Murray Cod were identified as part of the aquatic surveys.</p> <p>The Murray Cod may potentially occur at the Condamine River and Columboola Creek crossing as they both contain flowing or standing water. Of these crossings the Condamine River provides the most likely potential habitats due to the water levels at this crossing location however it is not considered likely to provide habitat for an existing important population of the species. As this watercourse will be transected by HDD which passes under the watercourse, any impacts to the most likely aquatic habitats of this species will be minimal, reducing the potential for fragmentation of any habitat areas or populations.</p> <p>Mitigation measures including clearing minimization, sedimentation and erosion control measures identified in the AVMP will be implemented to further ensure that any potential impacts are minimised. It is therefore considered unlikely that the proposed works will fragment any existing populations of Murray Cod.</p>
<p><i>There is a real chance or possibility to adversely affect habitat critical to the survival of a species.</i></p>	<p>No Murray Cod were identified as part of the aquatic surveys.</p> <p>The Murray Cod may potentially occur at the Condamine River and Columboola Creek crossings as they both contain flowing or standing water. Of these crossings the Condamine River provides the most likely potential habitats due to the water levels at this crossing location. The crossing sites were not considered to provide habitat critical to the survival of the Murray Cod.</p> <p>As the Condamine River will be transected by HDD which passes under the watercourse, any impacts to the most likely aquatic habitats of this species will be minimal.</p> <p>Mitigation measures identified in the AVMP will be implemented to further ensure that any impacts on the habitats critical to the survival of this species are minimised. On this basis the proposed construction techniques are not expected to adversely affect habitats critical to the survival of the Murray Cod.</p>

MNES Impact Criteria	Comment
<p><i>There is a real chance or possibility to disrupt the breeding cycle of an important population.</i></p>	<p>No Murray Cod were identified as part of the aquatic surveys.</p> <p>The Murray Cod may potentially occur at the Condamine River and Columboola Creek crossing as they both contain flowing or standing water. Of these crossings the Condamine River provides the most likely potential habitats due to the water levels at this crossing location. However, as this watercourse will be transected by HDD which passes under the watercourse, any impacts to the most likely aquatic habitats of this species will be minimal.</p> <p>Mitigation measures identified in the AVMP, including the restriction of construction activities during the breeding season of the Murray Cod (from mid-October to mid-December) will be implemented to further ensure that any potential impacts are minimised. It is not anticipated that the proposed construction techniques will result in any impacts upon the breeding cycles of the Murray Cod.</p>
<p><i>There is a real chance or possibility to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</i></p>	<p>No Murray Cod were identified as part of the aquatic surveys.</p> <p>The Murray Cod may potentially occur at the Condamine River and Columboola Creek crossing as they both contain flowing or standing water. Of these crossings the Condamine River provides the most likely potential habitats due to the water levels at this crossing location. However, as this watercourse will be transected by HDD which passes under the watercourse, any impacts to the most likely aquatic habitats of this species will be minimal.</p> <p>Mitigation measures identified in the AVMP will be implemented to further ensure that any potential impacts on potential habitat areas are minimised. The proposed construction techniques to be implemented are not expected to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p>
<p><i>There is a real chance or possibility to result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</i></p>	<p>No Murray Cod were identified as part of the aquatic surveys.</p> <p>The Murray Cod may potentially occur at the Condamine River and Columboola Creek crossing as they both contain flowing or standing water. Of these crossings the Condamine River provides the most likely potential habitats due to the water levels at this crossing location. However, as this watercourse will be transected by HDD which passes under the watercourse, any impacts to the most likely aquatic habitats of this species will be minimal.</p> <p>Mitigation measures identified in the AVMP will be implemented to further ensure that potential impacts from invasive species are minimised. The implementation of management procedures for weed and pest species is expected to minimise or eliminate impacts upon the Murray Cod.</p>

MNES Impact Criteria	Comment
<i>There is a real chance or possibility to introduce disease that may cause the species to decline</i>	<p>No Murray Cod were identified as part of the aquatic surveys.</p> <p>The Murray Cod may potentially occur at the Condamine River and Columboola Creek crossing as they both contain flowing or standing water. Of these crossings the Condamine River provides the most likely potential habitats due to the water levels at this crossing location. However, as this watercourse will be transected by HDD which passes under the watercourse, any impacts to the most likely aquatic habitats of this species will be minimal.</p> <p>Mitigation measures identified in the AVMP will be implemented to further ensure that no introduced disease that may cause the species to decline occurs as a result of the proposed works.</p>
<i>There is a real chance or possibility to interfere substantially with the recovery of the species</i>	<p>No Murray Cod were identified as part of the aquatic surveys.</p> <p>The Murray Cod may potentially occur at the Condamine River and Columboola Creek crossing as they both contain flowing or standing water. Of these crossings the Condamine River provides the most likely potential habitats due to the water levels at this crossing location. However, as this watercourse will be transected by HDD which passes under the watercourse, any impacts to the most likely aquatic habitats of this species will be minimal.</p> <p>The proposed construction techniques are not expected to hinder any recovery of the Murray River Cod. Mitigation measures identified in the AVMP will be implemented to further ensure that no interference will affect the recovery of this species.</p>

5.2 Boggomoss Snail

Table 2 presents the MNES significant impact criteria for Critically Endangered species, and an assessment of the potential for a significant impact to occur as a result of construction of the pipeline. An activity is considered likely to have a significant impact if there is a possibility that it will meet the criteria.

Table 2 assesses the potential impact on the Boggomoss Snail which is listed as Critically Endangered under the EPBC Act.

Table 2 Assessment of Potential Impacts on Boggomoss Snail

MNES Impact Criteria	Comment
<i>There is a real chance or possibility to reduce the extent of an ecological community.</i>	Despite targeted searches for this species and its preferred habitat, none were detected along the banks of drainage lines likely to be impacted by construction for the Pipeline. Where clearing of dense riparian vegetation may be required, the extent will be minimal and will not reduce the extent of an ecological community.
<i>There is a real chance or possibility to fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines.</i>	No Boggomoss Snails were detected during the field assessment. The literature review has identified two populations 150km to the west of the proposed Pipeline RoW. Therefore the Project is not expected to result in fragmentation of the known habitat of this species.
<i>There is a real chance or possibility to adversely affect habitat critical to the survival of an ecological community.</i>	The two known areas inhabited by this species in the Taroom area will not be impacted by this Project. While impacts to riparian vegetation will result, this species was not detected in the areas proposed for works. Therefore it is unlikely that habitat critical to the survival of the species will be affected.
<i>There is a real chance or possibility to modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns</i>	The proposed works will involve short term disturbance to riparian areas. During works it is recommended that sedimentation and erosion control measures be implemented to ensure abiotic and biotic factors of these areas are not impacted. Upon completion, the waterways should be reinstated and armored as appropriate, to ensure long term impacts are avoided.
<i>There is a real chance or possibility to cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting</i>	As neither Boggomoss Snail nor its preferred habitat was detected during targeted surveys of waterways along the alignment, this species is not expected to be impacted by the proposed works. Construction and post construction mitigation measures should be employed to ensure minimal impacts result. The proposed works will not result in any substantial change to potential habitat composition or availability.
<i>There is a real chance or possibility to cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:</i> -- assisting invasive species, that are harmful to the listed	The proposed works will be undertaken in a highly modified landscape subjected to historical agricultural practices. The proposed construction of a pipeline within this landscape is not expected to result in any additional reduction in the integrity of ecological communities beyond the impacts already being experienced. During construction all appropriate mitigation measures will be put in place to ensure invasive weed species are not introduced

MNES Impact Criteria	Comment
<i>ecological community, to become established, or -- causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or</i>	or spread. Chemical use will be in accordance with the sensitivity of the aquatic environment and relevant guidelines and regulations.
<i>There is a real chance or possibility to interfere with the recovery of an ecological community.</i>	The proposed works are proposed to be undertaken in a highly modified landscape subjected to historical agricultural practices. The proposed construction of a pipeline within this landscape is not expected to interfere with the recovery of any ecological communities used by the Boggomoss Snail.

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6 Conclusion

Results from the aquatic ecology survey indicate that:

- In the vicinity of the proposed RoW crossings of the Condamine River and Columboola Creek the watercourses are disturbed and degraded;
- No migratory bird breeding or roosting colonies were observed at the proposed crossing locations along the Condamine River or Columboola Creek;
- No MNES species were observed at either of the crossing locations;
- The Condamine River has relatively good aquatic and riparian habitat values and appropriate construction mitigation measures should be implemented to ensure any impacts to this watercourse are minimised. The use of HDD to cross the river will ensure aquatic values are not impacted;
- Columboola Creek is predominantly a dry creek and offers limited potential habitat for Murray Cod. Notwithstanding this it does offer occasional habitat areas and should be subject to appropriate construction mitigation measures to protect the values present; and
- Provided the mitigation measures outlined within this document and **Table 2** of the AVMP are employed as part of the watercourse crossing construction, it is considered that the impacts to potential habitat will be minimal and any downstream impacts can be minimised.

Table 3 below provides a summary of the key findings of the survey at each of the two crossings surveyed throughout the GCH and EP.

Table 3 Summary of Surveyed Crossings

Watercourse Crossing	Catchment	MNES Potentially Occurring	Water Present	Habitat Quality	Potential impact to MNES
Condamine River at KP 68.6	Condamine (Balonne Condamine Basin)	Murray Cod	Yes	Moderate	Unlikely
Columboola Creek at KP 90.1	Balonne (Balonne Condamine Basin)	Murray Cod	Yes	Poor	Unlikely



7 Appendices

Appendix A: Location Maps

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Watercourses

Proposed Gas Collection Header & KPs

Potential Distribution of Murray Cod

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TITLE: Potential Distribution of Murray Cod within the Study Area

DOCUMENT NO: QCLNG-BX00-ENV-MAP-000066-02

DATA SOURCE:
Drainage Basins Sub Area © State of Queensland (Department of Environment and Resource Management) 2009
Topographic Raster 1:250,000 © Commonwealth of Australia (Geoscience Australia) 2003

048 Kilometres

12-516

1:30,000 (A3) GCS GDA 1994

DATE	AUTHOR	APPROVED	REVISION NOTE	REV.
18/07/2011	KS	JG	Issued for Use	0
19/10/2011	JH	LK	Issued for Use	1

PROPOSED PIPELINE ALIGNMENT

Export Pipeline & KP's

Collection Header & KP's

REVISION

Rev L

19-04-2011

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DATE

Rev K

19-04-2011

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LOCATION DIAGRAM

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Appendix B: Photographs



Figure 1. Condamine River crossing at KP 68.6 (looking south).



Figure 2. Condamine River crossing at KP 68.6. Presence of snags



Figure 3. Condamine River crossing at KP 68.6



Figure 4: Columboola Creek Crossing at KP 90.1



Figure 5: Columboola Creek Crossing at KP 90.1, wading survey.



Figure 6: Columboola Creek Crossing at KP 90.1

Gas Collection Header Watercourse Crossing Assessment

Addendum to Appendix 1 of the EMP

QCLNG-BG00-ENV-PLN-000004

Rev 0

April 2012

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QCLNG PROJECT

DOCUMENT INFORMATION SHEET

TITLE: Gas Collection Header Watercourse Crossing Assessment – Addendum to Appendix 1 of the EMP

PURPOSE AND SCOPE:

This document was developed in 2010 to provide additional information on watercourse crossing construction techniques and potential environmental impacts, in support of the Environmental Authority application for the QCLNG Gas Collection Header (PPL 153).

This document provides high level background information on the process of pipeline route selection, watercourse construction methods and original watercourse crossing assessments.

It has been updated in 2012 to reflect the change of crossing method at two watercourses, arising from completion of an Aquatic Values Management Plan (AVMP) for the QCLNG Pipeline and to ensure consistency of this document with the AVMP.

Although the QCLNG Pipeline has now progressed past the stage of route selection and choice of crossing method, the background information contained in this document has been retained to provide an overview of the process which was followed for this phase of the Pipeline works.

DOCUMENT VERIFICATION

Responsible: sch4p3(3) Prejudice

Signature:

Position: Environment Advisor – Permits and Approvals

Name: Emma Clement

Date: 18th April 2012

Accountable:

Signature: sch4p3(3) Pre

Position: Environment Manager – Compliance

Name: Pauline Jacob

Date: 18th April 2012

Consulted:

Enter name/position of those required to review the document

Informed:

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Signature: sch4p3(3) Pre

Position: Environment Manager – Compliance

Name: Pauline Jacob

Date: 18th April 2012

RACIE Terms

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A	Accountable: the person who has to answer for the success or failure of the quality and timeliness of the document
C	Consulted: those who must be consulted before the document is published
I	Informed: those who must be informed after the document is published
E	Endorsed: the person who must approve the document before publication

Revision Record

Issue	Date	Reason for Issue	Responsible	Accountable
A	April 2010	For supporting information to the EA application for the Gas Collection Header	P. Jacob	M. Harris
0	18 April 2012	Revised with updates to the water crossing method at Columboola Creek and Dogwood Creek as per the AVMP	E. Clement	P. Jacob

1.0 INTRODUCTION

This document was developed in 2010 to provide additional information on watercourse crossing construction techniques and potential environmental impacts, in support of the Environmental Authority (EA) application for Petroleum Pipeline Licence (PPL) 153 (the QCLNG Gas Collection Header).

