Surat Basin Acreage Development
QGC Upstream

Matters of National Environmental Significance
Impact Assessment Report

Rev 0

August 2018

Revision Record

Issue	Date	Reason for Issue	Responsible	Accountable
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ACRONYMS / ABBREVIATIONS

In this document, the following acronyms and abbreviations apply:

Acronyms /Abbreviations	Meaning
ATP	Authority to Prospect
BAAM	Biodiversity Assessment and Management Pty Ltd (BAAM) Ecological Consultants
BOP	Blowout preventer
CMA	Cumulative Management Area
COPS	Chinchilla Operation Production Support
CPP	Woleebee Creek Central Processing Plant
DoEE	Department of Environment and Energy
DEHP	Department of Environment and Heritage Protection (now Department of Environment and Science – DES)
DES	Department of Environment and Science
DNRME	Department of Natural Resources, Mines and Energy
EMP	Environmental Management Plan
EPBC Act	Environment Protection and Biodiversity Conservation Act (C'wth)
EPBC Permit	QGC's existing EPBC Permit 2013/7047 granted 16 December 2014
FCS	Field Compressor Station
FOC	Fibre Optic Communications
GAB	Great artesian basin
GDE	Groundwater dependent ecosystem
HDPE	High density polyethylene
HSSE	Health, Safety, Security and Environment
ML	Mining Lease
MLA	Mining lease application
MNES	Matters of national environmental significance
OGIA	Office of Groundwater Impact Assessment
PL	Petroleum lease
PLA	Petroleum lease application
PMST	Protected Matters Search Tool
QGC	Queensland Gas Company – QGC Pty Ltd (the proponent)
QWC	Queensland Water Commission
RE	Regional Ecosystem
RO	Reverse Osmosis
RSP	Regional Storage Pond
TDS	Total dissolved solids
TEC	Threatened Ecological Community
UWIR	Underground Water Impact Report

Acronyms /Abbreviations	Meaning
WCM	Walloon Coal Measures
WTP	Woleebee Creek Water Treatment Plant
WWMP	Water Monitoring and Management Plan

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Background and Objectives

QGC Pty Ltd (QGC) proposes to increase natural gas production from within its existing Surat Basin Acreage Development (the Project area). The Project area is defined by ten existing Petroleum Leases (PLs) occupying approximately 123,500 ha, near Wandoan in Queensland (Figure 1.1). The Surat Basin Acreage Development was first approved under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), specifically EPBC Permit 2013/7047 (the EPBC Permit), on 16 December 2014 and gas is now being produced for both the domestic and export markets.

Additional authorised activities are required to meet current demands for natural gas by QGC's customers. This document has been prepared to support assessment and approval of the next phases of the Project in accordance with the relevant provisions of the EPBC Act.

1.2 EPBC Title of the Action

The EPBC title of the action is: "QGC Pty Ltd – Energy Generation and Supply (non-renewable), Surat Basin, Queensland – Development of natural gas acreage in Surat Basin."

1.3 Existing Operations

The Surat Basin Acreage Development Project is an existing natural gas production operation located in the northern Surat Basin, Queensland. The Project area previously comprised Authority to Prospect (ATP) 852 and 768 on which exploration wells and ponds were developed from 2007. The ten PLs were then granted over the Project area over time, occupying an area of approximately 123,500 ha. Activities on the ten PLs which may affect Matters of National Environmental Significance (MNES) had been regulated under the EPBC Permit 2013/7047.

Existing and approved operations within the Project area include:

- natural gas wells;
- gathering lines and trunklines for gas and water within the Project area;
- a field compressor station, where gas is received and compressed for transfer through trunklines off the Surat Basin Acreage tenure to an existing and already approved Central Processing Plant (CPP)[1] located on the adjacent Woleebee Creek Project area (EPBC Ref: 2008/4398);
- regional storage ponds and in-field water storage, including ponds, tanks and pumping stations for transfer through trunklines to the existing and already approved Woleebee Creek Water Treatment Plant (WTP); and

[1] CPP and WTP facilities at Woleebee Creek were approved under QCLNG related approvals

- ancillary and support infrastructure including access roads, electrical supply infrastructure, communications, laydown areas, borrow pits and temporary drilling camps.

1.4 Proposal

QGC is approaching completion of the first phase of its Surat Basin Acreage Development. The next phases of development look to compliment and expand upon the initial phase predominantly utilising infill development wherever possible. This concept allows proposed new wells to be connected into already developed infrastructure networks (located both inside this Project area developed under EPBC 2013/7047 and within the Woleebee Creek Project area immediately adjacent developed under EPBC 2008/4398) while not expanding outside of the existing Project area's authorised boundaries. The next phases of the development will occur within the same referral area of EPBC 2013/7047 for which activities will be authorised under a new EPBC referral.

It is envisaged that the Project area can accommodate full-field development of up to approximately 1,200 wells. QGC had previously planned to seek all relevant approvals to allow for the full development of the Project area in 2013, however the scope was subsequently reduced as a result of the falling price of oil and gas, and QGC's parent company at the time, BG Group, only electing to sanction the initial phase of the development (~400 wells) as part of its "Project Charlie".

With the development of those 400 wells now online and producing gas, QGC is looking to develop the remaining phases, subject to sanction from the Shell Group.

To reach full field development, QGC is seeking approval to develop 740 additional production wells in phases to align with project sanctioning, which includes:

- "Sustaining Wells 2019" – involving the development of an additional 100 production wells within the Surat Basin Acreage Development Project area; and

- "Sustaining Wells 2020+" – consisting of the remaining 640 production wells, and subject to Project sanctioning and Final Investment Decision.

These next phases of development will only require the authorisation of additional wells, access and gathering to support the ongoing supply of natural gas to existing gas processing facilities and on to the domestic and international markets. All works are proposed entirely within the boundaries of the existing approved Project area and will utilise existing authorised infrastructure, associated approvals and management plans to further develop the additional wells.

The new infrastructure developed during these phases will connect into existing and already approved operational infrastructure described above in Section 1.3. No development is proposed as part of this referral outside of the Project area.

An assessment of impacts against all relevant MNES has been undertaken to determine likely impacts resulting from the development of the next phases and propose appropriate management practices. The assessment determined that the proposed development will have minimal impact on existing environmental values resulting from the construction and operation of the additional wells, access and gathering. This includes potential cumulative impacts of the proposed and existing operations. Elements of this are outlined below, and further detail can be found throughout the remainder of this document.

1.5 Details of the Proponent

The development will be constructed, operated and maintained by a joint venture, currently comprising QGC Upstream Holdings Pty Ltd, CNOOC Coal Seam Gas Company Pty Ltd, and Tokyo Gas QCLNG Pty Ltd, with QGC as the operator.

The contact details for QGC are:

- Address: QGC, Level 30, 275 George Street, Brisbane, QLD 4000
- Postal Address: QGC, GPO Box 3107, Brisbane, QLD, 4001
- Telephone: 1800 030 443 (24-hour toll-free line)
- Email: qgccommunity@shell.com

Further information regarding the proponent and the Surat Basin Acreage Development can be found at: https://www.shell.com.au/about-us/projects-and-locations/qgc.html

1.6 QGC's Environmental Management Policy

QGC's environmental policy is to manage all its construction and operational activities and those conducted by its contractors in a pro-active manner to minimise any environmental impacts from the development. QGC has developed and implemented a structured environmental program that involves:

- identification of environmental values;
- assessment of impacts to environmental values;
- implementation of strategies to avoid, minimise, or mitigate environmental impacts;
- environmental monitoring, inspections and auditing;
- complaint investigation and resolution;
- corrective action;
- transparent reporting;
- community consultation and engagement; and
- management reviews.

FIGURE 1.1 SURAT BASIN ACREAGE DEVELOPMENT PROJECT AREA

1.7 Legislative Context

1.7.1 Commonwealth legislation

The EPBC Act provides for the protection of MNES, which includes:

- World Heritage Properties;
- National Heritage Places;
- Wetlands of International Importance (Ramsar Sites);
- The Great Barrier Reef marine Park;
- Threatened Species and Communities;
- Migratory Species listed under international agreements;
- The Commonwealth Marine Environment;
- Nuclear Actions (that may have significant impacts on the environment); and
- Water Resources as related to coal seam gas and large coal mine developments.

If an action will, or is likely to, have a significant impact on MNES, then the action should be referred to the Commonwealth Department of the Environment and Energy (DoEE). The definition of an action includes a project or a development. DoEE are responsible for determining whether the action requires assessment and approval under the EPBC Act. For actions which will, or are likely to, have a significant impact on MNES, DoEE determine these to be a controlled action.

DoEE will also determine the relevant controlling provisions (i.e. which MNES) that are to be considered to be supported by assessment documentation to inform an approval decision. Whether an action will, or is likely to have, a significant impact on MNES is subject to the criteria set-out within DoEE's Significant Impact Guidelines.

Two Significant Impact Guidelines are relevant to the Surat Basin Acreage Development:

- *Significant Impact Guideline 1.1: Matters of National Environmental Significance* (DoEE, 2013a)*; and*
- *Significant Impact Guideline 1.3: Coal Seam Gas and Large Coal Mining Developments – Impacts on Water Resources* (DoEE, 2013b)*.*

1.7.2 EPBC Permit 2013/7047

The existing Surat Basin Acreage Development was referred under the EPBC Act by QGC in November 2013.

The Commonwealth Government determined the original referral a controlled action for which two controlling provisions applied:

- Listed threatened species and communities; and
- A water resource, in relation to coal seam gas development and large coal mining development.

Following an appropriate assessment process, the existing operations were approved in December 2014 subject to conditions set out in EPBC Permit 2013/7047. These conditions provide for the management of MNES as part of the existing development. Existing and approved operations within the Project area are described above in Section 1.3.

QGC submits annual returns to DoEE which report on the Company's compliance and progress in implementing the requirements of EPBC Permit 2013/7047. To date, QGC has complied with all conditions of the Permit. Copies of all annual returns submitted to DoEE for the permit are available online at:

https://www.shell.com.au/about-us/projects-and-locations/qgc/environment/environment-management/reports.html

1.7.3 Assessment and Approval of the Next Phases of the Surat Basin Acreage Development

There is no mechanism under the EPBC Act to vary the existing EPBC Permit in order to account for the next phases of development. As such, the upcoming phases of development must undergo a new and separate assessment process under the EPBC Act, despite the referral areas being the same for the existing and proposed operations (i.e. the 10 PLs).

The relevant controlling provisions for this new and separate EPBC referral will be;

- Listed Threatened Species and Communities; and
- Water Resources.

Justification for this is presented in Section 4.

1.7.4 Queensland Legislation

This section provides the legislative context of the Project's regulation within Queensland. Amendments to the Project's State approvals to enable the next phases of development are being managed separately to the Commonwealth approvals.

The existing Surat Basin Acreage Development is primarily regulated under the following instruments:

- Environmental Authority EPPG00700113 - which authorises environmentally relevant activities (i.e. resource activities) under the *Environmental Protection Act 1994* (Qld); and
- Ten PLs – which provide tenure rights under the *Petroleum and Gas (Production and Safety) Act 2004* (Qld).

QGC will apply to the Queensland Department of Environment and Science (DES) to amend the EA as part of the next phases of the development. The EA amendment will be independently sought through a separate process to this EPBC Permit amendment. No new PLs are being applied for as part of the next phase of development. All PLs have been granted and are currently scheduled to expire as late as 2046, noting that there is an ability to renew PLs with justification for another term.

2 PROJECT LOCATION

This section provides a general description of the location of the Project area and its surrounds, including the relevant resource authorities.

2.1 General Location

The Project area is located in the northern Surat Basin. To the east, Wandoan is located approximately 20 km away and Taroom approximately 35 km northeast. Miles is approximately 70 km southeast and Dulacca approximately 50 km to the south.

The Project is located predominantly within the Western Downs Regional Council (WDRC) local government area but a small part of the northern section lies within the Banana Shire Council (BSC) local government area.

2.2 Land Use

The region is predominantly rural, with the majority of the Project area being freehold land that has been historically cleared and primarily used for cattle grazing. Some small-scale dry land cropping also occurs generally adjacent to rivers and creeks. The Mount Organ State Forest is located in the south of the Project area and is used for timber production. Timber production also occurs further south outside of the Project area at Dinoun, Combabula and Gurulmundi State Forests (see Figure 2-1). Dwellings are sparsely distributed across the Project area.

2.3 Surrounding Resource Activities

The Project area lies within a region where significant natural gas extraction is currently occurring. Immediately to the south and east, QGC operates part of the QCLNG Project. To the southwest, Australia Pacific LNG has a number of PLs and PL applications. There are also petroleum exploration (ATP) and evaluation (Potential Commercial Area) tenures to the north and west. Immediately adjacent and southeast of the Project area is PL 1037, which is Senex's Atlas Gas Project area also currently in development. A number of Petroleum Pipeline Licences (PPLs) are located within and adjacent to the Project area. See Figure 2-2.

Mining lease (ML) 50229 overlaps part of the Project area. This ML was granted to a subsidiary of Glencore on 8 August 2017 to enable open cut coal mining. This project was assessed and approved under the EPBC Act (EPBC Ref 2008/4284). It overlaps with parts of PLs 401 and 506 in the east of the Project area. Construction of the mine has not yet commenced at the time of writing. The development of these coal tenements has been undertaken through a co-development plan agreed between QGC and Glencore, which provided the coordination arrangement between overlapping tenures required under petroleum legislation.

Three ML applications (MLAs) 50254, 50270 and 50271 by Taroom Coal, a subsidiary of New Hope Group, overlap PLs 299 and 397 in the centre of the site. MLA 50254 is an application for open cut coal mining whilst 50270 and 50271 are for surface infrastructure. This project has been determined 'not a controlled action' under the EPBC Act (EPBC Ref: 2008/4130). It is understood that the MLAs have progressed through the Queensland Land Court and grant of these MLAs is contingent on the applicant securing compensation agreements with affected landholders, prior to final assessment by the Department of Natural Resources, Mines and Energy (DNRME). At present, no coal mining operations have commenced in the North Surat and development of any new mines is unlikely to occur until the approved Surat Basin Rail corridor is constructed. QGC has a co-development agreement with the overlapping coal tenure holder, in which the upcoming phases of development within this Project area have been included.

There are a number of other mineral exploration permits, mineral development licences and applications for these tenures across the region, owned by a number of companies. These surrounding tenements will not be affected by future stages of the development.

2.4 Relationship to Relevant Resource Authorities

The current relevant resource authorities and the ownership details are outlined in Table 2-1 below.

TABLE 2-1: RESOURCE AUTHORITIES AND OWNERSHIP DETAILS

Project Tenements	Current Registered Title Holders
PLs 299, 397, 401, 464, 467, 498, 505, 506, 507 and 1008	QGC Upstream Holdings Pty Ltd; CNOOC Coal Seam Gas Company Pty Ltd; Tokyo Gas QCLNG Pty Ltd.

The development incorporates 16 graticular blocks as identified in Table 2-2 below.

TABLE 2-2: BLOCK IDENTIFICATION AND FIELD NAMES

QGC Field Name	Block ID
Botany	CHAR 1650
Charlotte	CHAR 1651
Friendship	CHAR 1652
Scarborough	CHAR 1653
Pleiades	CHAR 1654
Fishburn	CHAR 1722
Borrowdale	CHAR 1723
Golden Grove	CHAR 1724
Bloodworth	CHAR 1725
Thackery	CHAR 1794
Penrhyn	CHAR 1795
Charlie	CHAR 1796
Portsmouth	CHAR 1797
Arthur	CHAR 1867
Phillip	CHAR 1868
Cameron	CHAR 1869

2.5 Real Property Descriptions

The Project area comprises 106 land parcels owned by 50 landholders. Tenure within the Project area includes freehold, leasehold and State-owned land. The average land parcel size is approximately 1,400 ha. Figure 2-3 below identifies those properties that are fully or partially included within the Project area.

QGC has existing Conduct and Compensation Agreements (CCAs) with many of these landholders.

2.6 Native Title and Indigenous Cultural Heritage

There are currently two Native Title claims over the proposed Project area, QI2010/003 and QI2010/034, which have separate Indigenous Land Use Agreements (ILUAs) between QGC Pty Ltd and the Iman People and Mandandanji People, respectively. Both ILUAs were signed in 2011 and comprise an Area Agreement with the Indigenous Persons extending over a significant area of the QCLNG Project pipeline and gas field areas (and do not overlap other Native Title claims). In the Surat Basin locality, the Iman People are the predominant Native Title claimant, with the Native Title area covering the vast majority of the defined area.

In signing the ILUA agreements of the site area with the Mandandanji and Iman Peoples, QGC has been granted Project Rights over the land, allowing them to plan, investigate, construct, operate and maintain, decommission and rehabilitate direct and incidental works associated with the QCLNG Project.

QGC has successfully negotiated Cultural Heritage Management Plans (CHMPs) with the Iman People and the Mandandanji People. These CHMPs are whole of claim agreements and are designed to address the cultural heritage management requirements of the Project. These CHMPs are already in place and fulfil QGC's obligations under the Aboriginal Cultural Heritage Act 2003 (Qld). Therefore, the focus of impact assessment is on non-Indigenous cultural heritage matters.

FIGURE 2-1 LAND USE

FIGURE 2-2 SURAT BASIN ACREAGE DEVELOPMENT SURROUNDING LEASES

FIGURE 2-3 SURAT BASIN ACREAGE DEVELOPMENT PROPERTY DESCRIPTIONS

3 DESCRIPTION OF PROJECT ACTIVITIES

3.1 Overview

The Project will involve three distinct stages covering construction, operation and rehabilitation. The anticipated activities to be undertaken at each stage of the Project are outlined in this section.

3.1.1 Construction phase

Construction activities include:

- development of additional natural gas wells, including the construction of well pads and access tracks, drilling and completion of wells, installation of down-hole and surface facilities and potential flare or vent;
- installation of gas and water gathering pipelines; and
- installation of incidental, ancillary and support infrastructure including but not limited to access roads, electrical and communications infrastructure, laydown areas, borrow pits, temporary and mobile camps.

Final well and infrastructure locations and route selection for gathering pipelines and access tracks within the development area will be determined in accordance with QGC's approved Constraints Planning and Field Development Protocol, which is to be implemented for the proposed activities. This will require on-the-ground environmental assessment and consideration of landholder requirements, prioritising the avoidance of environmental constraints wherever practical. This approach has worked successfully as part of the existing operations to date.

3.1.2 Operation phase

Operational activities include:

- well operation and maintenance, including stimulation, workovers, flaring and venting (where required);
- gathering system operation and maintenance;
- maintenance of ancillary infrastructure, such as access roads; and
- undertaking all necessary and incidental activities to facilitate operation.

Natural gas and produced water extracted from the development will be transported to the existing Woleebee Creek facilities (authorised under EPBC 2008/4398) for further processing and distribution. As identified above, those activities are already authorised under related QCLNG approvals and are not included within the scope of this referral. No new gas or water storage/processing infrastructure is required as part of the referral.

3.1.3 Decommissioning and rehabilitation phase

QGC currently implements both its Rehabilitation Framework document and Surat Basin Acreage Remediation Rehabilitation Recovery and Monitoring plan (RRRMP) throughout the Project area.

The RRRMP establishes the standards and methods for managing disturbance resulting from all development within the Project area, as authorised by the EPBC Act approval. It provides measures for the rehabilitation of wells, access, gathering and auxiliary infrastructure already approved. These measures would be extended to include rehabilitation of the additional development sought by this referral.

QGC's rehabilitation objectives for the Project area are to rehabilitate significantly disturbed land resulting from its activities, as far as reasonably practicable, to its predominant pre-clearance land use and condition. The goals of rehabilitation are to ensure rehabilitated areas are:

- safe to humans and wildlife;
- non-polluting;
- stable;
- able to sustain an agreed post-disturbance land use; and
- equal in maintenance requirements to that required prior for the land prior to its disturbance by QGC's petroleum activities.

Together, the Rehabilitation Framework and the RRRMP have been developed to provide a schedule and standard method for each type of structure to be decommissioned. In summary, the general decommissioning principles for the specific infrastructure are as follows:

- all above-ground equipment and infrastructure will be decommissioned and removed from the site as appropriate in accordance with the Australian Standard applicable at the time; and
- infrastructure will be rehabilitated to the pre-existing land use, unless required for use by the landholder or overlapping tenure holder and subject to assessment requirements.

Further details on the proposed rehabilitation methodologies can be found in QGC's Rehabilitation Framework document and Surat Basin Acreage Remediation, Rehabilitation, Recovery and Monitoring Plan.

3.2 Project Alternatives

The development is proposed pursuant to QGC's development rights and obligations with respect to the relevant petroleum tenures. The timing of the development relates in part to its prospectivity for gas production, its proximity to existing gas and water management infrastructure and market demand. The project has been heavily integrated with existing infrastructure, including compression facilities, trunklines and water management infrastructure, minimising the surface disturbance and total infrastructure required. Accordingly, the proposed action has no feasible alternatives. The option of not pursing the project has been considered, however, it is unfavourable due to current demand, in light of the unique opportunity to develop in co-location with existing projects, and the ability to undertake the project without increasing already approved impacts to MNES.

3.3 Disturbance and Impacts to MNES

The Project area covers approximately 123,500 ha, of which approximately 94% has been previously cleared and is primarily used for grazing. Natural habitats therefore comprise approximately 6% of the Project area.

QGC's initial EPBC referral provided an assessment of likely impacts to MNES resulting from development across the Project area. Maximum disturbance limits to MNES were subsequently authorised in the EPBC Approval 2013/7047.

Existing operations have resulted in impacts to MNES and these impacts have been much lower than initially predicted. As reported by QGC in its 2018 Annual Return for the EPBC Permit (QGC, 2018), actual impacts on MNES to date have only impacted 1.75 ha of koala habitat. There have not been any impacts to the other MNES listed in Table 1 of the EPBC approval.

This demonstrates QGC's commitment to avoiding, minimising and mitigating impacts to biodiversity and the effectiveness of the approved management strategies. The successful implementation of QGC's Constraints Planning and Field Development Protocol (the Protocol) has ensured that the previously heavily cleared nature of the Project area has been utilised to the greatest extent possible and potential impacts on MNES and the wider environment have been avoided or minimised. The Protocol ensures that environmental constraints are considered during planning by modifying the placement and alignment of infrastructure, as is further discussed in Section 3.4.

Remaining phases of development (i.e. the subject of this referral) will be dispersed across the Project area for the development of approximately 740 wells and associated infrastructure over the life of the Project. QGC seeks disturbance limits for impacts on MNES for the next phases of development as detailed in Table 3-1 below.

TABLE 3-1: PROPOSED DISTURBANCE LIMITS

Threatened Fauna Species	Maximum Disturbance (ha) to core habitat known and core habitat potential
Koala (*Phascolarctos cinereus*) (combined populations of QLD, NSW and the ACT)	62
Threatened Ecological Communities	**Maximum Disturbance (ha)**
Brigalow (*Acacia harpophyla* dominant and co-dominant)	8.8

3.4 Constraints Planning and Field Development Protocol

Natural gas projects generally involve phased development of large areas over several years. Wells are drilled and facilities constructed progressively to maintain gas production, with well locations and timing of development determined by ongoing appraisal of the resource and in response to production performance and demand.

The final locations of proposed infrastructure may be dictated by any number of constraints, including environmental, cultural, landholder, legislative and/or economic. For this reason, proponents working within the Queensland gas industry have developed, and are employing, adaptive management frameworks to guide site selection.

QGC has an established adaptive management framework based on constraints planning to inform the siting of proposed infrastructure that include specific controls and procedures that are applied to development activities at specific sites. QGC's constraint ranking and classifications are shown in Table 3-2 and Table 3-3. To ensure appropriate location of infrastructure, QGC maps constraints on a site and activity-specific basis to identify areas that are subject to environmental and social limitations. Constraints mapping is continually updated and refined to consider revised mapping and field validation. All proposed infrastructure locations are surveyed to confirm mapped constraints and to identify additional constraints not previously identified.

Areas with significant constraints are considered higher risk for development because of their environmental and social sensitivity. QGC's priorities in regard to constraints are (in order):

- Avoid;
- Minimise; and

- Mitigate and rehabilitate.

Examples of the factors considered in constraints mapping include:

- Terrestrial and aquatic ecology:
  - Commonwealth matters of national environmental significance (MNES);
  - Environmentally Sensitive Areas (ESAs);
  - Watercourses and wetlands;
  - Bioregional corridors for listed threatened species and migratory species, and connectivity for listed threatened ecological communities;
- Sensitive receptors, such as residential dwellings;
- Topography and soil erosion potential;
- Areas of regional interest – e.g. Strategic Cropping Areas (SCA) or Priority Agricultural Areas (PAA), etc; and
- Land use and infrastructure – e.g. community centres, rural residential zones, towns and cultural heritage sites.

TABLE 3-2: CONSTRAINTS RANKINGS

Zone	Ranking	Value
1	Low – Minimal Ecological Constraints	Altered landscapes, grazing, agricultural land
2	Medium	Remnant Vegetation – Not of Concern Category C ESA – comprised of State Forests and Of Concern Regional Ecosystem (RE)
3	High	BPA Corridors Category C ESA – Essential Habitat, Nature refuges, Koala Habitat Areas and resource reserves Watercourses (excluding linear infrastructure) Category B ESAs General ecological significance (GES) Referable Wetlands
4a / 4b	Very High / No Go	EPBC Listed Threatened Ecological Communities EPBC Listed Flora High Ecological Significance (HES) Referable Wetlands

TABLE 3-3: CONSTRAINTS CLASSIFICATION

Constraint Ranking	Description
Low	Development permitted with application of standard environmental management measures.
Medium	Development permitted with application of additional non-standard environmental management measures as required.
High	Environmental and/or social feasibility must be assessed prior to development and/or landholder agreement and compensation or offsets may be required.
Very High / No Go[1]	Development may not be environmentally and/or socially feasible for the proposed infrastructure Other location options must be considered and assessed for viability.
[1]Infrastructure will not be located within very high / no-go constraint areas unless: • ecological field surveys demonstrate that siting infrastructure in that location will cause minimal adverse impact or can be managed through additional non-standard environmental management measures • other constraints preclude the selection of an alternative location	

With MNES, proposed infrastructure locations are determined in accordance with:

1. Preferentially avoid native vegetation that constitutes a listed threatened ecological community (TEC) and/or may provide habitat for listed threatened and migratory fauna species and utilise (where possible) previously cleared or previously utilised areas;

2. Exploration and production wells proposed within areas identified as very high / no-go constraint zone require justification for siting including site based (survey) assessment that the potential impact on any MNES will be minimal, short term and recoverable;

3. Where the location of other non-linear infrastructure in the very high constraint zone is justified given other constraints and cannot be avoided, only authorise the siting of that infrastructure in that zone where field ecological surveys demonstrate that there will be minimal, short term and recoverable, or no adverse impact on any MNES, including habitat for any listed species;

4. Linear infrastructure (e.g. pipelines), constraints are not generally assigned a no-go constraint ranking as it is not always possible to avoid constraint areas, especially where they are also linear in nature (e.g. watercourses). However, disturbance of any MNES will only be authorised, where necessary and preference will be given to collocation of linear infrastructure and siting within existing disturbed areas. Appropriate and proven QGC management methods to mitigate impacts will be implemented where practicable.

The constraint planning prioritises avoidance of constraints and disturbance is only undertaken where necessary and unavoidable due to other constraints. Where disturbance is authorised, appropriate and proven QGC management methods to minimise and mitigate impacts will be implemented.

QGC's management procedures for infrastructure design and site selection incorporate a thorough review of all constraints, which in addition to environmental issues, must also involve consideration of landholder requirements and social impacts.

The requirements of the Protocol will be applied to the next stages of the development, as they have already been used to avoid and minimise impacts as part of the existing development.

3.5 Natural Gas Wells

Most surface production facilities will comprise a well pad hosting the wellhead, hydraulic lift pump and engine, miscellaneous pipework, valves and fittings, gas and water separator, instrumentation, potentially one or both of a water pump and a booster pump.