The Co-ordinator General's report on the QCLNG Project requested that further information be provided on water crossing construction methods and the watercourse aquatic values. QGC assessed those crossings to which it had land access at the time of the EA application and detailed the findings of these assessments, including the proposed crossing construction techniques, in this Gas Collection Header Watercourse Crossing Assessment –Addendum to Appendix 1 of the EMP.

Further assessments of water crossings along the Gas Collection Header have since been undertaken as part of the development of a QCLNG Pipeline Aquatic Values Management Plan (AVMP) (QCLNG-BG00-ENV-RPT-000009). These assessments have included aquatic ecology surveys and geotechnical assessments of the suitability of certain watercourses for horizontal direction drilling (HDD) crossing techniques. AVMP survey findings led to the modification of the proposed crossing construction technique for two water crossings along the Gas Collection Header, Columboola Creek and Dogwood Creek.

To ensure consistency with the AVMP, this Gas Collection Header Watercourse Crossing Assessment – Addendum to Appendix 1 of the EMP has been updated with the current crossing techniques be used at these two watercourses.

Although the QCLNG Pipeline has now progressed past the stage of route selection and choice of crossing method, the original background information has been retained as part of this updated revision to provide an overview of the process which was followed for the initial phase of pipeline works. The revisions to this document relate only to the updated crossing methods at the two crossings specified above and revised mapping of the current pipeline alignment and associated updated watercourse crossing location lists. The revisions to the document are contained within this Section 1, Section 5 and Attachments 1 and 3.

2.0 PROCESS OF PIPELINE ROUTE SELECTION AND WATERCOURSE CROSSING ASSESSMENT

2.1 Corridor selection process

At project inception, the study corridor for pipelines is selected on gross parameters, such as distance, terrain, land use and regional ecosystem classification. The initial corridor will be up to 10 kilometres wide.

Desktop assessment of the corridor with more in-depth analysis of parameters, including constructability will then initiated for the selection of a preferred alignment.

2.2 Preferred alignment investigation

The preferred alignment will be then subjected to assessment using published data from state and federal sources to identify constraints and landscape features which would affect alignment or construction methodology.

Site surveys are undertaken to confirm published data and support environmental impact assessment and environmental management planning. Access to the preferred alignment will be via investigation tenure such as petroleum survey licence. Entry to private property is enforceable under this tenure, the

preferred approach for productive negotiations for construction of the pipeline is to engage in 'voluntary/by agreement access' arrangements with willing landholders.

This is a limiting factor to the investigation of specific locations. Where access is gained, investigation can proceed for the portions of the pipeline within the permitted area, including vegetation and habitat assessment, erosion risk and ground survey. The preferred alignment corridor is usually 100-1000m wide at this stage.

Proximal locations for features such as watercourse crossings are often used to render an assessment of the feature (an analogous site) but may be hundreds of metres up to a few kilometres from the preferred alignment.

This preferred alignment investigation stage informs the impact assessment process and front end engineering design (FEED), including selection of watercourse crossing methodology and construction costs.

The watercourse crossing methodologies are defined in terms of minor crossings, major crossings and special crossings (e.g. Horizontal Directional Drilling (HDD)). Creeks with low profile (drainage lines/dry gullies) are generally classified for minor crossing, creeks with seasonal flows and wide and/or deep bed and bank structure or high risk erosion or terrain constraints are generally classified as major crossings. Rivers and high stream orders with baseflow/standing water are considered special crossings. The controls and design for crossing methodologies for the FEED stage are outlined in the following sections. Specific methodologies for the sites will be finalised following geotechnical assessment.

2.3 Site Investigation and Tertiary Vegetation Assessment

Where access permits, the preferred route assessment progresses to identification of habitat features and specific alignment of a construction right-of-way (ROW). Refinements of the construction ROW are constant at this stage of assessment and each realignment may trigger reassessment site investigation. Where the realignment has no particular change to the previous assessment – usually determined through desktop review using satellite imagery, no further assessment is made.

2.4 Alignment/Centreline Survey

When full or near full access to the construction ROW is obtained, a centreline survey is undertaken. A geotechnical survey is undertaken to determine construction methodologies through rock and for support of detailed design, in particular for horizontal directional drilling approaches. It is at this time, that final crossing methodologies are committed to detailed design.

An alignment sheet is generated at 1:5000 scale. Specific construction conditions are annotated on the alignment sheet for such issues as:

- erosion and sediment controls,
- specific vegetation for retention,
- cultural heritage no-go zones,
- additional workspace are detailed.

The alignment sheets are issued through document control and authorised by the project manager to the construction contractor as construction instruction. The alignment is controlled through this manner and method statements are issued for watercourse crossings and the controls to be applied are also issued.

2.5 Process Conclusion

This process is iterative and generally sequential, however the whole pipeline route is not progressed uniformly due to the constraints of land access. The following sections describe the status of this process for creek crossings identified for the preferred alignment, which is substantially at the level of definition to commence geotechnical survey.

3.0 WET AND DRY CROSSINGS

The preservation and or minimisation of impact of on aquatic values are best achieved by avoidance or management of construction timing. Typically, a “poor boy” crew is utilised for major crossings and a specialist team for HDD works. This allows some flexibility in the construction timeframe (days to weeks) to avoid construction during creek flow. Creeks with standing water or flowing water are usually considered for special crossings. This is confirmed through geotechnical assessment of the suitability for HDD and timing of construction.

4.0 CONSTRUCTION METHODS APPLIED TO EACH CROSSING

4.1 Minor Water Crossings

- Water course crossing shall be open cut unless specified otherwise by the company
- Construction methods shall be in accordance with the approved environmental management plan.
- Natural surface of creek crossing shall be surveyed prior to construction.
- Pipes shall be installed straight and horizontal for the width of the crossing between tops of banks.
- Pipe type, wall thickness and coating shall be as specified on alignment sheets.
- Minimum cover at least greater than 900mm shall be maintained within the crossing limits.
- When continuous bedrock is encountered, depth of cover to top of pipe may be reduced to 900mm.
- Pipe may be lowered into the trench only if the trench is smooth and clean and does not contain stones or debris. If water is present it shall be pumped out prior to lowering-in operation.
- Pipeline profile and depth of cover shall be surveyed after lower in. The installation shall be approved by the company representative prior to backfill.
- Creek and banks shall be restored as soon as practicable after laying and backfilling. Bed and restoration shall comply with the construction environmental management plan.
- Pipeline warning signs shall be installed at both sides of the crossing.

4.2 Major Water Crossings

- Water course crossing shall be open cut unless specified otherwise by the company. Construction methods shall be in accordance with the approved construction environmental management plan.
- Natural surface of creek crossing shall be surveyed prior to construction.
- Proposed crossing installation shall be drawn showing location of overbends, sand bags, protective weight coating and finished surface profile after restoration. Drawing shall be approved by the company prior to construction.
- Pipe shall be installed straight and horizontal between tops of banks.
- Pipe type, wall thickness and coating shall be as specified on alignment sheets.
- Minimum cover (greater than 900mm) as specified on the alignment sheets and specific crossing drawing, shall be maintained within the crossing limits.

- During construction, stable approach slopes to the watercourse shall be maintained at all times in order to minimise erosion and therefore siltation of the watercourse during rainfall. The following slope protection measures shall be in place from the start of clearing near the watercourse until restoration and clean up is complete.
 - o Surface water diversion berms along the top and at intermediate points down the slopes of any slope containing erodible material. (discharge to the downstream of the trench).
 - o Silt fences at the base of significant slopes.
 - o Settling ponds at the base of slopes to collect surface run off water and erosion material.
 - o Trench breakers in the pipeline trench to stop the slope flow of water and erodible materials.
 - o When continuous bedrock is encountered, depth of cover to top of pipe may be reduced to 1200mm.
- Pipes may be lowered into the trench only if the trench is smooth and clean and does not contain stones or debris. If water is present it shall be pumped out prior to lowering-in operation.
- Coating protection shall be provided over the entire pipe within crossing limits using;
 - o Rockshield application; or
 - o Continuous concrete coating.
- Construction activities shall cease during periods of heavy rainfall if it appears that measures to control siltation are likely to be ineffective.
- The depth of horizontal pipe is to be determined by the minimum depth of cover measured from the deepest point of the channel to the top of the pipe. If bank erosion is evident the limit of straight pipe shall extend beyond the zone of potential erosion as determined by the company.
- Pipeline profile and depth of cover shall be surveyed after lower in. The installation shall be approved by the company representative prior to backfill.
- Creek and banks shall be restored as soon as practicable after laying and backfilling. Refer to drawing no. QCLNG-BB00-PL-DET-000014. Bed and bank restoration shall comply with the construction environmental management plan.
- Pipeline warning signs shall be installed (if required) at both sides of the crossing. Both signs shall be clearly visible from the banks.

4.3 Bank Restoration

- Water course banks shall be restored as soon as possible after backfill and prior to dismantling any flow diversion measures.
- Banks shall be restored by grading and revegetating, except where other restoration methods are directed by the company representative.
- The restoration of banks shall comply with the construction environmental management plan and conditions of the relevant water management authority.
- Grade of restored banks shall be no greater than 40° and shall be smoothly contoured into adjoining undisturbed banks .
- Watercourse bed shall be restored to pre-construction profile to ensure smooth transitions to adjoining bed upstream and downstream.
- Width of bank disturbance shall be minimised.
- Trench breakers and cross berms shall be installed where required.

- Rip rap shall be placed where required as directed by company representative. Where fencing is present, fence shall be reconstructed to follow restored bank profile.
- Additional fencing shall be constructed where directed by company representative to exclude livestock from the area under rehabilitation.

Erosion control berms and sediment control fences will be installed at strategic locations along pipelines (e.g. on slopes, top and foot of the approaches to watercourses) during construction. During operation of the pipeline, these areas will be reviewed during routine inspection and after heavy rain to ensure that they are still required and operating correctly.

4.4 Rip Rap Bank Protection

- Bank shall be graded as directed by the company representative.
- Prepare bank by removing all stumps, organic matter and loose spoil material. Excavate at toe of bank to key rip rap into bed of watercourse.
- Rip rap material shall be clean, dense, durable and roughly equidimensional (not flat)
- Rip rap for placement on banks shall be graded material between nominally 200mm and 600mm except where use of coarser material is directed by the company representative.
- Rip rap for placement over trench shall be well graded material between nominally 150mm and 400mm except where use of coarser material is directed by the company representative.
- All rip rap material shall be approved by the company representative.
- Rip rap shall be placed with minimum void space and with a well interlocked smooth surface finish to resist movement by water. No rocks shall protrude more than 300mm above design lines and grades.
- Rip rap shall not alter elevation of bed or restrict width of flow and shall have smooth transitions to adjoining surfaces.
- All edges of rip rap shall be keyed in and constructed in a manner which resists undercutting.
- Rip rap height shall extend to 500mm minimum above normal high water level or top of bank if normal high water level is above top of bank.
- Width of bank rip rap shall be sufficient to protect all disturbed bank.
- Apron shall extend into watercourse bed where directed by company representative.
- Rip rap shall be placed over trench where directed by company.
- Concrete coating where required shall be as specified on alignment sheets.

4.5 Horizontal Direction Drilling

The feasibility of using horizontal directional drill (HDD) is strongly limited by site conditions such as soil stability, slope, access, available workspace and nature of subsurface rock. The length of the drill and the pipe diameter also influence the ability to use HDD.

The installation of the pipeline by HDD involves drilling a hole at a shallow angle beneath the surface through which the pipe is threaded. Drilling is conducted by a specially designed drill rig, operated by a specialist contractor. A variety of associated equipment and infrastructure is required. Note that the work area (equipment layout) usually exceeds the RoW width, being typically about 50 m wide.

Although HDD reduces impacts to the bed and banks of watercourses, the technique introduces additional environmental considerations. These include clearing of an area for the set up of the

equipment and pipe string, drill site sediment control, drill mud (water-based bentonite) management, potential for drill mud seepage through alluvial materials and waste management. Access for vehicles and equipment around the watercourse is also required resulting in the additional use, or creation of, access tracks.

HDD also has the potential for the drill bit to intersect a fracture within the riverbed. When this occurs, bentonite mud may be released into the watercourse. This event is referred to as a "frac out". Bentonite is a natural clay-like substance formed from the deposition of volcanic ash. When it is released into a watercourse through a frac out it will cause increased turbidity until the material is fully dispersed.