In general, well construction and operation activities will be undertaken in the following order:

- identification of well location;
- construction of necessary access tracks and well pads;
- construction of accommodation camps for drilling staff (if needed and agreed with the landowner);
- drill site preparation;
- drilling and well completion (setting casing in the well bore and placing a pump down hole);
- installation and operation of well pad infrastructure;
- progressive rehabilitation; and
- monitoring and maintenance.

QGC's standard development wells use steel casing; however, in certain locations, glass-reinforced epoxy (GRE) casings may be used. Each stage of well construction is detailed below.

The majority of natural gas wells are drilled as a single well per well pad, with each well pad having a disturbance area of approximately 1 ha. Wells are spaced approximately 750 m apart with the final number, spacing and phasing depending on field development optimisation, production performance, landholder consultation and management of other surface constraints (including, particularly, environmental constraints).

QGC are investigating the potential for double well spacing which would result in well spacing being approximately 1,050 m apart and reduce the overall total number of wells to be developed across the Project area. The final decision on the introduction of double well spacing will be subject to sub-surface and surface constraints.

After drilling of the well is completed, approximately 76% of the well pad will be partially rehabilitated to ensure stability of the area following installation of well pad infrastructure.

3.5.1 Well site selection

Development areas are selected based on a combination of geological analysis, reservoir modelling and engineering, each of which will be determined by on-going appraisal activities.

In particular, the factors considered include:

- landform and topography – a relatively firm and level pad is required;
- environmental, social, cultural heritage and tenure constraints – avoiding environmentally and culturally sensitive areas, using previously disturbed areas to minimise potential environmental impacts and considering tenure in accordance with the Constraints Planning and Field Development Protocol;

- landholder disturbance – the location of houses and existing land use will be considered to reduce impacts to landholders and ongoing land use or overlapping tenure requirements;
- existing site access – upgrading existing landholders' tracks, locating sites close to existing tracks and adjacent to fence lines, where practicable, to minimise impacts associated with access and disturbance to primary production; and
- constructability for gas and water gathering systems to the well location.

3.5.2 Drill site preparation

Depending upon the type of drill rig used, pre-drill work may include installation of and provision for:

- a hardstand area of approximately 100 m x 100 m (1 ha) to facilitate drilling and maintenance activities and infrastructure placement on site. Where wells are constructed on slopes, some cutting may be required to establish a level base which may increase the workspace required for the well pad. This is to allow the correct batters and sediment and erosion control measures to be put in place;
- a drill cutting pit (also referred to as drill sump) may be required for storage of water for drilling, recirculation of water into the drilling rig mud system and collection of drill cuttings. Where possible, sump-less drilling techniques may be adopted;
- fuel storage in accordance with Australian Standard AS1940 – Storage and Handling of Flammable and Combustible Liquids;
- flare pit for flaring where required or in the event of an emergency;
- transportable buildings for drill equipment, storage, lighting towers, site offices and amenities;
- drill rig and sub base, generators, mud tank casing racks and pipe trailer loading bays and entry and exit points for vehicles; and
- new access tracks, where required.

When drilling is complete, semi-permanent fencing will be erected around the well site. Appropriate signage relating to restricted entry, fire hazards and protective clothing requirements will be displayed prominently to warn of hazards and required controls. A typical drill site layout is provided in Figure 3-1 below.

Vegetation and topsoil will be graded and stockpiled separately for use during partial hardstand rehabilitation.

Well sites will be located principally on flat ground clear of vegetation (i.e. trees and shrubs). Some vegetation may be cleared but tall trees (including hollow-bearing trees) will be avoided as far as possible. Any clearing will be in accordance with existing relevant conditions.

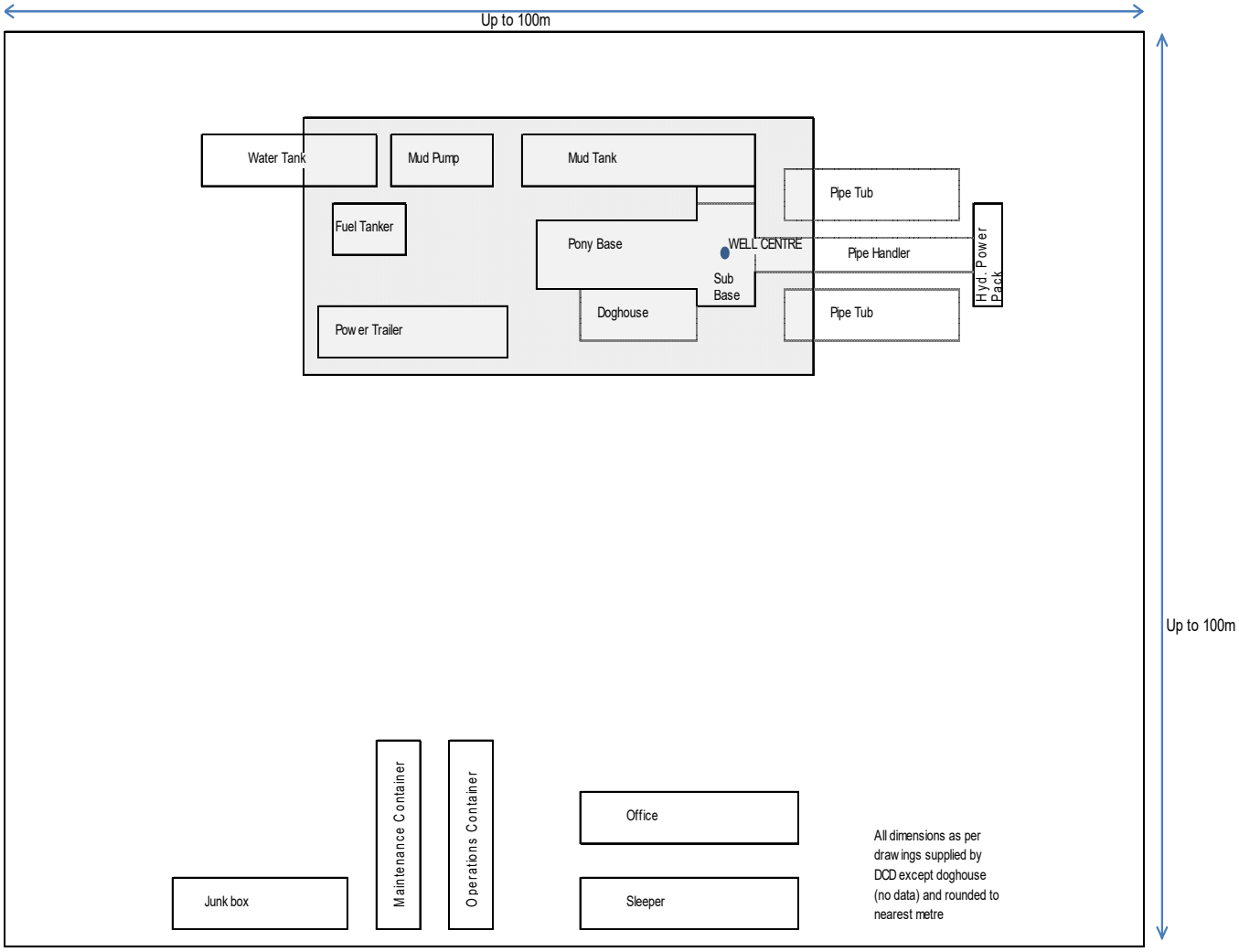

FIGURE 3-1 TYPICAL DRILL SITE LAYOUT (NOT TO SCALE)

3.5.3 Drilling and well development

Once site preparation is complete, drilling and well completion will be undertaken. Each section of the drill-hole will use progressively smaller drill bits, such that deeper sections have a smaller diameter than the section immediately above it. Refer to Figure 3-2 for a photo showing a typical drilling rig. A different drilling rig may be used for each stage of the hole. Refer to Figure 3-3 for the schematics of typical well designs.

Drilling will be carried out in stages. A conductor pipe is installed to about 6 m with an auger rig. This will be followed by a smaller diameter hole to between 60 m to 500 m in depth. Steel or glass-reinforced epoxy casing will then be run into the open hole and cement pumped in to fill the gap around the casing. Well control equipment will be installed at the surface and tested to verify integrity. A blow-out preventer (BOP) will prevent gas or water leakage while drilling operations are conducted.

The final section is then drilled to the required depth to intersect the target coal seams. Drilling muds, or drilling fluids, being a suspension of solids and additives (e.g. potassium chloride (KCl) solution to aid hole condition through inhibiting the swelling of clay) in a base of water, will be used to aid drilling. QGC uses bentonite, naturally-occurring clay, but does not use oil-based or synthetic drilling muds.

Cuttings are removed from the drilling fluids at the rig location using shale shakers. Other dewatering technology may be implemented. The fluids are re-used in the drilling process or disposed of at an appropriately authorised facility (which includes certain ponds) once the fluid is beyond standard solids control equipment conditioning capability. Where appropriate, QGC will reuse drilling mud material in our site rehabilitation or construction activities in accordance with our regulatory requirements.

With regards to preservation of aquifer isolation, QGC complies with the *Code of Practice for the construction and abandonment of coal seam gas wells and associated bores in Queensland*. This includes measures to preserve aquifer isolation.

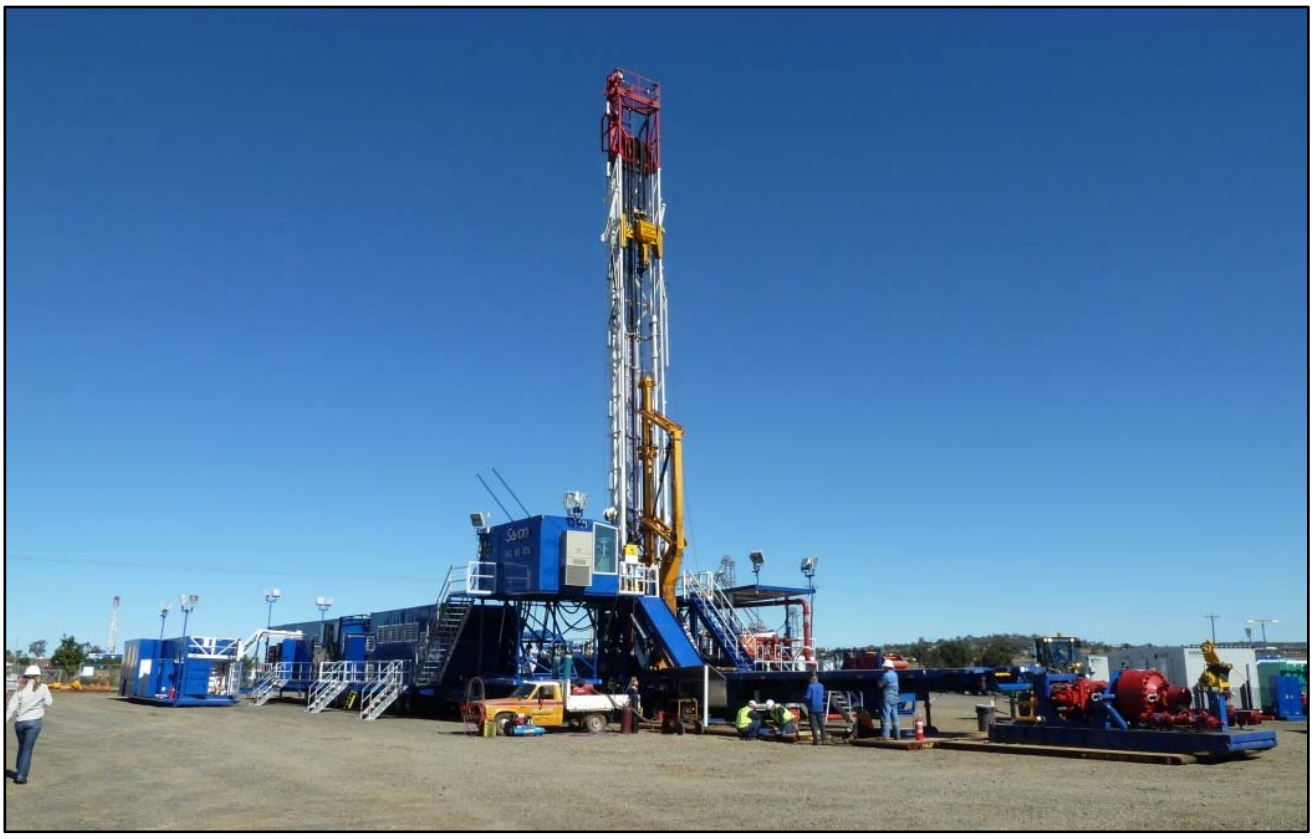

FIGURE 3-2: TYPICAL DRILLING RIG

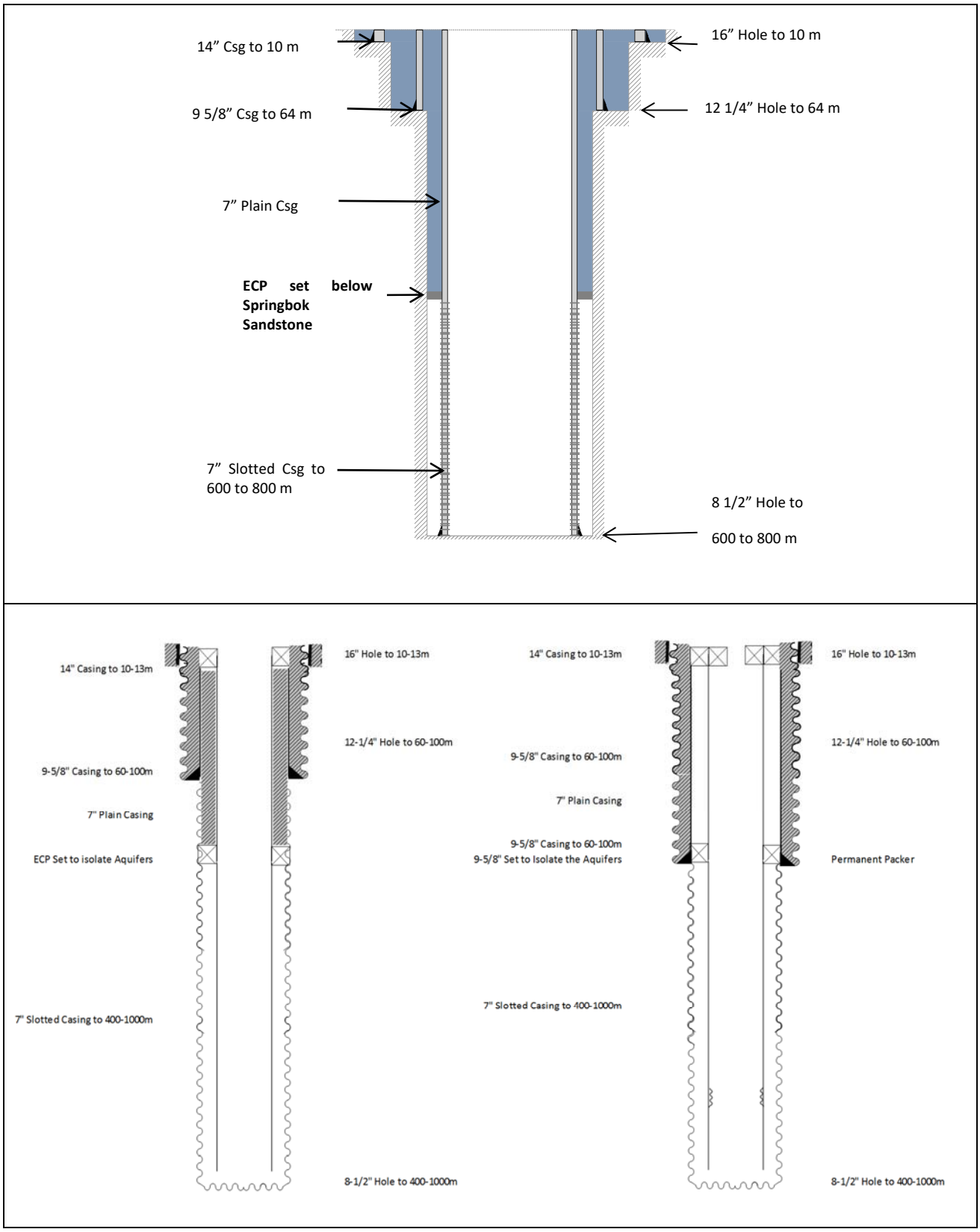

FIGURE 3-3: SCHEMATICS OF TYPICAL WELL DESIGNS

On completion of initial drilling, the formation will be logged with electric logging tools to determine the formation composition.

Well-drilling operations are conducted 24 hours a day. Table 3-4 below outlines an indicative drill site activity schedule.

TABLE 3-4: INDICATIVE DRILL SITE ACTIVITY SCHEDULE

Activity	Expected Duration
Site preparation, excavator, fencing, access tracks	3 to 7 days for each site
Top Hole rig setup – drill and set conductor pipe (10 m)	0.5 day
Drill surface hole to no less than 10% of predicted total depth	0.5 day
Exploration / appraisal wells: install drill rig, log test, under ream, drill stem test, set casing, drill and release	5 to 8 days
Development well: install drill rig, set casing, log test, under ream, drill and release	2 to 4 days
Total for exploration / appraisal well (excluding site preparation)	Approximately 5 to 9 days
Total for development well (excluding site preparation)	Approximately 3 to 5 days
Completion of well	2 to 4 days

Each drill rig will be powered by diesel generators. Depending on the type of drill rig and engine, about 2,000 L of fuel is required per day. Approximately 25,000 L of fuel is anticipated to be stored on each site, with typical individual stored volumes ranging between 10,000 and 20,000 L. All fuel will be stored in accordance with Australian Standard AS1940 – *Storage of Flammable and Combustible Liquids*.

A final casing will be installed to cover the reservoir section and to provide additional zonal isolation from aquifers. The well will then be suspended with a plug downhole and a cap at the surface to prevent fluid leakage prior to preparation for production.

After the drilling rig leaves the location, the completion rig will arrive on location to finalise the well for production. The completion rig will remove the suspension plug, test the well for a short duration to determine the pump required, and then run the pump, tubing, permanent downhole gauge, and rodstring into the well. The completion rig will finalise the wellhead installation, pressure test it to confirm integrity and then move off site to enable the production surface equipment to be installed. In some cases, the production surface equipment may be installed prior to the arrival of the completion rig.

When the well is ready to begin producing, surface equipment will be connected to the well. Gas and water pipelines will be run from the surface equipment and the separator to a flare stack and/or the existing FCS, and the pond or tanks. The produced water will either flow or be pumped to the surface, thereby lowering hydrostatic pressure in the coals and allowing gas to desorb from the coal seam and flow into the well. The gas then flows to the surface.

A gas, diesel or electric powered hydraulic unit connected to the top of the wellhead will rotate the pump rods in the wellbore. When pumping is required to remove water, a dewatering pump will be set in the well bore with water transferred up an inner tubing string with gas produced through a surrounding annulus. The proposed dewatering method will use either a beam or hydraulic lift pump, driven by gas or electric powered surface units. Once at the wellhead, the natural gas and produced water are piped to a separator. Once separated from the water, the natural gas is piped to the existing FCS and then on to the Woleebee Creek CPP.

A typical well cross-section upon completion of drilling and installation is provided in Figure 3-4 below.

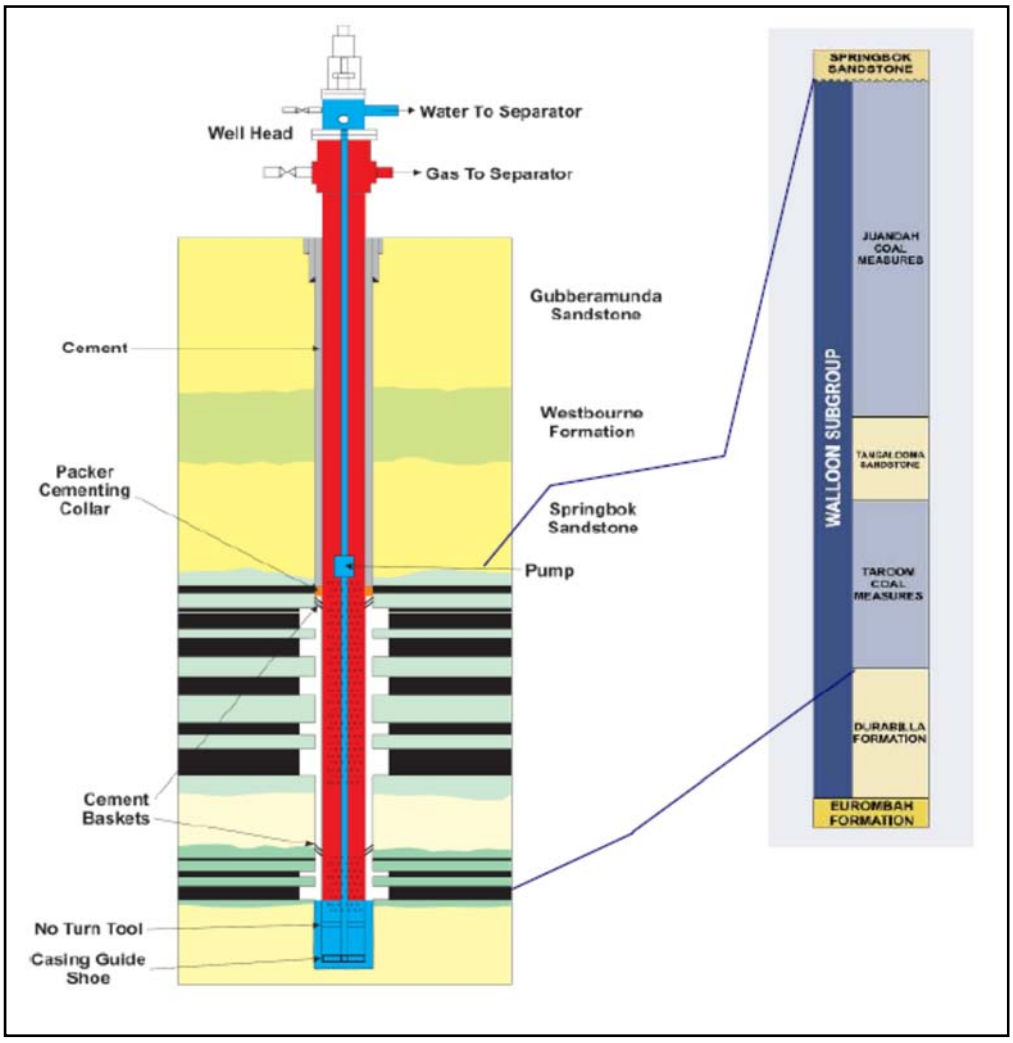

FIGURE 3-4: A GAS WELL CROSS-SECTION

3.5.4 Drill water management

Water or drilling fluids and muds (including water, solids and additives [about 5% potassium chloride]) will be used for primary well control, transportation of cuttings and conditioning of the well hole. Water sourced from untreated or treated produced water or from freshwater bores will be used for drilling purposes and will be delivered in tanker trucks or via the pipeline network. It is anticipated that the volume required will be in the order of 50,000 L (50 m^3) per well.

The water is stored on site either in water trucks, tanks or in constructed drill pits/sumps. Where drill pits are used, they are constructed with upslope drainage to divert stormwater run-off around the pit. The drill cuttings are collected and stored on site in drill pits. Most often, sumpless drilling techniques are used where all fluids are stored in tanks.

3.5.5 Workovers

Wells may be 'worked over' to improve production. Generally, a workover is required to clean out the well bore or to maintain or change out down-hole pumps used to provide artificial lift to remove water from the coal seams. Some pumping wells may be converted to free-flowing wells for a period of time. Free-flowing wells require workovers far less frequently.

Workovers generally require a workover rig (similar to, but smaller than, a drilling rig) to enable well flushes, pump installation or changes and other necessary work. The procedure allows field operators to enhance well productivity or maintain downhole equipment. Once the hole is completed by a workover rig, the production wellhead will be re-installed.

A workover rig consists of a derrick, a workover platform with hydraulic powered tongs, a pump and a BOP. In addition to the initial workover following drilling to complete the well for production, workovers are also carried out on individual wells roughly every two years and each workover takes about three days per well. The actual frequency of workovers on any well depends on well design and well performance.

3.5.6 Multiple well drilling from a single well pad

QGC may use deviated or high-angle drilling for field development of multiple wells from a single drill pad (Figure 3-5). Use of a single pad for multiple wells is likely to decrease the number of well pads required for Project development and increase spacing between pads. Some change in drilling pad layout would be required, but overall Project disturbance footprint would likely be reduced.

The target coal measures consist of multiple coal seams separated by non-coal intervals. To tap into all coals, a well needs to be vertical or deviated (drilled at an angle) so that they intersect multiple seams. In certain circumstances, multiple wells may be drilled from the same pad. Multi-well pad drilling requires wells to be deviated so that each well drains a separate area of the coals. However, because the target coal measures are shallow, well interception points with the top coals may be too close together for optimum drainage and too far apart in relation to the lowermost coals.

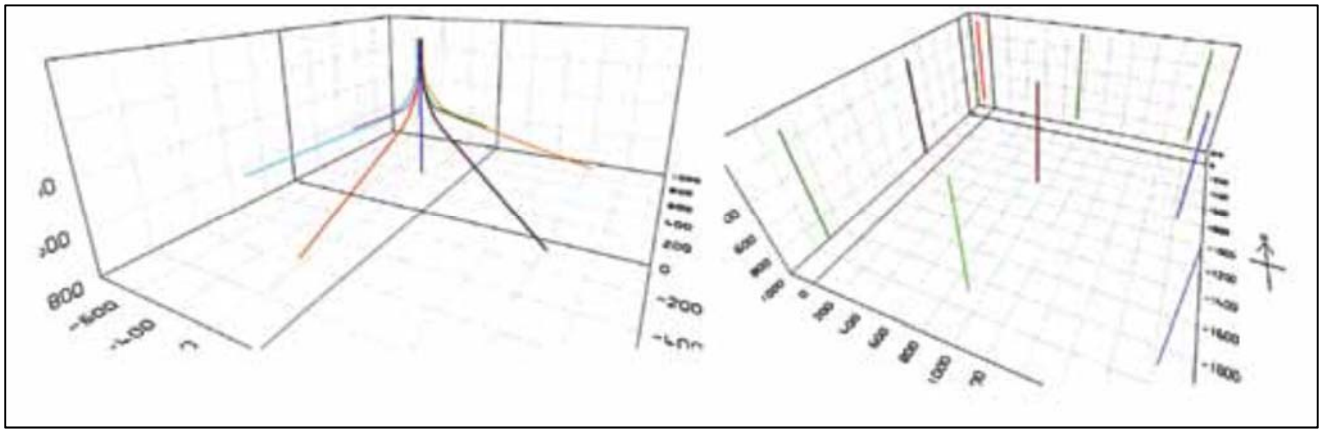

FIGURE 3-5: 3D SCHEMATIC OF MULTIPLE WELL PAD VS TRADITIONAL SINGLE WELL PAD

3.5.7 Well stimulation

Target coal seams in the Project area are anticipated to have sufficiently high permeability to allow the flow of gas without any need for well stimulation anywhere within the Project area. Routine stimulation is not part of the development plan, however, where required, stimulation may be undertaken to enhance gas extraction.

Well stimulation techniques can increase natural gas production from low yielding or otherwise uneconomic wells. The objective is to enhance openings in the coal and increase pathways for gas to flow.

Well stimulation techniques can involve using high-pressure pumps to inject mostly water and sand into wells to open and connect existing tiny cracks in gas reservoirs, known as ‘natural fractures’ or cleats. This increases the reservoir surface area exposed to the bore hole thereby increasing gas yields. Water blended with small

amounts of chemicals and sand is pumped into the well to keep the newly created fractures and pathways open for fluid and gas to flow.