As expansive clay, bentonite works to reseal the fracture and released material normally settles quite rapidly. To aid the sealing of the fracture, wood or bark chips are often pumped into the drill hole combined with the bentonite. Where the watercourse is dry it is often preferable to leave the spilt bentonite in situ where it will dry out and break down into the surrounding area. Where a large spill occurs the material can be removed and buried.

To address these issues, QGC will prepare site-specific management procedures prior to drilling as an outcome of the detailed design phase of this Project.

5.0 RESULTS OF ASSESSMENT

The maps contained at Figure 1 show the location of the major and minor water crossing locations along the Gas Collection Header alignment. This includes those crossings which have been subject to ecological survey as part of the preparation of the AVMP as specified in Section 1.0. Examples of construction alignment sheets for two typical major water crossings are included at Figure 2.

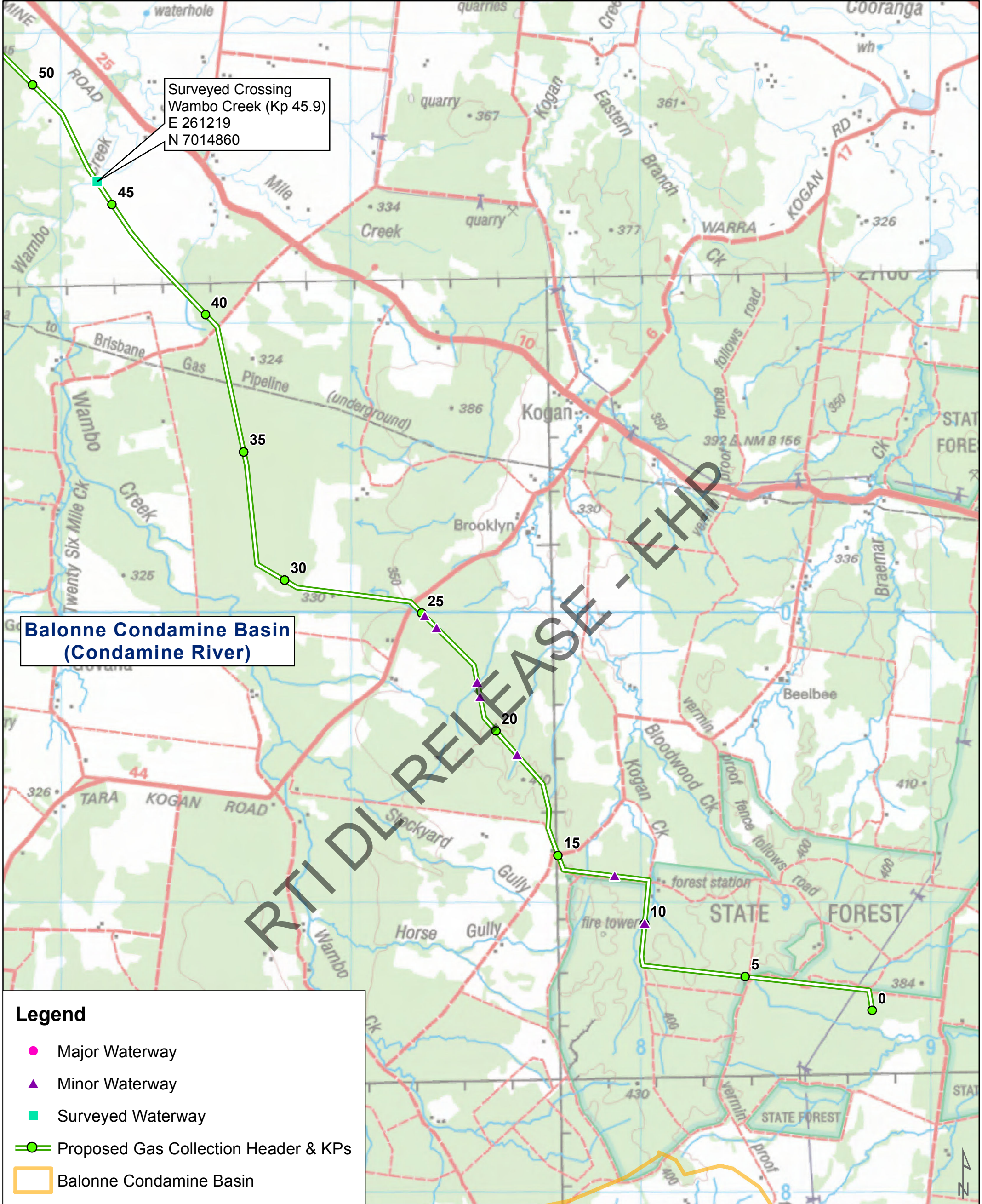
The tables contained in Attachment 1 provide the original assessment details for the major crossings. Additional ecological details on crossings which have been subject to further aquatic survey are contained within the AVMP.

The original Tertiary Vegetation Assessments for the relevant crossings (as per the table comments) have also been included in Attachment 2.

A summary table of all major and minor crossing locations along the Gas Collection Header based on an updated pipeline alignment current as at early 2012 is provided in Attachment 3.

Figure 1 (Maps 1- 6): Gas Collection Header Pipeline Major and Minor Water Crossing Locations

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Balonne Condamine Basin
(Condamine River)

Legend

- Major Waterway
- Minor Waterway
- Surveyed Waterway
- Proposed Gas Collection Header & KPs
- Balonne Condamine Basin

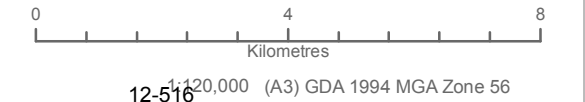
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LOCATION DIAGRAM

TITLE: QCLNG Pipeline Watercourse Crossings
GCH
Map 2: Kp 0 - 50

DOCUMENT NO: QCLNG-BX00-PLE-MAP-000310-02

DATA SOURCE:
Drainage Basins Sub Area © State of Queensland
(Department of Environment and Resource Management) 2009
Topographic Raster 1:250,000 © Commonwealth of Australia
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08/07/2011	NC	JG	Issued for Review	A
13/07/2011	NC	JG	Issued for Use	0

PROPOSED PIPELINE ALIGNMENT	REVISION	DATE	SUPPLIED BY
Export Pipeline & KP's	Rev L	19-04-2011	Unidel
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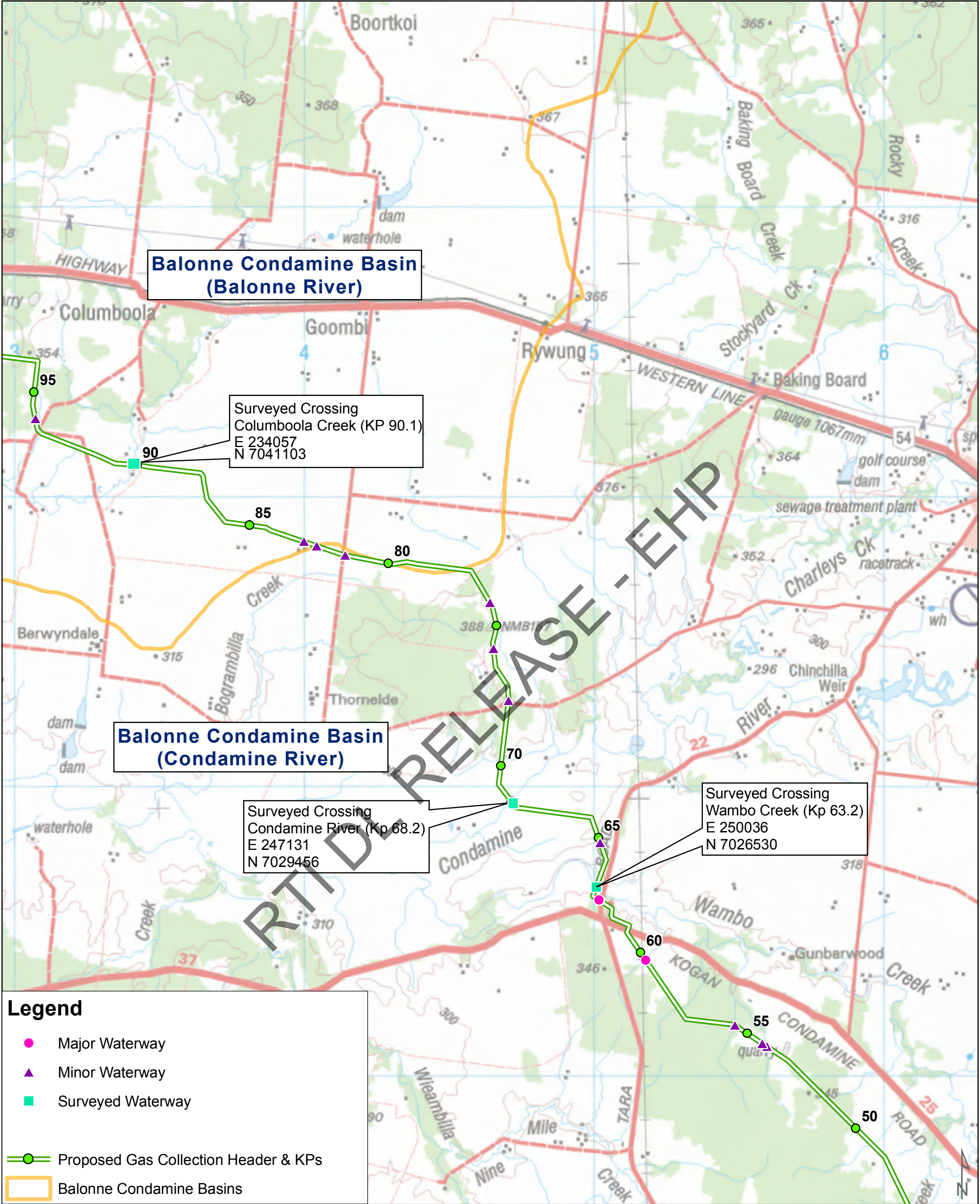
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Legend

- Major Waterway
- Minor Waterway
- Surveyed Waterway
- Proposed Gas Collection Header & KPs
- Balonne Condamine Basins

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TITLE: QCLNG Pipeline Watercourse Crossings
GCH
Map 3: Kp 50 - 95

DOCUMENT NO: QCLNG-BX00-PLE-MAP-000310-03

DATA SOURCE:
Drainage Basins Sub Area © State of Queensland
(Department of Environment and Resource Management) 2009
Topographic Raster 1:250,000 © Commonwealth of Australia
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04120,000 (A3) GDA 1994 MGA Zone 56

12-516

04 Kilometres8

04 Kilometres8

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08/07/2011	NC	JG	Issued for Review	A
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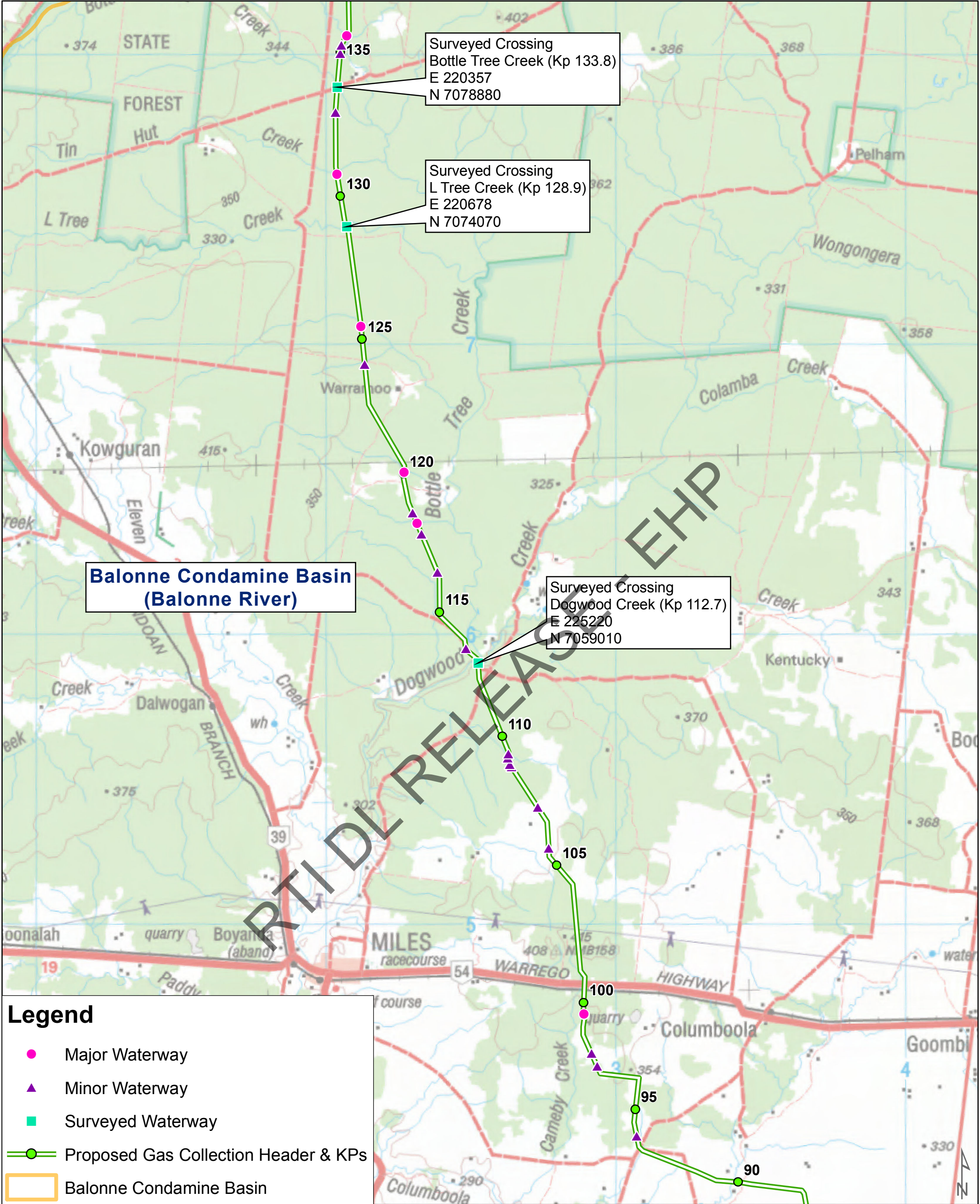
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LOCATION DIAGRAM