Well stimulation fluid is approximately 99% water and sand, supplemented with chemicals found in many household products. It may contain gel starches, nitrogen and carbon dioxide. Various proppant types are used including sand, resin-coated sand and man-made ceramics depending on the permeability or grain strength needed. The final composition of stimulation fluid is tailored to suit well-specific requirements and varies between wells. A list of the chemicals used by QGC may be found at:

http://www.shell.com.au/about-us/projects-and-locations/qgc/about-onshore-natural-gas/hydraulic-fracturing-and-chemicals-used.html

Stimulation activities typically involve the injection of 1,000 m^3 to 3,000 m^3 of associated water, around 200 t of sand and less than 1% chemical additives. Typically, QGC's EA conditions require 150% of the initial stimulation fluid injected into the well be extracted. Once the well is stimulated, the 'flowback' water is captured and stored in tanks or High Density Polyethylene (HDPE) lined ponds. An understanding of the chemicals used would then direct how the water is to be managed, with water either being treated at the Woleebee Creek WTP or tankered as regulated waste to an appropriate offsite facility. No ‘flowback’ waters will be released to receiving waters.

3.5.8 Wellhead production infrastructure

Surface production facilities will typically consist of a well pad fitted out with the wellhead, hydraulic lift pump and engine, pipe work, valves and fittings, gas and water separator, instrumentation and solar-powered telemetry package (see Figure 3-6 below). Some wells will also require a small well-site pump to transfer water to in-field storage. QGC may use gas or electric drives as appropriate, depending on final design and layout.

A wellhead seals casing strings and isolates the underground fluids (gas and water) from the surface. The separator is provided with safety devices as protection against overpressure, with vessel design pressure specified to provide a safe margin for the downstream gathering network rating.

The hydraulic lift pump utilises a gas, diesel or electric engine to pump water from the wells. Where a diesel engine is present, approximately 2,000 L of diesel may be stored in tanks on site. One or more two-phase (water and gas) separators will be fitted to each well to channel water and gas into separate gathering lines.

FIGURE 3-6: TYPICAL PUMPING WELL CONFIGURATION WITH WELLHEAD, DRIVE HEAD UNIT AND SEPARATOR

Wells are equipped with instrumentation and telemetry to transmit information including production and gas flow data to QGC's control rooms. The control rooms' primary function is to manage and balance natural gas production against demand, as well as provide a central point for managing and responding to field-based process issues. Shutdown triggers can include potential well leaks and production constraints.

3.6 Progressive Rehabilitation and Reinstatement

Once wellhead infrastructure is established, the pads are typically reinstated to a 0.24 ha (60 m x 40 m) operational area. The surface equipment is fenced to prohibit stock access. Further details are outlined in QGC's Rehabilitation Framework.

3.7 Gathering Network

Gas gathering connects wells to the FCSs. Water gathering lines connect wells to in-field and regional storage facilities (tanks or ponds).

3.7.1 Gas and water gathering lines

Typical gathering systems will utilise HDPE pipes as per Australian Standard *AS4130 - Polythene Pipes for Pressure Application*s. HDPE pipes require no coating or cathodic protection (CP) and are designed for temperatures of 10 to 50^{o}C. Low point drains are installed on gas gathering lines to remove any free water condensed from the gas. High-point vents and vacuum breakers are installed on water gathering lines to release free gas from the water and mitigate vacuum formation in the pipeline. HDPE pipe sizes used by QGC range from 110 mm up to 900 mm.

3.7.2 Gathering line route selection

Route selection for gas and water gathering is undertaken in consultation with affected landholders and uses previously cleared or disturbed areas where practicable. Constraints mapping, as described in Section 3.4, will inform route selection of areas of environmental, cultural or social significance so they can be avoided where

practicable. Pre-construction surveys will be undertaken to verify known constraints and provide additional information where necessary.

3.7.3 Gathering line installation

QGC's preferred method of laying gas and water gathering lines is by direct installation using standard pipeline trenching methodologies. This involves the following:

- Right of way (RoW) clearance, including vegetation clearing and topsoil stripping;
- Pipe stringing: small diameter pipe (up to 250 mm) via coils, large diameter pipe via 20 or 21 m lengths;
- Pipe welding to join supplied lengths into networks;
- Trenching, pipe lowering and trench backfilling/compaction;
- Pneumatic pressure and leak testing;
- RoW rehabilitation including top soil instatement;
- Regular communication with affected landholders and patrols to monitor any subsidence for repair.

Construction will be executed progressively by multiple work crews. Depth of pipe burial will comply with the requirements in the *APGA Code of Practice for Upstream Polyethylene Gathering Networks – Natural Gas Industry*. Gas and water pipelines are collocated as much as possible.

Generally, a RoW width of 21 m is required to allow stockpiling of subsoils and topsoils, and safe access and movement of personnel and heavy machinery (including trenching machines). The RoW width is dependent upon the number of gathering lines in the RoW, safety, construction and/or operational concerns.

3.7.4 Gathering line maintenance

Surface structures including manifolds, low point drains, high point vents, end-of-line risers and isolation valves will be inspected under an integrity management plan.

3.8 Transfer and Processing of Gas

As previously identified, additional natural gas wells will tie into existing QGC infrastructure. As such, all gas produced from these wells will be transferred to, and processed by, an existing FCS already operational in the Project area. The existing FCS has capacity to receive the additional gas and no capital upgrades are required. From the FCS, gas will be transferred to the operational Woleebee Creek CPP, where it is further compressed and managed as part of the wider QGC gas portfolio. No new infrastructure is required downstream of the gas or water gathering lines.

Monitoring, control and communications facilities at the Chinchilla Operation Production Support (COPS) facility will continue to be used as a remote process control centre for operators. The individual FCS sites will not be manned constantly but operators and technicians will continue to visit periodically for operational and maintenance purposes. More detailed scheduled inspections and major maintenance works will continue to occur at intervals from one to five years.

3.9 Water Supply and Management

Water generated by the additional gas extraction will be pumped to existing regional storage ponds and on to the Woleebee Creek WTP for treatment and future beneficial use, as occurs for operations currently. No capital works are required to increase the capacity of the trunklines, regional storage ponds or Woleebee Creek WTP as a result of this phase of development. Produced water treated at the Woleebee Creek WTP will then be supplied into the Glebe Weir Beneficial Use Scheme (ENBU04254412) which is operated by SunWater which was referred and approved under EPBC 2011-6181. The Woleebee Creek WTP and the Glebe Weir Beneficial Use Scheme had been designed to accommodate the volume of produced water extracted from the next phases of development in the Surat Basin Acreage Development.

The estimated construction water requirements and water sources anticipated to be relied upon to satisfy those requirements are summarised in Table 3-5 below.

TABLE 3-5: INDICATIVE CONSTRUCTION WATER REQUIRMENTS

Water requirement	Water quantity requirement	Water sources	Additional treatment – where required	Onsite storage facilities
Wells	575 kl per well	Treated water / untreated water of appropriate quality / groundwater / overland flow water	Treatment by Reverse Osmosis (RO) or other methods	Ponds
Gathering	1,000 kl/km	Treated water / untreated water of appropriate quality / groundwater / overland flow water	Treatment by RO or other methods	Ponds
Access tracks	50 kl/km	Treated water / untreated water of appropriate quality / groundwater / overland flow water	Treatment by RO or other methods	Ponds
Dust suppression	As required to meet environmental obligations	Treated water / untreated water of appropriate quality / groundwater / overland flow water	Treatment by RO or other methods	Ponds

Operational activities will require about 1 ML of water per day over the operational life of the development for:

- Potable water supplies at camps;
- Dust suppression;
- Washdown facilities; and
- Emergency services.

It is generally expected that operational water requirements will be met through the use of treated and untreated produced water. However, should produced water be unavailable due to geographical or timing issues, alternative sources such as groundwater and overland flow / runoff may be sourced for operational requirements. The provision of water for operational activities is already authorised and from an approved resource.

Table 3-6 summarises estimated operational water quantity and quality requirements, as well as the source of supply and treatment and storage requirements.

TABLE 3-6: INDICATIVE OPERATIONAL WATER REQUIREMENTS

Water requirement	Water quantity (kL)	Water quality (mg/L)	Water source	Additional treatment	Onsite storage facilities
Washdown facilities	Mean daily 55 kL/day Annual total: 20,000	TDS < 2,000	Treated water / untreated water of appropriate quality / groundwater	Treatment by RO or other methods	Ponds
Dust suppression	Mean 750 kL/day Annual total: 273,750	TDS < 2,000			
Operational Phase Total	Predicted mean daily 1,000 kL/day Predicted annual total: 365,000				

3.9.1 Produced Water Infrastructure

The following section describes the infrastructure proposed for storage, transportation and treatment of produced water. As previously described, produced water from the development area will be transported to QGC's Woleebee Creek Water Treatment Plant for treatment and on-supply for beneficial re-use. Treatment of produced water, brine and on-supply is authorised under the Woleebee Creek EA EPPG00700113 and EPBC 2008/4398 and the beneficial use approval ENBU04254412 and EPBC 2011/6181 and is not the subject of this referral.

The development of treatment and storage i.e. ponds for the management of produced water is not the subject of this referral as they are already authorised under EPBC 2013/7047.

The infrastructure associated with the storage and transport of produced water is detailed below.

Infield Storage Ponds

There will be no infield storage ponds required on the development area subject to this referral.

Regional Storage Ponds

The development will use existing RSPs. There will be no regional storage ponds on the development area subject to this referral.

Water Pipelines

Water pipelines will comprise of water gathering lines that will be connected to the existing water gathering network. Water gathering lines connect wells to infield buffer storages (where required) and RSPs. There are no water trunklines required for the development area subject to this referral.

Water Gathering Lines and Water Transfer Lines

Typical gathering systems will utilise HDPE pipes in accordance with the *Australian Standard AS4130 - Polythene Pipes for Pressure Applications*. Water gathering line diameters are expected to be 110 mm to 900 mm.

Pumping Stations

Pumping stations are required to transfer water between major sections of the water management system. Pumping stations will be used to transfer produced water between primary RSPs and on to the storage ponds at the WTP. No additional water pumping stations, excluding well head infrastructure, will be required for the development area.

3.9.2 Treatment of produced water

Produced water from the development area will be transported to and treated at the Woleebee Creek WTP. This WTP has a sufficient capacity to treat produced water from the development area and was sized to accommodate the water produced from full field development of the Project area. Once the water is treated at the WTP, the water will be on-supplied to the Glebe Weir Beneficial Use Scheme.

Water Treatment Plant General Description

QGC's Woleebee Creek WTP employs RO as the primary treatment method. RO is a proven technology and will enable QGC to treat variable produced water qualities to meet the required treatment standards and project delivery requirements.

RO is a process for the removal of dissolved solids from brackish or saline feed water. This process uses pressure to 'force' water through a semipermeable membrane, leaving the ions behind. A clean water stream (known as 'permeate') and a RO Reject (brine) solution are produced. A recovery ratio of up to 97% can be achieved with multiple-stage RO and brine concentrators. Brine concentrators further process the RO reject to produce pure water (known as 'distillate') and concentrated brine, maximising the volume of treated water available for beneficial use and minimising waste.

The treated water or permeate has numerous beneficial use options due to its low TDS concentration. However remineralisation of the treated water may be required to meet the specific end use (i.e. irrigation, industrial users, stock use or domestic supply).

3.9.3 Brine and salt management

The development area does not require any facility for brine or procedures for salt management and is not relevant to this referral. The treatment of the produced water from the development area will be undertaken at the Woleebee Creek WTP. The WTP uses RO technology that results in up to 97% recovery of treated water for beneficial use and the generation of a number of waste streams. The largest of these waste streams is the RO brine which is essentially concentrated saline water. This brine solution is further concentrated in a brine concentrator to minimise the total area required for brine disposal.

The waste brine stream typically contains 185,000 to 250,000 mg/L of Total Dissolved Solids (TDS). TDS is primarily made up of sodium bicarbonate/sodium carbonate (40%) and sodium chloride (60%).

Brine will be managed within existing process. QGC will store brine in the short to medium term while investigating management and technology options, including a Salt Encapsulation Facility (not part of this amendment application) for disposal of salt in the longer term.

3.10 Workforce and Accommodation

3.10.1 Construction workforce

In general, QGC will utilise the existing workforce where possible and seek to source any additional workforce for the development locally and regionally, and then from other Australian states. Skilled labour is required in the following areas:

- Ironworking trades (e.g. welding, diesel fitting, gas fitting, boiler making);
- Electrical trades;
- Mechanical trades;
- Drilling; and
- Pipeline infrastructure construction.

It is anticipated that workforce numbers will peak at approximately 300-350 people.

3.10.2 Operational workforce

QGC requires operations staff in various roles to perform the following functions:

- Exploration drilling and survey;
- Well drilling and workover;
- Gas and water gathering infrastructure operation and maintenance;
- Systems maintenance;
- Cultural heritage clearances;
- Liaison with landholders and other stakeholders; and
- Workforce management.

The workforce is expected to include contractors for monitoring, auditing and specialised maintenance tasks.

3.10.3 Accommodation

Workers will be housed at existing and previously authorised camp facilities. Should any additional accommodation be required, these will be located in the local township of Wandoan.

The development area will also include temporary drilling camps (approximately 1 for every 5 wells) to be located in close proximity to the wells in existing disturbed areas where possible. The temporary drilling camps consist of demountable buildings which are packed up and moved to the next site to support the drilling campaign. The additional area required for the temporary camps would only be in place for a short duration during the construction of the wells. The camps would then move to the next area to service the next lot of well construction. In some instances, existing local housing may also be utilised by QGC in addition to camp facilities.

Staff will primarily be based locally and workers from outside the region will be accommodated at existing facilities. QGC does not seek approval for the construction of any additional camps as a result of this development.

3.11 Waste Management Infrastructure

QGC is required to comply with applicable environmental protection and waste legislation and manage operations consistent with the Shell's Health, Security, Safety, Environment and Social Performance (HSSE & SP) Control Framework. The HSSE & SP Control Framework requires major installations to be certified to an internationally recognised environmental management system (EMS) standard. QGC has operated a certified ISO14001:2004 EMS since 2012 which was recertified to ISO14001:2015 in 2017.

Management of solid and liquid waste streams is described in QGC Waste Management Manual which forms part of QGC's HSSE Management System, elements of which are summarised below.