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Legend

- Major Waterway
- Minor Waterway
- Surveyed Waterway
- Proposed Gas Collection Header & KPs
- Balonne Condamine Basin

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TITLE: QCLNG Pipeline Watercourse Crossings
GCH
Map 4: Kp 90 - 135

DOCUMENT NO: QCLNG-BX00-PLE-MAP-000310-04

DATA SOURCE:
Drainage Basins Sub Area © State of Queensland
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Topographic Raster 1:250,000 © Commonwealth of Australia
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Kilometres

12-516
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13/07/2011	NC	JG	Issued for Use	0

PROPOSED PIPELINE ALIGNMENT	REVISION	DATE	SUPPLIED BY
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LOCATION DIAGRAM

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Legend

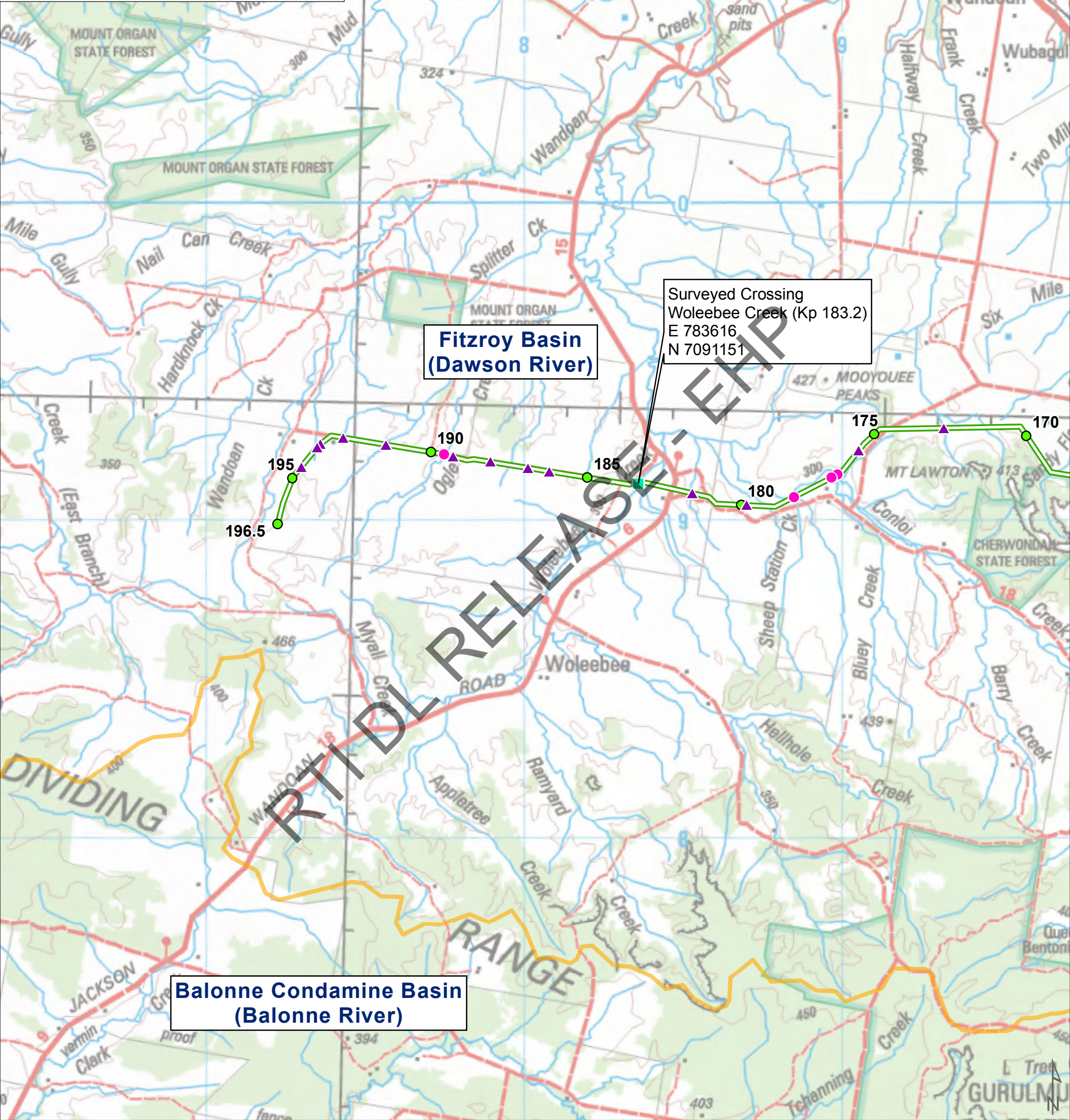
Major Waterway

Minor Waterway

Surveyed Waterway

Proposed Gas Collection Header & KPs

Fitzroy and Balonne Condamine Basins



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LOCATION DIAGRAM

TITLE: QCLNG Pipeline Watercourse Crossings
GCH
Map 6: Kp 170 - 195

DOCUMENT NO: QCLNG-BX00-PLE-MAP-000310-06

DATA SOURCE:
Drainage Basins Sub Area © State of Queensland
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08/07/2011	NC	JG	Issued for Review	A
13/07/2011	NC	JG	Issued for Use	0

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Kilometres

12-516
1:120,000 (A3) GDA 1994 MGA Zone 55

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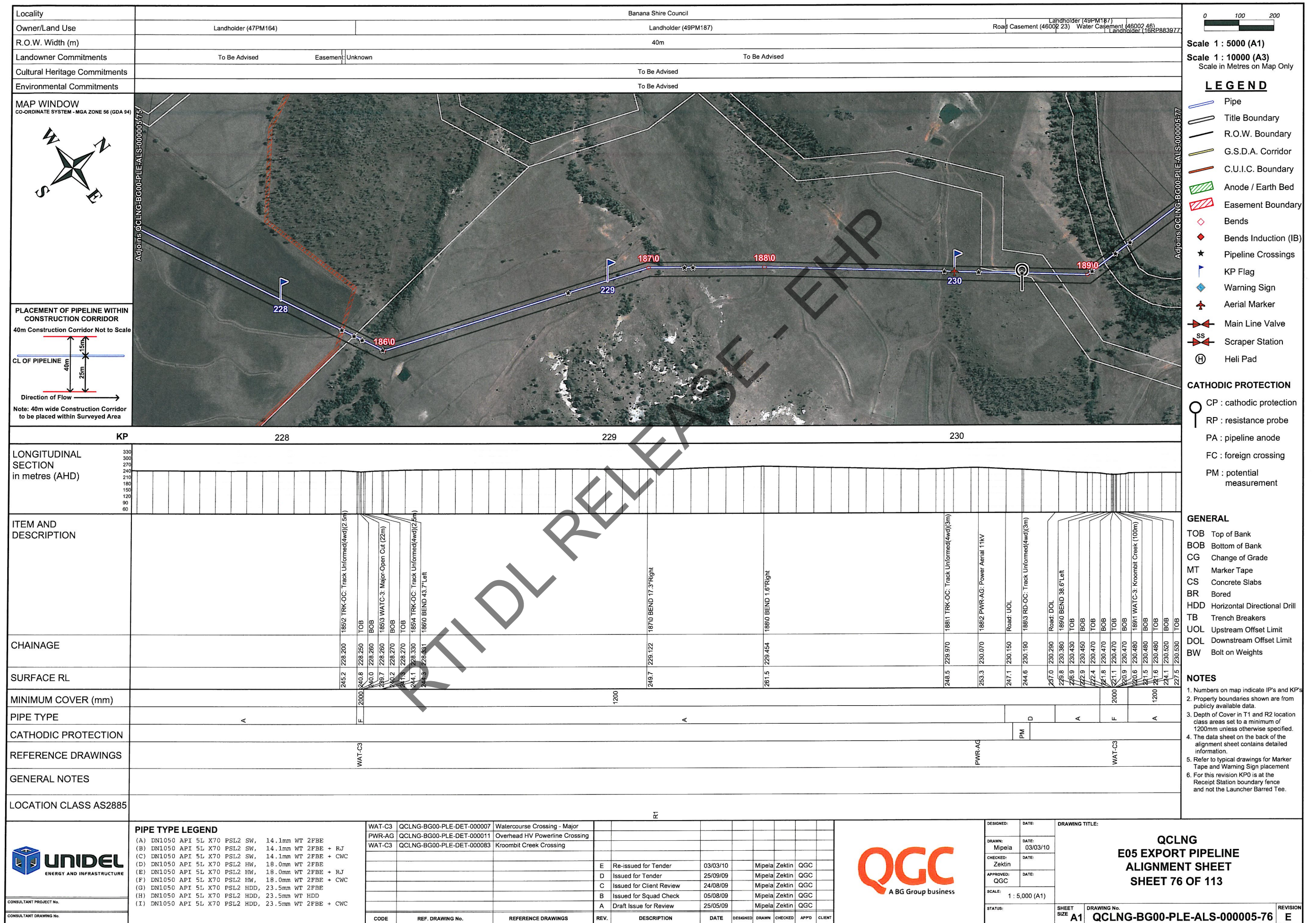
INFRASTRUCTURE ENERGY RESOLUTS

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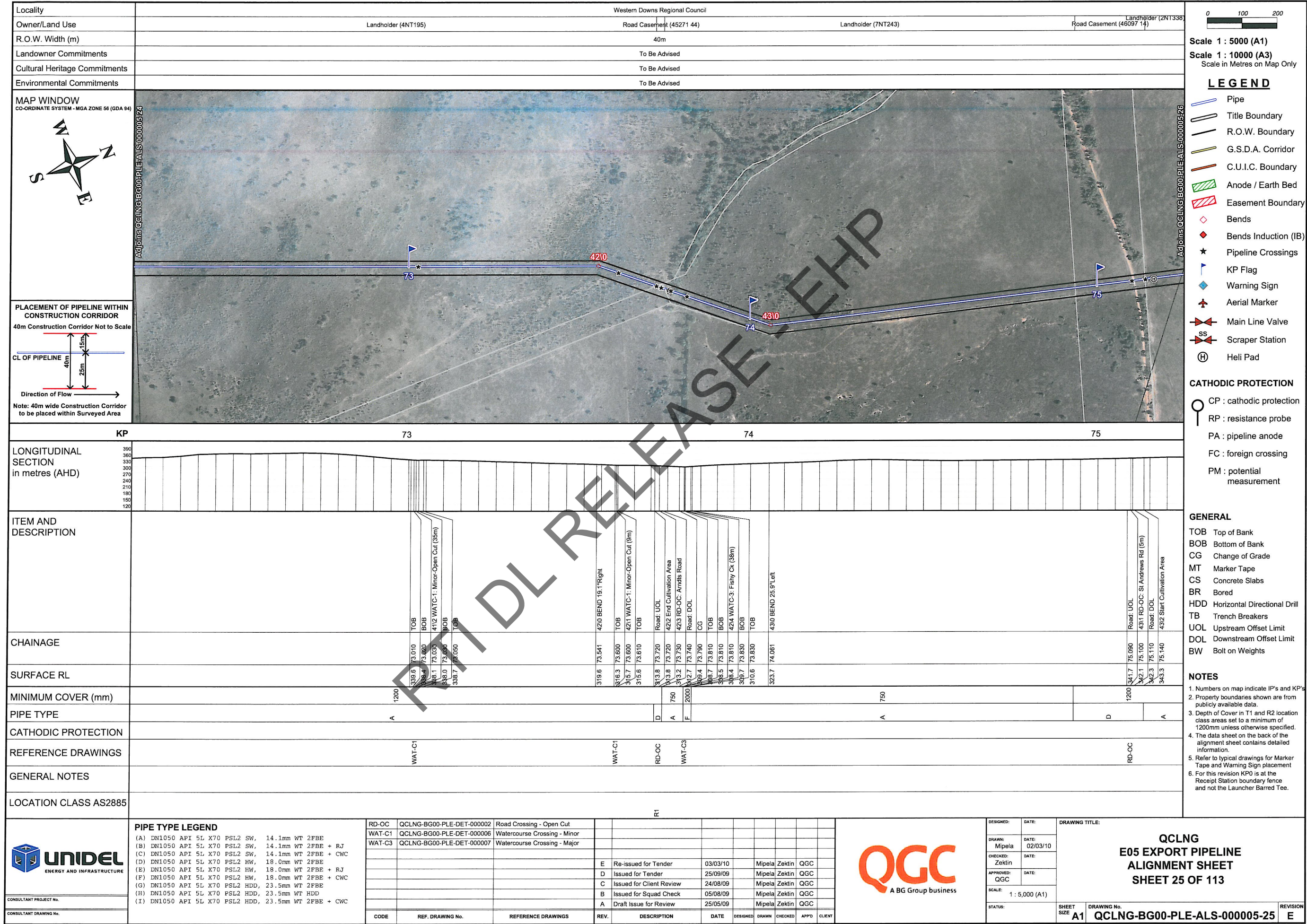
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Figure 2: Two examples of typical alignment sheets for Major water crossings