3.11.1 Sewage treatment

As previously described in Section 3.10.3, workers will be accommodated at existing and previously authorised camps. As such, sewage generated there will be managed in accordance with the relevant EA conditions.

Sewage from temporary drilling camps will either be irrigated to land (consistent with QGC's Land Release Manual), transported to the Woleebee Creek area for management or taken by licensed contractors to licensed facilities for disposal. Treated sewage effluent from temporary drilling camps will be managed in accordance with the existing EA conditions.

3.11.2 Regulated waste storage

Temporary storage of regulated waste may be required to be undertaken as an incidental activity for this development, should regulated waste be produced.

Wastes are anticipated to be produced includes spent hydrotest water and vehicle, plant and equipment oils and lubricants.

3.11.3 Other wastes

Waste is managed by QGC in accordance with the requirements of the *Environmental Protection (Waste Management) Policy 2000* (Qld) and the *Waste Reduction and Recycling Act 2011* (Qld) which applies to both construction and operational activities. Furthermore, waste is also managed through the implementation of the HSSE & SP Control Framework and QGC's Waste Management Manual.

Currently there is a regulated waste storage facility authorised and operating at QGC's Woleebee Creek facility. This area contains a number of small waste aggregation yards where bins for various solid and liquid waste materials are stored. Site personnel empty waste into these bins and waste is collected by licensed waste management contractors.

Waste management practice throughout the QGC operations is routine collection of solid waste, solid recyclables and liquid waste, contracted to established mainstream waste management contractors. Post-collection, the waste contractors manage each material via their procedure, consistent with the QGC Waste Management Manual and under established waste industry standard practices.

3.12 Ancillary Activities

In addition to the activities listed above, the development is required to be supported by, but not limited to, the following ancillary activities.

3.12.1 Access tracks

Access tracks will be required for all proposed activities, including well sites and gathering line ROWs. Wherever possible, existing roads and tracks will be used. Actual access routes will not be determined until the final well sites and pipeline routes have been chosen. The location of access tracks and upgrading of existing tracks will be completed in consultation with the relevant landholders with a view to minimising environmental impacts. As a result, access tracks may potentially provide a beneficial use for the landholder by allowing additional access to and on the property or providing an upgraded all weather access track.

Access tracks will be constructed with a typical RoW width of 10 m. Additional working space may also be required to facilitate creek crossings and safe vehicle movement (e.g. for additional sediment and erosion control at creeks and for turning and passing bays for vehicles).

Additional working space may also be required within ESAs or their associated protection zones to facilitate creek crossings and safe vehicle movement (e.g. for additional sediment and erosion control at creeks, vegetation and soil stockpiles and for turning and passing bays for heavy vehicles).

3.12.2 Laydown, workspace and office areas

Additional laydowns are required to support construction and operational activities proposed. Should temporary project office structures be required, these will be collocated within associated development footprints, such as laydown areas.

3.12.3 Borrow pits

Borrow pits are necessary to provide aggregates for the construction infrastructure as is reasonably required. Land disturbance will be required for the establishment of these borrow pits. The location of borrow pits depends on a variety of factors including:

- Whether a source of suitable quarry material can be identified from within QGC's tenements, or failing this, within the local area or region;
- The significance of impacts to the local environment; and
- The significance of impacts on roads and traffic from transporting quarry material should the quarry material be sourced from local or regional sources.

When determining the location of borrow pits, potential sites will be assessed on a case by case basis using the Upstream Delivery Process and utilising the findings of the geotechnical investigation, to determine the appropriate size and depth of the borrow pit. The aim of this undertaking is to minimise the environmental disturbance and impacts resulting from borrow pit development by identifying the maximum amount of available material at that location. The number of borrow pits required for the development area will depend on the area and depth of each borrow pit and the quarry material it may supply and securing the relevant landholder agreements that may be required to develop pits in the identified locations.

3.12.4 Concrete batching

More than 200 t of concrete products will be required within the development area each year for construction.

It is likely that mobile concrete batching facilities will be used to facilitate efficiencies in construction activities across the development area. Appropriately licensed contractors will be engaged to operate any mobile concrete batching facilities to be used on site.

All concrete batching facilities will be bunded to enable the collection of contaminants, including concrete process and wash water, and contaminated stormwater. Where possible contaminated water will be reused in concrete production.

3.12.5 Abrasive blasting and surface coating activities

Abrasive blasting and surface coating activities are anticipated to be undertaken during construction and on-going maintenance of the authorised activities within the development area. Abrasive blasting is required for the cleaning of equipment, trunklines and structures using a stream of abrasives in either a wet or dry pressure stream. Once cleaning has occurred, appropriate surface coating materials such as paint or powder coating will be applied.

3.12.6 Boilermaking or engineering activities

The production, fabrication, assembling, or building of metal products may occur within the development area, associated with the construction of authorised infrastructure such as pump stations, above-ground infrastructure and pipelines. All activities will be undertaken in accordance with the relevant manufacturing controls and/or standards.

3.12.7 Site security

All of QGC's gas field assets are subject to a security risk assessment conducted by suitably qualified professionals.

Access to the general area will be via existing roads and tracks wherever practicable. Access to infrastructure will be limited to authorised personnel.

3.12.8 Communications and power infrastructure

Communications infrastructure is already in place as part of the existing operations and is a necessary part of QGC's activities and provides data and voice communications into remote areas where QGC is working. Specifically, the communications systems are used for:

- Radio communications for emergency response management;
- Radio communications for day to day operations and maintenance activities;
- Data communications for the collection of Supervisory Control and Data Acquisition (SCADA) from remote well sites and facilities for gas and water control purposes; and
- Communications for construction personnel working in remote areas.

Where additional coverage is required, QGC will install additional communication infrastructure to support the next stages of the development. The following provides a summary of the type of communication infrastructure which could be developed. Requirements for communications infrastructure to support the development will be considered for construction and operations.

Construction requirements are generally focused on current available telecommunications items such as:

- Mobile (wireless) communications (e.g. mobile phones, two-way radios); and
- Temporary office facilities that provide network and internet connectivity remote or well-site telemetry with low bandwidth requirements.

Operational requirements are generally the same as construction requirements. However, installation is permanent and fully supported. Operational requirements include:

- Mobile (wireless) communications (e.g. mobile phones, two-way radios);
- Existing permanent office facilities that provide network and internet connectivity; and
- Remote and well-site telemetry with higher bandwidth requirements.

Mobile communication (phone and radio) coverage generally requires surveying before a particular technology is selected for specific development areas. The development is likely to encompass areas with little or no third-party coverage. For this reason, QGC will install microwave, radio and/or repeater towers to obtain the necessary coverage as incidental activities.

During construction, trailer-mounted towers may be erected to service development and mobile construction areas. In areas with significant construction activity and longer-term communication requirements, QGC will install permanent towers.

The towers that QGC will require to provide the above services will have a height range of 30 m to 100 m, with actual height and locations of the towers dependent upon the local topography, existing communication coverage and subject to a survey.

For construction of a communication tower, an area of 0.5 ha is typically required and includes laydown and assembly areas. The construction area (excluding the operational 40 x 40 m tower fenced area) is remediated to original condition post construction. These areas may be collocated with existing well pads where there are no constraints.

QGC is open to negotiation with third-party telecommunications providers over access to the towers, which could be used for improving communications coverage for local communities.

QGC may also:

- Install fibre optic cable (FOC) with pipelines to service data and voice requirements between facilities;
- Install buried or above ground 33 kV power lines to electrify well head infrastructure or pumps;
- Employ satellite communications to service data and voice requirements for remote facilities that cannot be connected, or are not cost-effective to connect, to existing infrastructure using fibre; and
- Use secure wireless communications between wellheads and gas field component facilities.

Permanent telecommunications sites will be selected to service the life of the development. These will be maintained with a view to indefinite use. Upon development completion, QGC will discuss removal or relocation with interested parties such as the landholder or a third-party telecommunications provider which may be offered ownership if a long-term beneficial use is identified.

3.13 Rehabilitation and Decommissioning

QGC does not propose to change the way rehabilitation and decommissioning is managed under the existing EPBC Permit for the new referral

QGC currently implements both its Rehabilitation Framework document and Surat Basin Acreage Remediation Rehabilitation Recovery and Monitoring plan (RRRMP) throughout the Project area.

The RRRMP establishes the standards and methods for managing disturbance resulting from all development within the Project area, as authorised by the EPBC approval. It provides measures for the rehabilitation of wells, access, gathering and auxiliary infrastructure already approved. These measures would be extended to include rehabilitation of the additional development sought by this referral.

3.13.1 Objectives

Rehabilitation within the development area will be undertaken in accordance with its State EA conditions which govern progressive rehabilitation for significantly disturbed land and details final acceptance criteria. Rehabilitating disturbed land aims to ensure those sites are:

- Safe to humans and wildlife;
- Stable;
- Non-polluting; and
- Able to sustain an agreed post-disturbance land use with maintenance requirements comparable to that required prior to its disturbance by petroleum activities.

Rehabilitation activities aim to reinstate the pre-disturbance land use, in consultation with relevant land holders and government departments. Vegetation re-establishment methods are selected on a site-specific basis to reflect the agreed land use and analogue / reference condition to be achieved.

3.13.2 Rehabilitation Methods

Reinstatement is undertaken once construction is complete for areas not in use for continued operation of the infrastructure. Reinstatement of disturbance associated with the construction of well pad areas, and gathering RoWs is undertaken once construction is complete. Reinstatement will commence on disturbance associated with buried pipelines within three months of the completion of construction. For well pads, reinstatement of areas not required for operations will commence within nine months of completion of construction.

The methods described below will be undertaken to rehabilitate disturbed areas across the development area and are applicable to achieving both stability and final rehabilitation objectives as required. The Infrastructure specification component of the Rehabilitation Framework identifies the methods appropriate to each infrastructure type. These have been consolidated below to provide a general understanding of the sequence of rehabilitation activities that will be carried out at each site.

3.13.3 Reinstatement

The following methods will be undertaken to stabilise and reinstate disturbed areas:

- All waste materials will be removed from site.
- All temporary works provided for construction shall be removed and fences and private roads disturbed by construction will be reinstated in accordance with landholder agreements.
- Appropriate sediment and erosion control measures (i.e. the construction of contour banks or diversion banks) will be installed.
- The area is to be inspected for hydrocarbon contamination and contaminated soil, if any, is to be appropriately disposed of in accordance with regulatory requirements.
- Disturbed areas will be re-profiled to the pre-disturbance profile (original surface contours) or as close as possible to original survey of disturbance area.
- Surface contouring is to be completed prior to re-spreading of topsoil. Contouring will focus on drainage lines for surface water flows to ensure erosion potential is minimised.
- Stockpiled topsoil will be re-spread evenly over the original area after the disturbed area has been re-contoured and after erosion control banks have been constructed. Topsoil will be sourced from the nearest suitable stockpile where possible and spread to all disturbed areas. Topsoil will be left rough to reduce erosive potential. It will cover the entire disturbance area so there is no exposed subsoil. If there is limited availability of topsoil, mulch or other soil amendments may be mixed where appropriate and in consultation with the landholder.
- Compacted surfaces will be loosened where deemed necessary, along contours and to a limited depth to ensure no subsoil is ripped to the surface. Areas with hard set mud or clay will be ripped. Care will be taken to avoid soil inversion if scarifying or ripping is carried out where topsoil has not been removed. Any ripping or scarifying operation of topsoil will be restricted to a depth of 50 mm and will follow natural contours to avoid soil erosion.
- Promotion of natural regeneration of vegetation consistent with pre-disturbed vegetation characteristics and land use through operational maintenance programs.
- Supplementary seeding with selected grass species to promote site stability, with consideration of soil type and land use where appropriate.

Where excavation has occurred for side-hill cut or other purposes, the areas will be backfilled with the original material, and compacted to replicate the natural contours with sufficient surplus fill to compensate for subsidence.

3.13.4 Decommissioning

Where rehabilitation cannot commence until infrastructure is decommissioned, the following activities will be carried out prior to rehabilitation:

- Diversion and erosion and sediment control devices will be kept in place and maintained fully functional until the area has been decommissioned.
- Cut and fill batters will be profiled to re-instate the land surface.
- Surface water will be diverted around contaminated areas to minimise water contamination. Surface water from contaminated areas will be contained and treated.

- Contaminated areas will be identified, mapped, and treated to prevent or minimise environmental harm. Contaminated soil will be removed from site and topsoil respread. Any removed soil will need to be appropriately classified, handled and disposed of in accordance with applicable legislative requirements.

- Areas impacted by acid sulphate soils will be kept submerged or treated to prevent or minimise environmental harm.

When pipelines are no longer required they and associated infrastructure (pressure valves, metering equipment etc.) will be decommissioned in accordance with legislative requirements, Australian Standards and relevant industry codes of practice.

On sites where grass cover or remnant vegetation has been cleared, re-establishment will be undertaken if required, as the final outcome of the rehabilitation process.

4 MNES BASELINE

4.1 Environmental Context

The Project area lies within the Brigalow Belt South bioregion. This bioregion experiences a hot semi-arid climate, which is typically hot and dry for most of the year. Rainfall is highest during the summer months (wet season), and lowest during the winter months (dry season).

Topographically, the Project area is 195 m to 390 m above sea level, dissected by three north-east to south-west low-rise ridge systems and has two similarly oriented sub-basins. These basins drain in a general north-easterly direction.

The central and southern ridges are marked by unique table landform features (also called 'mesas'), where fresh sandstone outcrop exposures are typically observed. Slightly tilted table landforms (also called 'hogbacks') occur in undulating terrain.

The Project area lies within the Dawson River Catchment, within the Fitzroy Basin. The highest order watercourses that occur within the Project area include Eurombah Creek, Horse Creek and Juandah Creek. These are intermittent, ephemeral watercourses that have limited or no flow for parts of the year and may be reduced to a few small pools. These streams flow into the Dawson River, that occurs to the north outside of the Project area. Downstream, the Dawson River joins the Mackenzie River to become the Fitzroy River, which flows to the Coral Sea south of Rockhampton (360 km to the east).

Three major soil units are present within the Project area: Vertosols, Dermosols and Sodosols. Most soil units are sodic and have saline subsoils. The majority of topsoils from the dominant soil units have a moderate erosion hazard, with one Dermosol soil unit exhibiting a high topsoil erosion hazard. The presence of acid sulphate soils is highly unlikely.