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KP	KP End Description	Easting	Northing	Easting	Northing
Additional Features					
228.250	TOB	265253.272	7295805.471		
228.260	BOB	265258.731	7295808.100		
228.270	BOB	265268.544	7295812.819		
228.270	TOB	265273.293	7295815.109		
230.150	Road: UOL	266247.441	7297376.181		
230.290	Road: DOL	266338.203	7297486.129		
230.430	TOB	266397.177	7297602.745		
230.450	BOB	266397.532	7297624.391		
230.470	BOB	266397.927	7297648.906		
230.470	BOB	266397.870	7297645.117		
230.470	TOB	266397.812	7297641.747		
230.470	TOB	266397.911	7297648.056		
230.480	BOB	266398.101	7297659.754		
230.480	TOB	266398.109	7297660.253		
230.520	BOB	266398.653	7297693.417		
230.530	TOB	266398.802	7297702.675		
Cathodic Protection					
230.190	Road Crossing	266277.093	7297411.714		
CROSSINGS					
228.200	185\2 TRK-OC: Track Unformed(4wd)(2.5m)	265203.575	7295781.546		
228.260	185\3 WATC-3: Major-Open Cut (22m)	265262.417	7295809.870		
228.330	185\4 TRK-OC: Track Unformed(4wd)(2.5m)	265321.597	7295838.364		
229.970	188\1 TRK-OC: Track Unformed(4wd)(3m)	266136.006	7297240.649		
230.070	188\2 PWR-AG: Power Aerial 11kV	266198.197	7297316.053		
230.190	188\3 RD-OC: Track Unformed(4wd)(3m)	266277.093	7297411.714		
230.480	189\1 WATC-3: Kroombit Creek (100m)	266398.051	7297656.254		
Cultural Heritage Commitments					
0.000	346.039 To Be Advised	220819.106	7086573.060	317113.135	7370684.839
Easements					
270.244	270.253	265199.996	7295779.836	265208.497	7295783.925
Environmental Commitments					
0.000	346.039 To Be Advised	220819.106	7086573.060	317113.135	7370684.839
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228.230	Type: Barb, Condition: Good, Height: 1250mm	265238.702	7295798.452		
228.880	Type: Barb, Condition: Good, Height: 1100mm	265519.522	7296356.009		
229.230	Type: Barb, Condition: Good, Height: 1300mm	265667.799	7296662.716		
229.250	Type: Barb, Condition: Good, Height: 1300mm	265682.485	7296681.603		
230.400	Type: Barb, Condition: Good, Height: 1200mm	266396.691	7297572.871		
230.530	Type: Barb, Condition: New, Height: 1350mm	266398.900	7297708.824		
IP					
228.331	186\0 BEND 43.7°Left	265325.588	7295840.314		
229.122	187\0 BEND 17.3°Right	265603.985	7296580.743		
229.454	188\0 BEND 1.6°Right	265808.003	7296843.000		
230.380	189\0 BEND 38.6°Left	266396.460	7297556.335		
Landowner Commitments					
0.000	228.190 To Be Advised	220819.106	7086573.060	265199.996	7295779.836
228.190	228.200 Easement: Unknown	265199.996	7295779.836	265209.619	7295784.475
228.200	239.500 To Be Advised	265209.619	7295784.475	264130.188	7305702.886
Locality					
194.690	267.842 Banana Shire Council	259174.386	7265099.421	271025.363	7328271.933
LOCATION CLASS AS2885					
225.450	238.980 Rural	263185.536	7294148.808	264174.089	7305197.909
MINIMUM COVER (mm)					
223.920	230.430 Minimum Cover: 2000	262451.590	7292930.486	266397.210	7297602.475
230.430	230.530 Minimum Cover: 2000	266397.210	7297602.475	266398.826	7297702.655
230.530	234.690 Minimum Cover: 2000	266398.826	7297702.655	266139.923	7301580.915
Owner/Land Use					
226.687	228.235 Landholder: Bolton, Joyce Doreen; Bolton, Justin Conrad; Bolton, Graham Thomas (47PM1	264043.030	7294946.546	265239.090	7295798.662
228.235	230.145 Landholder: Muller, Jenny & Gordon; Van It allie, Allan James (49PM187)	265239.090	7295798.662	266247.070	7297375.241
230.145	230.289 Road Casement: Road (46002 23)	266247.070	7297375.241	266338.582	7297486.169
230.289	230.441 Landholder: Muller, Jenny & Gordon; Van It allie, Allan James (49PM187)	266338.582	7297486.169	266397.441	7297617.082
230.441	230.519 Water Casement: Kroombit Creek (46002 46)	266397.441	7297617.082	266398.711	7297695.486
230.519	231.157 Landholder: Muller, Jenny & Gordon; Van It allie, Allan James (16RP883977)	266398.711	7297695.486	266409.026	7298333.466
PIPE TYPE					
224.390	228.250 Pipe Type: A	262488.705	7293385.484	265253.281	7295805.491
228.250	228.270 Pipe Type: F	265253.281	7295805.491	265273.277	7295815.129
228.270	230.150 Pipe Type: A	265273.277	7295815.129	266247.012	7297375.171
230.150	230.290 Pipe Type: D	266247.012	7297375.171	266338.574	7297486.159
230.290	230.430 Pipe Type: A	266338.574	7297486.159	266397.210	7297602.475
230.430	230.530 Pipe Type: F	266397.210	7297602.475	266398.826	7297702.655
230.530	231.160 Pipe Type: A	266398.826	7297702.655	266409.026	7298333.446
R.O.W. Width (m)					
0.000	346.039 40m	220819.106	7086573.060	317113.135	7370684.839



KP	KP End Description	Easting	Northing	Easting	Northing
Additional Features					
73.010	TOB	249205.985	7150748.267		
73.020	BOB	249209.069	7150756.805		
73.030	BOB	249213.646	7150769.473		
73.050	TOB	249218.470	7150782.800		
73.600	TOB	249420.946	7151289.337		
73.610	TOB	249426.619	7151296.285		
73.720	Road: UOL	249496.717	7151382.658		
73.740	Road: DOL	249511.807	7151401.544		
73.790	CG	249543.323	7151440.406		
73.810	BOB	249553.482	7151453.063		
73.810	TOB	249552.072	7151451.254		
73.830	BOB	249564.622	7151466.791		
73.830	TOB	249567.211	7151469.980		
75.090	Road: UOL	249947.056	7152652.219		
75.110	Road: DOL	249951.591	7152671.685		
CROSSINGS					
73.030	41½ WATC-1: Minor-Open Cut (35m)	249211.147	7150762.554		
73.600	42½ WATC-1: Minor-Open Cut (9m)	249423.956	7151293.016		
73.720	42½ End Cultivation Area	249496.594	7151382.728		
73.730	42½ RD-OC: Armdts Road	249505.169	7151393.386		
73.810	42½ WATC-3: Fishy Ck (38m)	249554.216	7151453.893		
75.100	43½ RD-OC: St Andrews Rd (5m)	249949.340	7152661.987		
75.140	43½ Start Cultivation Area	249957.907	7152698.750		
Cultural Heritage Commitments					
0.000	346.039 To Be Advised	220819.106	7086573.060	317113.135	7370684.839
Environmental Commitments					
0.000	346.039 To Be Advised	220819.106	7086573.060	317113.135	7370684.839
Fence Crossings					
73.750	Type: Barb, Condition: Good, Height: 1300mm	249518.717	7151410.052		
73.760	Type: Other, Condition: Derelict, Height: m	249523.821	7151416.391		
75.140	Type: Barb, Condition: Sound, Height: 1300m	249958.113	7152699.670		
IP					
73.541	42½ BEND 19.1° Right	249386.058	7151246.206		
74.061	43½ BEND 25.9° Left	249713.484	7151650.633		
Landowner Commitments					
0.000	228.190 To Be Advised	220819.106	7086573.060	265199.996	7295779.836
Locality					
0.000	86.818 Western Downs Regional Council	220819.106	7086573.060	257442.800	7161592.510
LOCATION CLASS AS2885					
0.000	209.070 Rural	220819.106	7086573.060	258392.771	7279021.757
MINIMUM COVER (mm)					
67.840	73.740 Minimum Cover: 1200	247453.174	7145900.684	249511.807	7151401.524
73.740	73.810 Minimum Cover: 750	249511.807	7151401.524	249552.039	7151451.224
73.810	73.830 Minimum Cover: 2000	249552.039	7151451.224	249567.227	7151469.980
73.830	74.940 Minimum Cover: 750	249567.227	7151469.980	249912.242	7152502.920
74.940	79.140 Minimum Cover: 1200	249912.242	7152502.920	252358.635	7155879.173
Owner/Land Use					
67.843	73.717 Landholder: Hatton, Cheryl Barbara; Hatton, Hilton Roger; Hatton, Shane Roger (4NT195)	247453.257	7145900.954	249496.552	7151382.688
73.717	73.742 Road Casement: Armdts Road (45271 44)	249496.552	7151382.688	249511.815	7151401.544
73.742	74.937 Landholder: Dalby Regional Council (7NT2 43)	249511.815	7151401.544	249912.250	7152502.980
74.937	75.139 Road Casement: Andrews Road (46097 14)	249912.250	7152502.980	249957.932	7152698.880
75.139	86.862 Landholder: Hatton, Cheryl Barbara; Hatton, Hilton Roger; Hatton, Shane Roger (2NT338)	249957.932	7152698.880	257471.900	7161625.533
PIPE TYPE					
66.860	73.720 Pipe Type: A	246921.293	7145081.340	249496.561	7151382.688
73.720	73.740 Pipe Type: D	249496.561	7151382.688	249511.807	7151401.524
73.740	73.810 Pipe Type: A	249511.807	7151401.524	249552.039	7151451.224
73.810	73.830 Pipe Type: F	249552.039	7151451.224	249567.227	7151469.980
73.830	74.940 Pipe Type: A	249567.227	7151469.980	249912.242	7152502.920
74.940	75.140 Pipe Type: D	249912.242	7152502.920	249957.932	7152698.890
75.140	75.470 Pipe Type: A	249957.932	7152698.890	250102.061	7152992.620
R.O.W. Width (m)					
0.000	346.039 40m	220819.106	7086573.060	317113.135	7370684.839

RTI DL RELEASE - EHP

ATTACHMENT 1:

**GAS COLLECTION HEADER MAJOR CROSSING INVESTIGATION
SUMMARY 2010**

RTI DL RELEASE - EHP

Crossing 1 – Unnamed Watercourse (KP 2.356)

	Desktop	Proximal Site Inspection	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	N	Y (see attached)	N
DERM data Stream Order	Not currently mapped in DERM data			
Aquatic Values	Riparian vegetation present/no aquatic vegetation			
Construction method	Major Crossing as per construction methodology above.			

Crossing 2 – Unnamed Watercourse (KP 31.917)

	Desktop	Proximal Site Inspection	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	Conducted 500m NW of crossing (see attached)	N	N
DERM data Stream Order	Not currently mapped in DERM data			
Aquatic Values	Riparian vegetation present/ no aquatic vegetation			
Construction method	Major Crossing as per construction methodology above.			

Crossing 3– Unnamed Watercourse (KP 43.949)

	Desktop	Proximal Site Inspection	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	N	Y (see attached)	N
DERM data Stream Order	4	4	4	4
Aquatic Values	Riparian vegetation present/ no aquatic vegetation			
Construction method	Major Crossing as per construction methodology above.			

Crossing 4 – Unnamed Watercourse (KP 57.727)

	Desktop	Proximal Site Inspection	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	N	N	N
DERM data Stream Order	1	1	1	1
Aquatic Values	No riparian vegetation present/ no aquatic vegetation			
Construction method	Major Crossing as per construction methodology above.			

Crossing 5 – Wambo Creek (KP 63.192)

	Desktop	Proximal Site Inspection	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	N	Y (see attached)	N
DERM data Stream Order	4	4	4	4
Aquatic Values	Riparian vegetation present/ no aquatic vegetation			
Construction method	Major Crossing as per construction methodology above.			

Crossing 6 – Unnamed Watercourse (KP 66.582)

	Desktop	Proximal Site Inspection	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	Conducted 500m to the East of crossing	N	N
DERM data Stream Order	1	1	1	1
Aquatic Values	Riparian vegetation present/ no aquatic vegetation			
Construction method	Major Crossing as per construction methodology above.			

Crossing 7 – Condamine River (KP 68.592)

	Desktop	Proximal Site Inspection	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	N	Y (see attached)	N
DERM data Stream Order	8	8	8	8
Aquatic Values	Riparian vegetation present – nominal drill location			
Construction method	Horizontal directional drilling as per construction methodology above.			

Crossing 8 – Columboola Creek (KP 90.135)

	Desktop	Proximal Site Inspection	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	N	Y (see attached)	N
DERM data Stream Order	3	3	3	3
Aquatic Values	Riparian vegetation present/ nominal drill location			
Construction method	Major Crossing as per construction methodology above.			

Crossing 9 – Dogwood Creek (KP 112.694)

	Desktop	Proximal Site Inspection	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	N	Y (see attached)	N
DERM data Stream Order	6	6	6	6
Aquatic Values	Riparian vegetation present/ nominal drill location			
Construction method	Major Crossing as per construction methodology above.			

Crossing 10 – Unnamed Watercourse (KP 115.88)

	Desktop	Proximal Site Inspection	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	N	N	N
DERM data Stream Order	2	2	2	2
Aquatic Values	Riparian vegetation present/ no aquatic vegetation			
Construction method	Major Crossing as per construction methodology above.			

Crossing 11 – Unnamed Watercourse (KP 117.72)

	Desktop	Proximal Site Inspection	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	Y (Conducted 750m downstream)	N	N
DERM data Stream Order	2	2	2	2
Aquatic Values	Riparian vegetation present/ no aquatic vegetation			
Construction method	Major Crossing as per construction methodology above.			

Crossing 12 – Ltree Creek (KP 128.925)

	Desktop	Proximal Site Inspection	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	Conducted 1.5km to the east of crossing on same stream order	N	N
DERM data Stream Order	4	4	4	4
Aquatic Values	Riparian vegetation present/ no aquatic vegetation			
Construction method	Major Crossing as per construction methodology above.			

Crossing 13– Tin Hut Creek (KP 130.769)

	Desktop	Proximal Site Inspection	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	N	N	N
DERM data Stream Order	3	3	3	3
Aquatic Values	Riparian vegetation present/ no aquatic vegetation			
Construction method	Major Crossing as per construction methodology above.			

Crossing 14 – Unnamed Watercourse (KP 131.44)

	Desktop	Proximal Site Inspection	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	N	N	N
DERM data Stream Order	3	3	3	3
Aquatic Values	Riparian vegetation present/ no aquatic vegetation			
Construction method	Major Crossing as per construction methodology above.			

Crossing 15 – Bottle Tree Creek (KP 133.782)

	Desktop	Proximal Site Inspection	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	N	N	N
DERM data Stream Order	3	3	3	3
Aquatic Values	Riparian vegetation present/ no aquatic vegetation			
Construction method	Major Crossing as per construction methodology above.			

Crossing 16 – Juandah Creek (KP 154.598)

	Desktop	Proximal Inspection	Site	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	N		N	N
DERM data Stream Order	4	4		4	4
Aquatic Values	Minimal existing vegetation				
Construction method	Major Crossing as per construction methodology above.				

Crossing 17 – Unnamed Watercourse (KP 160.62)

	Desktop	Proximal Inspection	Site	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	N		N	N
DERM data Stream Order	2	2		2	2
Aquatic Values	Minimal existing vegetation				
Construction method	Major Crossing as per construction methodology above.				

Crossing 18 – Unnamed Watercourse (KP 174.02)

	Desktop	Proximal Inspection	Site	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	N		N	N
DERM data Stream Order	4	4		4	4
Aquatic Values	Minimal existing vegetation				
Construction method	Major Crossing as per construction methodology above.				

Crossing 19 – Unnamed Watercourse (KP 175.56)

	Desktop	Proximal Inspection	Site	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	N		N	N
DERM data Stream Order	3	3		3	3
Aquatic Values	Minimal existing vegetation				
Construction method	Major Crossing as per construction methodology above.				

Crossing 20 – Unnamed Watercourse (KP 175.68)

	Desktop	Proximal Inspection	Site	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	N		N	N
DERM data Stream Order	4	4		4	4
Aquatic Values	Minimal existing vegetation				
Construction method	Major Crossing as per construction methodology above.				

Crossing 21 – Unnamed Watercourse (KP 180.6)

	Desktop	Proximal Inspection	Site	Tertiary Vegetation Assessment	Alignment Survey
Assessment (Y/N)	Y	N		N	N
DERM data Stream Order	5	5		5	5
Aquatic Values	Minimal existing vegetation				
Construction method	Major Crossing as per construction methodology above.				

ATTACHMENT 2:

**GAS COLLECTION HEADER MAJOR CROSSING TERIARY VEGETATION
ASSESSMENT REPORTS AND DATA 2010**

RTI DL RELEASE - EHP

CROSSING 1 (KP 2.356)

TERTIARY SITE VEGETATION ASSESSMENT

Date: 15.2.10

Site Number: SC9

Projection:

Photos:

Location: -27.2217

Datum: 150.8410

Easting:

Assessor: W. Harris

Zone:

Nothing:

	RE code	EPBC Status	VMA Status	Biodiversity Status
DNRW RE map	11.2.4 11.7.5			
Survey result	"			
Vegetation Communities (NSW)				
Survey result				

Canopy stratum form	Tree	☒ Shrub	☒ Herb	☒ Grass	☒ Aquatic	
Canopy Crown Cover (%)	5	Canopy Median Height (m)	5	Structural Code	DS	

All woody species present within 50m x 10m plot (plus dominant and EVR non-woody species)

[illegible]

Relative Numbers within stratum (D = dominant; A = Abundant C = Common; O = Occasional; U = Uncommon; Present R = Rare)
Strata: E = Emergent; T1-3 = Tree strata 1-3; S1-2 = Shrub strata 1-2; G = Ground stratum

Scheduled flora possibilities	No	Yes	Comments
		✓	none recorded

Additional notes on pest plants	
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Weed Cover (%):	<5	5-25	25-50	>50
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Disturbance (% of site affected):	0	<1	1-5	>5
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Health	Pristine	Excellent	Very Good
	Good	Average	Degraded
	Completely Degraded (almost without natives)		

Slope	Crest	Ridge	Hillock
	Simple slope	Upper slope	Mid slope
	Lower slope	Flat	Open depression
	Closed depression		

Soils	Map	Cutting	Core	Surface observation
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Reliability	Low	Medium	High
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Soil Colour	whitish	grayish	mottled
	yellow	orange	brown
	red	black	dark
	grey	pale	

Soil Texture	clay	clay loam	silty loam
	loam	sandy loam	sand
	stony	silty clay	sandy clay
	silty clay loam	sandy clay loam	loam sand

Particular sensitivities to proposed impacts (Incl. fragmentation):

Other notes such as Health, Condition:

Comments:

Top of desiccated 'jump-up'

CROSSING 2 (KP 31.917)

TERTIARY SITE VEGETATION ASSESSMENT

Date: 25.2.10

Site Number: **sc 26**

Projection:

Photos:

Location:- 27° 03' 26.1"

Datum: 150° 38' 45.0"

Easting:

Assessor: W. Harris

Zone:

Northing:

	RE code	EPBC Status	VMA Status	Biodiversity Status
DNRW RE map	11.7.7, 11.7.4 / 11.7.5			
Survey result				
Vegetation Communities (NSW)				
Survey result				

Canopy stratum form Tree ☐ ☒ Shrub ☒ Herb ☒ Grass ☒ Aquatic

Canopy Crown Cover (%)	30	Canopy Median Height (m)	20	Structural Code	W
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All woody species present within 50m x 10m plot (plus dominant and EVR non-woody species)

[illegible]

Relative Numbers within stratum (D = dominant; A = Abundant C = Common; O = Occasional; U = Uncommon; Present R = Rare)
Strata: E = Emergent; T1-3 = Tree strata 1-3; S1-2 = Shrub strata 1-2; G = Ground stratum

Scheduled flora possibilities	No	Yes	Comments
	✓		

Additional notes on pest plants	
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Weed Cover (%):	<5	5-25	25-50	>50
-----------------	----	------	-------	-----

Disturbance (% of site affected):	0	<1	1-5	>5
-----------------------------------	---	----	-----	----

Health	Pristine	Excellent	Very Good
	Good	Average	Degraded
	Completely Degraded (almost without natives)		

Slope	Crest	Ridge	Hillock
	Simple slope	Upper slope	Mid slope
	Lower slope	Flat	Open depression
	Closed depression		

Soils	Map	Cutting	Core	Surface observation
				✓

Reliability	Low	Medium	High
		✓	

Soil Colour	whitish	grayish	mottled
	yellow	orange	brown
	red	black	dark
	grey	pale	

Soil Texture	clay	clay loam	silty loam
	loam	sandy loam	sand
	stony	silty clay	sandy clay
	silty clay loam	sandy clay loam	loam sand

Particular sensitivities to proposed impacts (incl. fragmentation):

Other notes such as Health, Condition:

heavily logged, low diversity. Very sparse ground cover

Comments:

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Scheduled flora possibilities	No	Yes	Comments
	✓		

Additional notes on pest plants	Very common <i>Bryophyllum</i> & <i>Verbena</i>
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Weed Cover (%):	<5	5-25	25-50	>50
-----------------	----	------	-------	-----

Disturbance (% of site affected):	0	<1	1-5	>5
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Health	Pristine	Excellent	Very Good
	Good	Average	Degraded
	Completely Degraded (almost without natives)		

Slope	Crest	Ridge	Hillock
	Simple slope	Upper slope	Mid slope
	Lower slope	Flat	Open depression
	Closed depression	River Bank	

Soils	Map	Cutting	Core	Surface observation
				✓

Reliability	Low	Medium	High
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Soil Colour	whitish	grayish	mottled
	yellow	orange	brown
	red	black	dark
	grey	pale	

Soil Texture	clay	clay loam	silty loam
	loam	sandy loam	sand
	stony	silty clay	sandy clay
	silty clay loam	sandy clay loam	loam sand

Particular sensitivities to proposed impacts (incl. fragmentation):

The line should avoid all native *Angophora* trees

Other notes such as Health, Condition:

Some very fine specimens of *Angophora* in the immediate area.