The majority of the Project area has been cleared for grazing purposes, with relatively small and often fragmented areas of remnant and regrowth vegetation remaining. The largest patch of remnant vegetation occurs in Mount Organ State Forest to the south; however, surveys within the State Forest have confirmed that it has been extensively logged (selective logging mainly of Spotted Gum) and is currently leased to adjacent landholders for cattle grazing. Due to the use of the State Forest for timber production, it has opened the canopy and reduced the occurrence of large mature trees. Other significant areas of remnant vegetation occur primarily as narrow linear strips along high order watercourses.

Eleven plants and twelve animals listed as regulated Biosecurity matters under the *Biosecurity Act 2014* (Qld) are known or considered to potentially occur within the Project area (Table 4-1). Nine of the regulated plants are also listed as Weeds of National Significance (WONS).

TABLE 4-1: REGULATED PEST PLANTS AND ANIMALS KNOWN OR CONSIDERED TO OCCUR IN THE PROJECT AREA

Common name	Scientific name	Status/Source		
		Biosecurity Act	WONS[1]	PM Search[2]
Pest plants known to occur				
Parthenium Weed	*Parthenium hysterophorus*	Restricted Invasive	X	X
Tiger Pear	*Opuntia aurantiaca*	Restricted Invasive	X	
Prickly Pear	*Opuntia stricta*	Restricted Invasive	X	
Velvety Tree Pear	*Opuntia tomentosa*	Restricted Invasive	X	

Common name	Scientific name	Status/Source		
		Biosecurity Act	WONS[1]	PM Search[2]
Harrisia Cactus	*Harrisia martinii*	Restricted Invasive		
Mother of Millions	*Bryophyllum delagoense*	Restricted Invasive		
Parkinsonia	*Parkinsonia aculeata*	Restricted Invasive	X	X
Pest plants considered potential to occur				
Prickly Acacia	*Acacia nilotica*	Restricted Invasive	X	X
Lantana	*Lantana camara*	Restricted Invasive	X	X
Athel Pine[3]	*Tamarix aphylla*	Restricted Invasive	X	
Pest animals known to occur				
Dingo/Wild Dog	*Canis lupus dingo/familaris*	Restricted Invasive		
Feral Cat	*Felis catus*	Restricted Invasive		X
Rabbit	*Oryctolagus cuniculus*	Restricted Invasive		X
Feral Pig	*Sus scrofa*	Restricted Invasive		X
Cane Toad	*Rhinella marina*	Other invasive animal[4]		X
Feral Horse	*Equus caballus*	Other invasive animal[4]		X
House Mouse	*Mus musculus*	Other invasive animal[4]		X
Asian House Gecko	*Hemidactylus frenatus*	Other invasive animal[4]		X
Pest animals considered potential to occur				
Red Fox	*Vulpes vulpes*	Restricted Invasive		X
Feral Goat	*Capra hircus*	Restricted Invasive		

[1]WONS = Weeds of National Significance.

[2]PM Search = Species highlighted in EPBC Act Protected Matters Search.

[3]Athel Pine was recorded in the Project area as an ornamental plant only.

[4] Other invasive animals, (Biosecurity Queensland): manage risks as part of the General Biosecurity Obligation.

4.2 Commonwealth Designated Sites

There are no Commonwealth designated sites listed under the EPBC Act within, or immediately adjacent to, the Project area. This concurs with that reported within the original referral and no designated sites were considered controlling provisions for the approval of the existing Project.

Table 4-2 summarises the list of designated sites under the EPBC Act. Figure 4.1 presents the locations of these sites to demonstrate their distance from the Project.

TABLE 4-2 PRESENCE OF DESIGNATED SITES UNDER THE EPBC ACT IN THE PROJECT AREA

Designated Sites	Presence within or nearby to the Project area
World heritage properties	There are no world heritage properties within the Project area. The closest World Heritage Sites are Fraser Island World Heritage Area (250 km east north-east) and the Gondwana Rainforests of Australia (200 km south-east).
National heritage places	There are no National Heritage Places within the Project area. The closest is the Glasshouse Mountains National Landscape 220 km east).
Wetlands of international importance (listed under the Ramsar Convention)	The development area is within the same catchment as two Ramsar sites but remote from either site. The Narran Lake Reserve is more than 450 km south-west and the Shoalwater Corio Bay areas are about 460 km to the north. Therefore, it is not deemed appropriate to consider these sites further in this assessment.
Commonwealth marine areas	The Project is not located within Commonwealth Marine Areas. This MNES is not considered further.
The Great Barrier Reef Marine Park	The Project is located within the upper reaches of a catchment that flows to the Great Barrier Reef Marine Park, which is approximately 400 km east of the Project. No impacts on this Marine Park are likely and it is therefore not considered further.

FIGURE 4.1 EPBC DESIGNATED SITES

4.3 Listed threatened species and ecological communities

The following sub-sections outline the listed threatened species, migratory species and TECs identified as known, likely or having the potential to occur within the Project area.

4.3.1 Methodology

A comprehensive ecological assessment was undertaken by BAAM Ecological Consultants (BAAM) in 2013 to map terrestrial ecology values within the Project area. This involved a detailed desktop assessment, targeted field surveys and mapping of ecological values. The BAAM report has been included in ATTACHMENT A of this referral. The report informed the original project referral and has been used as a baseline to inform the current referral. This ensures a consistent methodology is used and provides clarity throughout the assessment process.

The information provided by BAAM has been reviewed by ERM in 2018 to ensure the currency and validity of the data used. From this review, ERM concluded that the BAAM (2013) data is valid and suitably reliable to inform the current assessment. The BAAM (2013) field survey was targeted towards confirming regional ecosystem mapping and locating significant flora and fauna species. It was undertaken at the end of the wet season, a time that was considered appropriate to capture an optimal representation of the biodiversity of the Project area, while ensuring ground conditions allowed as many sites as possible to be accessed.

As part of reviewing the BAAM information, ERM repeated searches of the relevant desktop sources and field surveys undertaken by QGC during construction of EPBC 2013/7047 and incorporated those latest results into the analysis. Relevant legislative changes since the initial BAAM assessment were identified for consideration. Key aspects of change related to:

- Changes to species listings and new species added to threatened status; and
- New information relating to species records, species distribution or population information.

Essentially the assessments (BAAM and ERM) are based on vegetation community and habitat mapping, and an understanding of likelihood of threatened species occurring. The BAAM regional ecosystem mapping has been determined reliable, however the outcomes of the ERM review identified a number of changes to the understanding of species likelihood of occurrence. Appendix D of the BAAM report detailed the likelihood of occurrence assessment undertaken in 2013. Table 4-3 below summarises the updates to the assessment undertaken by ERM leading to the list of species considered known, likely or potential to occur for this referral. ERM's Protected Matters Search Tool (PMST) results are presented in ATTACHMENT B.

TABLE 4-3 DEPARTURE FROM BAAM (2013) LIKELIHOOD OF OCCURRENCE ASSESSMENT

Species	Change and Justification
Threatened Flora Species	
Finger panic grass (*Digitaria porrecta*)	Excluded: species no longer listed under the EPBC Act
Silver commersonia (*Commersonia argenta*)	Excluded: species no longer listed under the EPBC Act
Threatened Fauna Species	
Dulacca woodland snail (*Adclarkia dulacca*)	New addition: new species listing since 2013, potential to occur based on DoEE mapped 'species or species habitat likely to occur' area and suitable habitat within the Project area.
Brigalow scaly-foot (*Paradelma orientalis*)	Excluded: species no longer listed under the EPBC Act
Eastern great egret (*Ardea modesta*) and cattle egret (*Ardea ibis*)	Excluded: species no longer listed as migratory under the EPBC Act

Species	Change and Justification
White-bellied sea-eagle (*Haliaeetus leucogaster*)	Excluded: species no longer listed as migratory under the EPBC Act
Rainbow bee-eater (*Merops ornatus*)	Excluded: species no longer listed as migratory under the EPBC Act
Painted honeyeater (*Grantiella picta*)	Listing change: species now listed as Vulnerable under the EPBC Act
Australian reed-warbler (*Acrocephalus australis*)	Excluded: species no longer listed as migratory under the EPBC Act
Koala (*Phascolarctos cinereus*)	Known to occur: species likelihood updated based on Wildlife Online records within the Project area
Greater glider (*Petauroides volans*)	New addition: new species listing since 2016, unlikely to occur based on BAAM assessment for this species
Threatened Environmental Communities	
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Known to occur based on DoEE mapped 'species or species habitat likely to occur' area and suitable habitat within the Project area. Field surveys to date have not identified this TEC within the Project area and therefore has the 'Potential" to occur.

No new TECs are present at the site since the time of the original assessment. A likelihood of occurrence assessment was undertaken for threatened flora and fauna based on the following terms:

- Known: Where a species has been recorded during field surveys or there is a known database record within the Project area.
- Likely: The species has not been recorded (field survey or database record) within the Project area however database records are located in the Project area's vicinity; and the Project area is within the distribution of the species; and there is suitable habitat within the Project area.
- Potential: The species has not been recorded (field survey or database record) within the Project area or in the Project area's vicinity; and the Project area is within the distribution of the species; and there is suitable habitat within the Project area.

4.3.2 Regional Ecosystem Results

Current certified mapping of the Project area's remnant and regrowth Regional Ecosystems (RE) (as provided by DEHP) is 1:100,000 scale. BAAM (2013) utilised field surveys at key locations as well as satellite imagery to assess the RE mapping and revised the actual distribution of the REs in the field at 1:15,000 scale (shown in brackets below). This resulted in a slight increase in area of mapped remnant vegetation and a significant decrease in regrowth vegetation (compared to current government mapping) as well as correcting misrepresented RE's. The revised ecosystem mapping provided by BAAM is considered to be more accurate and reliable than the DES mapping as the department is limited to a 1:100,000 scale. However, the size of the Project area meant field surveys at all locations of vegetation were not possible and field surveys are still required to ultimately confirm the RE. This final validation is undertaken by QGC on an ongoing basis throughout the Project area. As a result of the above analysis, the Project area is considered to contain:

- 5,038 ha (4%) of remnant vegetation (5,134 ha ground-truthed);
- 1,918 ha (2%) of regrowth vegetation (1,335 ha ground-truthed); and
- Balance of the Project area (about 94%) is either cleared or not currently mapped as remnant or regrowth vegetation.

Remnant vegetation is typically present as linear strips associated with creek and river banks, property boundaries and road reserves within the Project area. There are only two substantial areas of remnant

vegetation remaining in the Project area, being the area associated with Mount Organ State Forest to the south (approximately 1275 ha) and a patch of approximately 130 ha within Pleiades Block to the north-east.

To date, the initial phase of development (occupying 1,544 ha of the Project area) has been predominantly constructed within existing cleared areas.

4.3.3 Threatened Ecological Communities (TECs)

The EPBC Act PMST identified four TECs with the potential to occur within the Project area and is included as ATTACHMENT B. Further desktop sources identified an additional TEC for consideration. The TECs identified by all sources are listed in Table 4-4.

Government mapping of TECs is not available; however, RE associations can be used to map potential distributions of TECs. Using the revised RE mapping and known locations of TECs within and adjacent to the Project area, an assessment of the likelihood of these communities occurring within the Project area was undertaken. The outcomes of this assessment and the associated REs analogous to these TECs (where applicable) are also presented in Table 4-4.

Figure 4.2 below provides the currently recognised distribution of TECs within the Project area, based on revised RE mapping (BAAM 2013) and field survey validations.

TABLE 4-4 TECS OCCURRING OR WITH THE POTENTIAL TO OCCUR WITHIN THE PROJECT AREA

Vegetation Community	Status (EPBC Act)	Likelihood of Occurrence and Notes on TEC
TECs known to occur		
Brigalow (*Acacia harpophylla* dominant and codominant) (Brigalow)	Endangered	• RE 11.9.1, RE 11.9.5 and RE 11.9.5a mapped by DES. Revised mapping included RE 11.3.1, RE 11.5.16, RE 11.9.5, RE 11.9.5a and RE 11.9.6. • Mapped high-value Brigalow regrowth and any Brigalow regrowth that meets the TEC criteria. • Mapped RE 11.3.2 could contain unmapped patches of Brigalow.
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (SEVT)	Endangered	• Potential SEVT mapped by BAAM and some small areas confirmed by QGC during surveys to date. • Limited occurrence within Project area. • RE 11.9.4a mapped within the Project area. Revised mapping included RE 11.9.4, RE 11.9.4a and RE 11.9.4c.
TECs potential to occur		
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	• RE 11.3.3 mapped within the Project area. Regrowth RE 11.3.3 may constitute this TEC, dependant on the criteria in the relevant conservation listing advice being met. • QGC have not confirmed any Coolibah Black Box to date but there remains a possibility that it occurs in the northern blocks. • Mapping by BAAM uses RE associations and the TEC has not been confirmed.
TECs unlikely to occur		
Weeping Myall Woodlands	Endangered	• Areas within RE 11.3.2, other REs or regrowth vegetation dominated by *Acacia pendula* may constitute this TEC;

Vegetation Community	Status (EPBC Act)	Likelihood of Occurrence and Notes on TEC
		• *Acacia pendula* was not recorded during the survey, and the TEC is therefore not likely to be present.
The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin	Endangered	• Mapped 12 km to the west of the site in association with springs. • Due to absence of springs at the site, this community is considered unlikely to occur.

FIGURE 4.2 CURRENTLY RECOGNISED DISTRIBUTION OF TECS WITHIN THE PROJECT AREA

4.3.4 Threatened species

Likelihood of occurrence assessment was undertaken for EPBC Act-listed flora and fauna species using known habitat requirement information, location of available species records and field survey information. Species identified as having a known, likely or potential likelihood of occurrence are summarised in Table 4-5.