Comments:

CROSSING 5 (Kp 61.158)

TERTIARY SITE VEGETATION ASSESSMENT

Date: 31.1.10

Site Number: SC 9

Projection:

Photos:

Location: -26,8608

Datum: 15.6.84

Easting:

Assessor: W.K. Harris

Zone:

Nothing:

	RE code	EPBC Status	VMA Status	Biodiversity Status
DNRW RE map	11.3.4/11.3.2/11.3.25			
Survey result	" "			
Vegetation Communities (NSW)				
Survey result				

Canopy stratum form	Tree	Shrub	Herb	Grass	Aquatic
Canopy Crown Cover (%)	5	Canopy Median Height (m)	18	Structural Code	0W

All woody species present within 50m x 10m plot (plus dominant and EVR non-woody species)

[illegible]

Relative Numbers within stratum (D = dominant; A = Abundant C = Common; O = Occasional; U = Uncommon; Present R = Rare)
Strata: E = Emergent; T1-3 = Tree strata 1-3; S1-2 = Shrub strata 1-2; G = Ground stratum

Scheduled flora possibilities	No	Yes	Comments

Additional notes on pest plants	<i>Serious invasion of <i>Banyophyllum</i></i>
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Weed Cover (%):	<5	5-25	25-50	>50
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Disturbance (% of site affected):	0	<1	1-5	>5
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Health	Pristine	Excellent	Very Good
	Good	Average	Degraded
	Completely Degraded (almost without natives)		

Slope	Crest	Ridge	Hillock
	Simple slope	Upper slope	Mid slope
	Lower slope	Flat	Open depression
	Closed depression		

Soils	Map	Cutting	Core	Surface observation
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Reliability	Low	Medium	High
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Soil Colour	whitish	grayish	mottled
	yellow	orange	brown
	red	black	dark
	grey	pale	

Soil Texture	clay	clay loam	silty loam
	loam	sandy loam	sand
	stony	silty clay	sandy clay
	silty clay loam	sandy clay loam	loam sand

Particular sensitivities to proposed impacts (incl. fragmentation):

Other notes such as Health, Condition:

Comments: *Riparian forest*

Crossing 6 + 7 (KP 66.115 + 66.582)

TERTIARY SITE VEGETATION ASSESSMENT

Date: 31.1.10

Site Number: SC 6

Projection:

Photos:

Location: -26,8347°

Datum: 15-11-1985

Easting:

Assessor: W. Harris

Zone:

Northing:

	RE code	EPBC Status	VMA Status	Biodiversity Status
DNRW RE map	11.3.25/11.3.14	11.3.3		
Survey result	as above			
Vegetation Communities (NSW)				
Survey result				

Canopy stratum form	Tree	Shrub	Herb	Grass	Aquatic
Canopy Crown Cover (%)	10	Canopy Median Height (m)		20	Structural Code

All woody species present within 50m x 10m plot (plus dominant and EVR non-woody species)

[illegible]

Relative Numbers within stratum (D = dominant; A = Abundant C = Common; O = Occasional; U = Uncommon; Present R = Rare)
Strata: E = Emergent; T1-3 = Tree strata 1-3; S1-2 = Shrub strata 1-2; G = Ground stratum

Scheduled flora possibilities	No	Yes	Comments
	✓		

Additional notes on pest plants	
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Weed Cover (%):	<5	5-25	25-50	>50
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Disturbance (% of site affected):	0	<1	1-5	>5
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Health	Pristine	Excellent	Very Good
	Good	Average	Degraded
	Completely Degraded (almost without natives)		

Slope	Crest	Ridge	Hillock
	Simple slope	Upper slope	Mid slope
	Lower slope	Flat - see below	Open depression
	Closed depression		

Soils	Map	Cutting	Core	Surface observation	✓
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Reliability	Low	Medium	High
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Soil Colour	whitish	grayish	mottled
	yellow	orange	brown
	red	black	dark
	grey	pale	

Soil Texture	clay	clay loam	silty loam
	loam	sandy loam	sand
	stony	silty clay	sandy clay
	silty clay loam	sandy clay loam	loam sand

Particular sensitivities to proposed impacts (incl. fragmentation):

Other notes such as Health, Condition:

Understory heavily grazed

Comments:

River bank with prominent overbanks.
C. teresolanis dominates in overbank conditions

Crossing 8 (KP 88.367)

TERTIARY SITE VEGETATION ASSESSMENT

Date: 30.1.10

Site Number: 5C3

Projection:

Photos:

Location: 26.7280°

Datum: 150.3256°

Easting:

Assessor: W. Harris

Zone:

Nothing:

	RE code	EPBC Status	VMA Status	Biodiversity Status
DNRW RE map	11.3.25			
Survey result	11.3.25			
Vegetation Communities (NSW)				
Survey result				

Canopy stratum form	Tree	Shrub	Herb	Grass	Aquatic
Canopy Crown Cover (%)	15	Canopy Median Height (m)		22	Structural Code

All woody species present within 50m x 10m plot (plus dominant and EVR non-woody species)

[illegible]

Relative Numbers within stratum (D = dominant; A = Abundant C = Common; O = Occasional; U = Uncommon; Present R = Rare)
Strata: E = Emergent; T1-3 = Tree strata 1-3; S1-2 = Shrub strata 1-2; G = Ground stratum

Scheduled flora possibilities	No ☒	Yes ☐	Comments
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Additional notes on pest plants	
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Weed Cover (%):	<5	5-25	25-50	>50
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Disturbance (% of site affected):	0	<1	1-5	>5
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Health	Pristine	Excellent	Very Good
	Good	Average	Degraded
	Completely Degraded (almost without natives)		

Slope	Crest	Ridge	Hillock
	Simple slope	Upper slope	Mid slope
	Lower slope	Flat	Open depression
	Closed depression		

Soils	Map	Cutting	Core	Surface observation
-------	-----	---------	------	---------------------

Reliability	Low	Medium	High
-------------	-----	--------	------

Soil Colour	whitish	grayish	mottled
	yellow	orange	brown
	red	black	dark
	grey	pale	

Soil Texture	clay	clay loam	silty loam
	loam	sandy loam	sand
	stony	silty clay	sandy clay
	silty clay loam	sandy clay loam	loam sand

Particular sensitivities to proposed impacts (Incl. fragmentation):

Other notes such as Health, Condition:

Ground cover is mostly pasture grasses and weeds.
Bank of river is cultivated

Comments:

CROSSING 9 (KP110.39)

Tertiary Site Vegetation Assessment Data Sheet

Job Number:

Site Number: M8..... KP: 13..... Assessor: Ann..... Date : 25/11/2008

Location: Dogwood Creek Photo #: .4.....

GPS Projection: UTM Datum: GDA94; Easting: 224983.. Northing: 7058925

Width of RE: >300

Width of total remnant: >300

Total RE Area: 50ha

Total remnant Area: >50ha

	RE code	EPBC status	VMA status
DNRW RE map	11.3.4/11.3.25		Of Concern / Not of Concern
Survey result	11.3.4		Of Concern

Canopy stratum form: Tree

Canopy Crown Cover: 70....%

Canopy Median Height: 25m.

Structural Code: Tall open forest.....

All woody species present within 50m x 10m plot (plus dominant and EVR non-woody species)

Name	Rel. No.	Height Ocular estimate (m)						Ground Cover	
		E	T1	T2	T3	S1	S2	Ground Layer >1m	No.
<i>Callitris glaucophylla</i>	A			15	10	8		<i>Lomandra leucocephala</i> v <i>leucocephala</i>	C
<i>Eucalyptus tereticornis</i>	A	25	20	15				<i>Lomandra longifolia</i>	C
<i>Callistemon viminalis</i>	C							<i>Desmodium rhytidophyllum</i>	O
<i>Eucalyptus populnea</i>	E				10	8		<i>Calotis lappulacea</i>	O
<i>Cymbidium canaliculatum</i>	O						4	<i>Emilia sonchifolia</i> v <i>sonchifolia</i>	O
<i>Hibiscus sturtii</i> v <i>sturtii</i>	O						2	<i>Tricoryne elatior</i>	O
<i>Leptospermum polygalifolium</i>	O						5	<i>Laxmannia gracilis</i>	O
<i>Angophora floribunda</i>	O	25					4	<i>Sonchus oleraceus</i>	P
								<i>Opuntia tomentosa</i>	P
								<i>Dianella rara</i>	P
								<i>Phyllanthus virgatus</i>	P
								<i>Commelina ensifolia</i>	U
								<i>Zornia dyctiocarpa</i> v <i>dyctiocarpa</i>	U
								<i>Cheilanthes sieberi</i>	U
								<i>Chrysocephalum apiculatum</i>	U
								<i>Podolepis longipedata</i>	U
								<i>Gahnia aspera</i>	U
								<i>Rostellularia adscendens</i> v <i>adscendens</i>	---
								<i>Fimbristylis dichotoma</i>	---
								<i>Crotalaria montana</i>	U
Canopy stratum (%) 70									
Mid stratum (%)									
Ground stratum (%)									
Rock cover (%)									
Bare ground cover (%)									
Litter cover (%)									

Species annotations: C = Collected * Exotic Species ** Declared Species E = Edge or Outside but adjoining 50m x 10m plot Relative Numbers within stratum (D = dominant; A = Abundant C = Common; O = Occasional; U = Uncommon; P = Present R = Rare)
Strata: E = Emergent; T1-3 = Tree strata 1-3; S1-2 = Shrub strata 1-2; G = Ground stratum\\

Scheduled flora possibilities: Yes *Fimbristylis vagans*.....

Additional notes on pest plants *Verbena tenuisecta* (maynes pest) was observed on the site.

Weed Cover (%): <5
Disturbance (% of site affected): 0
Health: Good
Slope: Open depression
Soils: Surface observation Reliability: Low
Soil Colour: yellow
Soil Texture: sand

	Description	Plants per plot
D	Dominant	>100
A	Abundant	50 - 100
C	Common	20 - 50
O	Occasional	10 - 20
U	Uncommon	5 - 10
P	Present	3 - 5
R	Rare	1 - 3

Particular sensitivities to proposed impacts (incl. fragmentation): Banks prone to erosion.

Special conservation significance:
Other notes such as Health, Condition: 11.3.27b old oxbow

Landuse Grazing.....culturalcommercialrecreational.....
observed or Horticultural Crops
Over fence or opposite sides road: cattle yard on western banks.

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Scheduled flora possibilities: Yes possible EVR sedge species

Additional notes on pest plants nil.....

.....
.....
.....

Weed Cover (%): <5

Disturbance (% of site affected): 0

Health: Good

Slope: Open depression

Soils: Surface observation **Reliability:** Low

Soil Colour: yellow

Soil Texture: sand

	Description	Plants per plot
D	Dominant	>100
A	Abundant	50 - 100
C	Common	20 - 50
O	Occasional	10 - 20
U	Uncommon	5 - 10
P	Present	3 - 5
R	Rare	1 - 3

Particular sensitivities to proposed impacts (incl. fragmentation): Erodible soils.....

Special conservation significance:.....

Other notes such as Health, Condition:

Landuse Grazing.....culturalcommercialrecreational.....

observed or Horticultural Crops

Over fence or opposite sides road

CROSSING 13 (KP 126.6)

Tertiary Site Vegetation Assessment Data Sheet

Job Number: Main Line

Site Number: M03 KP: 29.3

Assessor: Ann

Date : 25/11/2008

Location: LTREE CREEK ROAD

Photo #: 4

GPS Projection: UTM

Datum: GDA94; Easting: 219029 Northing: 7074135

Width of RE: >300

Width of total remnant: >300

Total RE Area: >50ha

Total remnant Area: >50ha

	RE code	EPBC status	VMA status
DNRW RE map	11.7.5		Not of Concern
Survey result	11.7.5		Not of Concern

Canopy stratum form: Shrub;

Canopy Crown Cover: 90%

Canopy Median Height: 3-4m

Structural Code: Shrubland with emergent

All woody species present within 50m x 10m plot (plus dominant and EVR non-woody species)

Name	Rel. No.	Height Ocular estimate (m)						Ground Cover	
		E	T1	T2	T3	S1	S2	Ground Layer <1m	No.
<i>Calytrix longiflora</i>	A						3	<i>Podolepis longipedata</i>	O
<i>Hovea longipes</i>	C						3	<i>Laxmannia gracilis</i>	O
<i>Melaleuca nodosa</i>	C						2	<i>Scleria sphacelata</i>	P
<i>Corymbia bloxsomei</i>	E		15					<i>Panicum decompositum</i>	P
<i>Lysicarpus angustifolius</i>	E				8			<i>Alloteropsis semialata</i>	P
<i>Eucalyptus exserta</i>	O					4	3	<i>Triodia scariosa</i>	P
<i>Homoranthus melanostictus</i>	O						3	<i>Homoranthus melanostictus</i>	O
<i>Hakea purpurea</i>	O						3	<i>Plectranthus parviflorus</i>	P
<i>Xanthorrhoea johnsonii</i>	O				2			<i>Poranthera microphylla</i>	O
<i>Homalocalyx polyandrus</i>	P						3	<i>Lindernia alsinoides</i>	P
<i>Melaleuca uncinata</i>	P						3	<i>Caladenia caerulea</i>	P
<i>Boronia bipinnata</i>	P						3	<i>Cassytha filiformis</i>	P
<i>Acacia blakei</i> ssp <i>blakei</i>	U						3		
<i>Micromyrtus sessilis</i>	U						3		
Mid stratum (90%)									
Ground stratum (50%)									
Rock cover (10%)									
Bare ground cover (20%)									
Litter cover (20%)									

Species annotations: C = Collected * Exotic Species ** Declared Species E = Edge or Outside but adjoining 50m x 10m plot Relative Numbers within stratum (D = dominant; A = Abundant C = Common; O = Occasional; U = Uncommon; P = Present R = Rare)
Strata: E = Emergent; T1-3 = Tree strata 1-3; S1-2 = Shrub strata 1-2; G = Ground stratum\\

Scheduled flora possibilities: Yes - very likely *Philotheca sporadica*

Additional notes on pest plants Nil on Site

Nearby creek banks had *Bryophyllum* spp (mother of millions) present.

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.....

Weed Cover (%): 0

Disturbance (% of site affected): 0

Health: Very Good

Slope: Crest; Ridge;

Soils: Surface observation **Reliability:** Low,

Soil Colour: yellow; orange;

Soil Texture: stony clay;

	Description	Plants per plot
D	Dominant	>100
A	Abundant	50 - 100
C	Common	20 - 50
O	Occasional	10 - 20
U	Uncommon	5 - 10
P	Present	3 - 5
R	Rare	1 - 3

Particular sensitivities to proposed impacts; Fragmentation of small heathland area

.....

Special conservation significance:.....

Other notes such as Health, Condition: Good health after recent fires

.....

Landuse Grazing.....Cultural – possible cultural heritage area

observed or Horticultural Crops

Over fence or opposite sides road

PLATES

RTI DL RELEASE - EHP

PLATE 1 – SITE T03 – CUMBOOLA CREEK



PLATE 2 – SITE T06 – THE CONDAMINE RIVER



PLATE 3 – SITES T08 – WAMBO CREEK



PLATE 4 – SITES T09, T10, T11, T12 and T14 – BRAEMAR STATE FOREST



PLATE 5 – SITE T23 – WAMBO CREEK



ATTACHMENT 3:

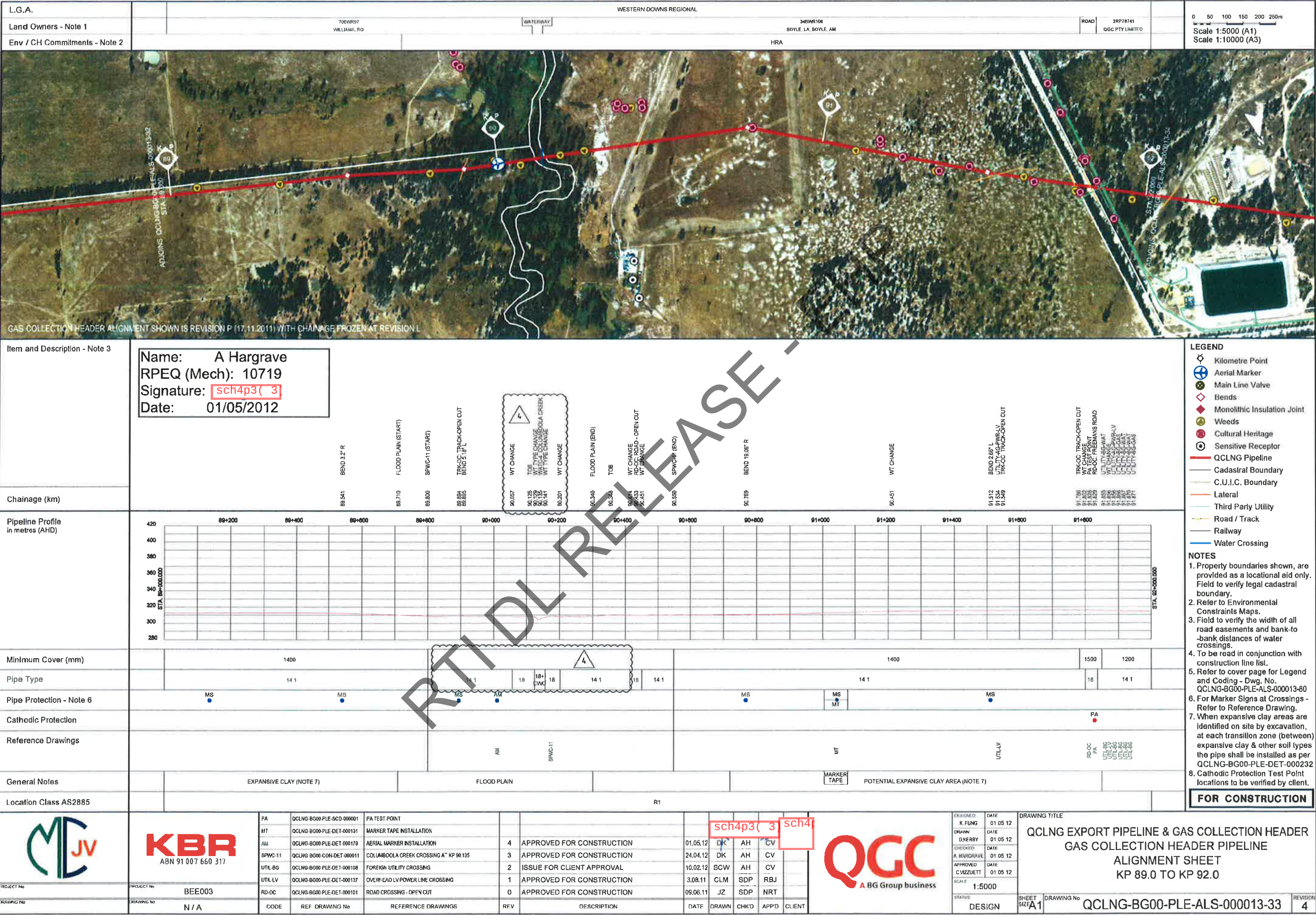
**GAS COLLECTION HEADER MINOR AND MAJOR WATER CROSSING
SUMMARY 2012**

RTI DL RELEASE - EHP

Location of Major and Minor Watercourse crossings along the GCH, based on Revision K of the GCH alignment

KP Start	Description	Easting	Northing
10.032	WATC-1: Minor Water Crossing	280115.0647	6989280.961
12.705	WATC-1: Minor Water Crossing	279075.2745	6990902.313
18.898	WATC-1: Minor Water Crossing	275715.1387	6995079.76
21.355	WATC-1: Minor Water Crossing	274434.7746	6997089.661
21.855	WATC-1: Minor Water Crossing	274339.1313	6997581.115
24.282	WATC-1: Minor Water Crossing	272937.6629	6999463.906
24.866	WATC-1: Minor Water Crossing	272524.7853	6999876.779
45.945	WATC-3: Wambo Creek	261218.7077	7014862.207
54.147	WATC-1: Minor Water Crossing	255960.738	7021003.111
54.184	WATC-1: Minor Water Crossing	255930.0269	7021023.641
54.379	WATC-1: Minor Water Crossing	255767.8439	7021132.058
55.512	WATC-1: Minor Water Crossing	254826.3976	7021761.4
59.685	WATC-3: Major Water Crossing	251746.2189	7024006.622
62.605	WATC-3: Major Water Crossing	250138.3487	7026080.331
62.614	WATC-3: Major Water Crossing	250130.1547	7026085.681
63.192	WATC-3: Wambo Creek	250036.3194	7026529.277
64.834	WATC-1: Minor Water Crossing	250173.6994	7028070.82
68.592	WATC-4: Condamine River	250173.6994	7029455.607
72.272	WATC-1: Minor Water Crossing	247008.2036	7032960.96
74.189	WATC-1: Minor Water Crossing	246492.4976	7034748.375
75.839	WATC-1: Minor Water Crossing	246372.7964	7036341.927
81.527	WATC-1: Minor Water Crossing	241371.6969	7037983.212
82.563	WATC-1: Minor Water Crossing	240387.7148	7038301.726
83.027	WATC-1: Minor Water Crossing	239947.6948	7038451.012
90.135	WATC-4: Columboola Creek	234057.3775	7041103.035
94.073	WATC-1: Minor Water Crossing	230684.9784	7042690.8
97.703	WATC-1: Minor Water Crossing	229324.3911	7045095.094
98.179	WATC-1: Minor Water Crossing	229127.6576	7045528.621
99.614	WATC-3: Major Water Crossing	228864.0472	7046896.91
105.701	WATC-1: Minor Water Crossing	227652.2882	7052624.332
107.211	WATC-1: Minor Water Crossing	227270.7583	7054034.233
108.872	WATC-1: Minor Water Crossing	226364.5511	7055426.493
108.974	WATC-1: Minor Water Crossing	226309.05	7055511.763
109.217	WATC-1: Minor Water Crossing	226238.09	7055729.508
109.357	WATC-1: Minor Water Crossing	226254.825	7055868.88
112.694	WATC-3: Dogwood Creek	225219.5024	7059010.325
113.385	WATC-1: Minor Water Crossing	224791.5168	7059506.165

116.391	WATC-1: Minor Water Crossing	223810.6464	7062138.946
117.815	WATC-1: Minor Water Crossing	223262.5217	7063453.348
118.217	WATC-3: Major Water Crossing	223107.7498	7063824.491
118.612	WATC-1: Minor Water Crossing	222955.5659	7064189.427
120.059	WATC-3: Major Water Crossing	222658.1849	7065590.761
124.123	WATC-1: Minor Water Crossing	221298.5507	7069312.142
125.435	WATC-3: Major Water Crossing	221167.2853	7070617.794
128.925	WATC-3: L Tree Creek	220677.9054	7074066.704
130.769	WATC-3: Tin Hut Creek	220343.6221	7075873.146
132.906	WATC-1: Minor Water Crossing	220296.4837	7078006.682
133.782	WATC-3: Bottle Tree Creek	220356.7402	7078880.928
134.958	WATC-1: Minor Water Crossing	220459.6682	7080051.283
135.245	WATC-1: Minor Water Crossing	220501.6978	7080332.686
135.617	WATC-3: Major Water Crossing	220675.477	7080661.378
138.043	WATC-1: Minor Water Crossing	220727.3403	7083064.657
140.827	WATC-1: Minor Water Crossing	220681.8089	7085848.796
151.096	WATC-1: Minor Water Crossing	212023.3213	7085290.571
153.189	WATC-1: Minor Water Crossing	209960.9684	7085209.865
154.598	WATC-3: Juandah Creek	208555.3731	7085097.866
163.214	WATC-3: Major Water Crossing	201485.6563	7088703.95
172.539	WATC-1: Minor Water Crossing	193883.1468	7092595.918
175.472	WATC-1: Minor Water Crossing	191255.7441	7091786.678
175.491	WATC-1: Minor Water Crossing	191244.7144	7091771.357
176.506	WATC-3: Major Water Crossing	190617.9802	7090985.058
176.721	WATC-1: Conloi Creek	190431.6065	7090878.162
178.054	WATC-3: Conloi Creek	189274.5451	7090214.525
179.622	WATC-1: Minor Water Crossing	187795.4552	7089884.43
181.426	WATC-1: Minor Water Crossing	186073.8679	7090178.844
183.159	WATC-3: Woleebee Creek	184367.2800	7090408.148
186.000	WATC-1: Minor Water Crossing	181545.5608	7090660.895
186.675	WATC-1: Minor Water Crossing	180875.5759	7090738.516
187.878	WATC-1: Minor Water Crossing	179680.8144	7090876.935
189.072	WATC-1: Minor Water Crossing	178503.0177	7090984.581
189.368	WATC-1: Ogle Creek	178212.6278	7091043.665
191.225	WATC-1: Minor Water Crossing	176368.4903	7091260.579
192.576	WATC-1: Minor Water Crossing	175026.2936	7091416.086
193.392	WATC-1: Minor Water Crossing	174311.8565	7091186.889
193.547	WATC-1: Minor Water Crossing	174210.445	7091071.276
194.332	WATC-1: Minor Water Crossing	173743.0408	7090439.911



PA

QCLNG-BG00-PLS-SCD-000001

PA TEST POINT

MT

QCLNG-BG00-PLS-DET-000131

MARKER TAPE INSTALLATION

AM

QCLNG-BG00-PLS-DET-000179

AERIAL MARKER INSTALLATION

SPWC-11

QCLNG-BG00-CON-DET-000011

COLUMBOOLA CREEK CROSSING A" KP 90.135

UTL-OC

QCLNG-BG00-PLS-DET-000108

FOREIGN UTILITY CROSSING

UTL-LV

QCLNG-BG00-PLS-DET-000137

OVERHEAD LV POWER LINE CROSSING

RD-OC

QCLNG-BG00-PLS-DET-000101

ROAD CROSSING - OPEN CUT

CODE

REF

DRAWING No

REFERENCE DRAWINGS

REV

DESCRIPTION

DATE

DRAWN

CHK'D

APP'D

CLIENT

4

APPROVED FOR CONSTRUCTION

01.05.12

DK

AH

CV

sch4p3 (3)

sch4

3

APPROVED FOR CONSTRUCTION

24.04.12

DK

AH

CV

sch4p3 (3)

sch4

2

ISSUE FOR CLIENT APPROVAL

10.02.12

SCW

AH

CV

sch4p3 (3)

sch4

1

APPROVED FOR CONSTRUCTION

3.08.11

CLM

SDP

RBJ

sch4p3 (3)

sch4

0

APPROVED FOR CONSTRUCTION

09.06.11

JZ

SDP

NRT

sch4p3 (3)

sch4

QGC

A BG Group business

DESIGNED

K. FUNG

DATE

01.05.12

DRAWN

D. REBY

DATE

01.05.12

CHECKED

A. HARGRAVE

DATE

01.05.12

APPROVED

C. VIZZUETI

DATE

01.05.12

SCALE

1:5000

STATUS

DESIGN

SHEET

SIZE A1

DRAWING No

QCLNG-BG00-PLS-ALS-000013-33

REVISION

4

QCLNG EXPORT PIPELINE & GAS COLLECTION HEADER

GAS COLLECTION HEADER PIPELINE

ALIGNMENT SHEET

KP 89.0 TO KP 92.0

FOR CONSTRUCTION

D:\GSI\CAD\Projects\BEE003\Drawings\GIS\AlignmentSheets\GCH_RevP-1_SHT27-50.dwg, 1/05/2012 9:36:33 AM

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DL Documents

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