TABLE 4-5: THREATENED FLORA AND FAUNA SPECIES KNOWN, LIKELY, POTENTIAL OR UNLIKELY TO OCCUR WITHIN THE PROJECT AREA

Scientific Name	Common Name	EPBC Act Status
Species known to occur		
Homopholis belsonii	Belson's panic grass	Vulnerable
Phascolarctos cinereus	Koala (combined populations of Qld, NSW and the ACT)	Vulnerable
Species with potential to occur		
*Nyctophilus corbeni (Formerly N. timoriensis) (*South-eastern form*)*	South-eastern long-eared bat	Vulnerable
Species unlikely to occur		
Rostratula australis	Australian painted snipe	Endangered, Migratory
Grantiella picta	Painted honeyeater	Vulnerable
Egernia rugosa	Yakka skink	Vulnerable
Petauroides volans	Greater glider	Vulnerable
Cadellia pentastylis	Ooline	Vulnerable
Tylophora linearis	Slender tylophora	Endangered
Xerothamnella herbacea	Herbaceous xerothamnella	Endangered
Delma torquata	Collared delma	Vulnerable
Furina dunmalli	Dunmall's snake	Vulnerable
Adclarkia dulacca	Dulacca woodland snail	Endangered

Species and habitat descriptions of threatened species known, likely or with potential to occur within the Project area are provided below. Known and potential habitat maps are provided for each species (Figure 4.3 to Figure 4.5). Species and habitat descriptions of new threatened species as identified in Table 4-3 have been provided below. Species that are unlikely to occur within the Project area are not further discussed beyond this section of the document.

KNOWN

Belson's Panic Grass - *Homopholis belsonii*

Belson's Panic Grass (*Homopholis belsonii*) is a tufted grass to 40 cm tall.

The distribution of this species is restricted to the Darling Downs region in southern Queensland to north-west slopes of northern New South Wales. This species is found in White Box (*Eucalyptus albens*) communities and Wilga (*Geijera parviflora*) woodlands on rocky hills; Belah (*Casuarina cristata*) forests in alluvial soils on flat to undulating lands; Poplar Box (*E. populnea*) woodlands; and dry woodlands on poor soils derived from basalt at 200-520 m altitude. Belson's Panic Grass has also been recorded in Brigalow (*Acacia harpophylla*), Myall (*A. melvillei*) and Weeping Myall (*A. pendula*) communities; Mountain Coolibah (*E. orgadophila*) communities; and on roadsides.

The species is under threat from the clearing of native habitat for cropping and pastures, heavy grazing and trampling by domestic stock, physical disturbance by machinery, urban expansion, weed invasion, herbicide application, soil compaction, rubbish dumping and collection of firewood (DoEE, 2018a).

There is one Wildnet record of Belson's Panic Grass in the vicinity of the Project area (approximately 10km west), and the species was recorded at a single location (Arthur Block) during field surveys undertaken by BAAM (BAAM 2013). Despite ongoing field surveys undertaken by QGC for the development of Project infrastructure, no further records of this species have been recorded to date.

Known and potential habitat has been mapped within the Project area using habitat associations, as shown in Figure 4.3. However, it is anticipated that only a very small population of Belson's panic occurs within the Project area, as no further records have been found (despite ongoing surveys) and the region is at the very north of the species known distribution.

Koala – *Phascolarctos cinereus*

The koala (*Phascolarctos cinereus*) has been listed as vulnerable under the provisions of the EPBC Act in Queensland, New South Wales and the Australian Capital Territory. Koalas occur throughout north-east, central and south east Queensland, extending south through Victoria into South Australia and Kangaroo Island.

Koalas have a distinct association with eucalypt woodland and forest habitat types containing suitable food trees (DoEE, 2018b). Food trees can include a range of species from the *Eucalyptus*, *Corymbia*, *Angophora* and *Lophostemon* genera. However, local populations tend to have preferences for a few specific species, which can be dictated by local factors including nutrients, water availability, temperature and elevation. Important food tree species within central and southwest Queensland include *E. camaldulensis, E. tereticornis, E. coolabah, E. populnea, E. thozetiana* and *E. melanophloia* and areas of riparian vegetation may be of particular importance (ERM 2015). There is one wildnet koala record from within the Project area, in Borrowdale Block, and three records within 20kms. Furthermore, QGC surveys detected a koala scat within Charlie block, on Back Creek, a tributary of Horse Creek. Consequently, the koala has been assessed as being known to occur within the Project area.

Potential habitat recognised within the Project area for this species is shown in Figure 4.4.

Potential

South-eastern long-eared bat – *Nyctophilus corbeni*

The south-eastern long-eared bat was formerly named *Nyctophilus timoriensis* which is no longer considered to occur in Australia. The south-eastern long-eared bat has been redescribed as *N. corbeni* (DoEE, 2018c).

N. corbeni is thought to roost solitarily in hollows and crevices of trees, and under exfoliated bark (DoEE, 2018c), and occurs in a variety of dry forest habitats including river red gum (*Eucalyptus camaldulensis*), open woodland, mallee and Brigalow (*Acacia harpophylla*) (BAAM 2013). The species appears to be more common in box, ironbark and *Callitris* forests on sandy soils on the western slopes of New South Wales and southern Queensland (DoEE, 2018c).

There is a lack of data to assess the current threats to this species, however key known threats are thought to include habitat fragmentation, loss and degradation due to altered fire regimes, timber extraction, mining and other factors (Woinarski et al., 2014). Other threats are likely to include bushfires, reduction in hollow availability, exposure to agrichemicals and predation by feral animals. Many of these threats have been extensive in the Project area to date, including habitat clearing, degradation, fragmentation, and timber extraction.

BAAM surveys included the use of Anabat sound recorders to capture bat echolocation, and some calls captured from these devices were identified as belonging to the *Nyctophilus* genus. However, classification of Anabat call recordings to species level is not currently possible for the genus *Nyctophilus* (BAAM 2013), so confirmation of the presence of *Nyctophilus corbeni* is not possible. BAAM suggested that the *Nyctophilus* calls recorded are far more likely to be from N. geoffroyi, not *N. corbeni*.

There are no available records of *N. corbeni* from within, or in close proximity to the Project area. However, there are records available north and south of the Project area and these typically occur in areas of large patches of remnant vegetation, such as Condamine, Belington Hut and Barakula State Forests (ALA 2018). This supports the indication that the species prefers larger tracts of remnant vegetation, as identified in the SPRAT profile (DoEE, 2018c). The species appears to prefer old-growth vegetation, in particular habitats with a distinct tree canopy and dense cluttered understorey. For that reason, the narrow linear strips of vegetation throughout the Project area are considered unlikely to support the species. This would leave Mount Organ as the primary area of potential habitat. However, due to ongoing removal of large mature trees in Mount Organ State Forest for timber production, the area is likely to have a more open canopy as well as few hollows and shelter sites for the species. Nevertheless, the species is considered potential to occur in the Project area.

Potential habitat recognised within the Project area for this species is shown in Figure 4.5.

Unlikely

The Australian painted snipe - *Rostratula australis*

The Australian painted snipe (*Rostratula australis*) is a stocky wading bird around 220–250 mm in length with a long pinkish bill.

The Australian painted snipe is a secretive, cryptic, crepuscular species that occurs in terrestrial shallow wetlands, both ephemeral and permanent. The species also uses inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains. The species is patchily distributed throughout Australia, with most records being in the south-east. Records are erratic, with the species being absent from areas in some years and common in others (DoEE, 2018d).

The species was not recorded during the field survey, and there are currently no database records from the Project area and its surrounds. The closest available record is approximately 37km north near Belington Hut State Forest (ALA 2018). The Australian painted snipe is considered unlikely to occur in the Project area, as the seasonal wetlands in the area do not support any significant populations of wetland birds. QGC has undertaken ongoing surveys throughout its Project region in order to validate ecological values at proposed infrastructure locations. This has included surveys in the SBAD Project area for the development to date. These surveys were undertaken by qualified ecologists and there have been no records of the Australian painted snipe to date.

Painted honeyeater - *Grantiella picta*

The painted honeyeater is a small to medium sized honeyeater. The species is sparsely distributed from south-eastern Australia to north-western Queensland and eastern Northern Territory. The greatest concentrations and almost all records of breeding come from south of 26ºS, on inland slopes of the Great Dividing Range between the Grampians, Victoria and Roma, Queensland. The species exhibits seasonal north-south movements governed principally by the fruiting of mistletoe, with which its breeding season is closely matched. Many birds move after breeding to semi-arid regions such as north-eastern South Australia, central and western Queensland, and central Northern Territory. Considering its dispersive habits, the species is considered to have a single population (DoEE, 2015).

The species was not recorded during the field survey, and there are no database records from the Project area and its surrounds. It is thought that the species prefers woodlands with a high number of mature trees and mistletoes, and it is more common in larger tracts of remnant vegetation (DoE 2015). Despite ongoing surveys

throughout the Project region there have been no records of the painted honeyeater to date. The species is considered unlikely to occur in the Project area due to the extensive historical clearing and timber extraction from Mount Organ State Forest.

Yakka skink – *Egernia rugosa*

The yakka skink is a pale fawn reptile growing to 40 cm (DoEE, 2018e). The species is endemic to Queensland, occurring in dry open forests and woodlands on coarse, well drained soils, from Cape York Peninsula to the St George area in the Southern Brigalow Belt. The species occupies communal burrows, often under dead timber or deep rock crevices.

The Yakka Skink can occur in a range of land zones and ecosystems, with microhabitat features, such as woody debris, rocks, logs, and dense ground vegetation, being of particular importance. Threats include: habitat loss and degradation, inappropriate roadside management, predation by feral animals and ripping of rabbit warrens.

There are no available records from within the Project area and the species has not been recorded during field surveys to date. Recent records to the south, outside of the Project area, have been associated with much larger tracts of remnant vegetation, and it appears this species may favour these larger intact areas. The extensive clearing of the Project area coupled with existing land management practices, presence of cattle and timber extraction suggest that suitable habitat and microhabitat for this species is unlikely to be present. Therefore, the species is considered unlikely to occur.

Greater glider - *Petauroides volans*

The greater glider is the largest gliding possum in Australia. It is restricted to eastern Australia, occurring from the Windsor Tableland in north Queensland through to central Victoria (Wombat State Forest), with an elevational range from sea level to 1200 m above sea level. An isolated inland subpopulation occurs in the Gregory Range west of Townsville, and another in the Einasleigh Uplands (Threatened Species Scientific Committee 2016a).

This species is sensitive to clearing and landscape fragmentation and appears to require areas of remnant vegetation greater than 160km^2 to maintain viable populations (Threatened Species Scientific Committee 2016a). This is likely due, in part, to the species reliance on large hollow bearing mature trees. The area of occupancy has decreased substantially mostly due to land clearing. This area is probably continuing to decline due to further clearing, fragmentation impacts, fire and some forestry activities. Kearney et al. (2010) predicted a ‘stark’ and ‘dire’ decline (‘almost complete loss’) for the northern subspecies *P. v. minor* if there is a 3^o C temperature increase.

There are no records of the greater glider within the Project area, but records exist within the region with the closest available record being around 20 km south-east. Due to the species reliance on large tracts of remnant vegetation and hollow bearing trees, it is unlikely that suitable habitat occurs within the Project area. Mount Organ State Forest contains the largest patch of remnant vegetation within the Project area; however, due to the previous and ongoing use of the area for logging, forestry practices and cattle grazing, it is unlikely that sufficient mature trees remain to support the species. The remaining areas of remnant vegetation are the smaller, narrow areas of vegetation along watercourses, these areas are likely too small to support a viable population. Therefore, the species is considered unlikely to occur.

Ooline – *Cadellia pentastylis*

Ooline (*Cadellia pentastylis*) is a medium-sized spreading tree to 28 m tall with dark, hard, scaly bark, most commonly to about 10 m tall.

Ooline is known to several protected areas including the Carnarvon, Sundown and Tregole National Parks and Stones Country Resource Reserve although total population size and extent of occurrence are unknown. This species occurs in semi-evergreen vine thickets in association with bitter bark (*Alstonia constricta),* hard alectryon (*Alectryon subdentatus*), leopard ash (*Flindersia collina*), wilga (*Geijera parviflora*) and narrow-leaved bottle tree (*Brachychiton rupestris)* on sandstone and basalt slopes. This species is also known in association with wattle (*Acacia sparsiflora*), brigalow (*A. harpophylla*) and belah (*Casuarina cristata*) communities on undulating clay plains and low hills at 200-500m altitude. Ooline is found from Narrabri in northern New South Wales to Rannes in central Queensland (DoEE, 2018f).

Threats include: fragmentation, logging, inbreeding depression, inappropriate fire regimes, intensive grazing, insect attack and herbivory, risk of local extinction, tunnel and sheet erosion, low seed viability and damage to roadside populations during roadworks.

There are only a few small areas of SEVT identified within the Project area and Ooline has not been identified within these areas to date. QGC have identified numerous records of Ooline to the south of the Project area, but despite ongoing surveys have not found any individuals within the SBAD Project area. The species is therefore considered unlikely to occur.

Slender tylophora - *Tylophora linearis*

Slender tylophora (*Tylophora linearis*) is a slender, almost hairless twiner to sub-shrub with dark green leaves (DEWHA, 2008). Slender tylophora produces small purple flowers from late spring to late autumn, and fruit from late summer to late winter.

The distribution of slender tylophora is restricted to the northern and central western slopes of New South Wales and near Glenmorgan in the western Darling Downs district, Queensland. Slender tylophora found in dry scrublands, open forests and woodlands in association with broombush (*Melaleuca uncinata*), broad-leaved red ironbark (*Eucalyptus fibrosa*), grey ironbark (*E. sideroxylon*), white box (*E. albens*), black cypress pine (*Callitris endlicheri),* white cypress pine (*C. glaucophylla*), Buloke (*Allocasuarina luehmannii*), hakea wattle (*Acacia hakeoides*), striped wattle (*A. lineata*) at low altitudes and on sedimentary flats (DEC 2010; DSEWPaC 2011).

According to the DoEE distribution map for the species, the nearest 'likely' habitat is approximately 95 km south, south of Yuleba State Forest (DoEE, 2018g). This area is associated with the northernmost available record of the species and the only publicly available record within QLD. There are areas mapped within the southern part of the Project area where the species or its habitat may occur (see ATTACHMENT B). These areas are mapped based on habitat associations. However, despite BAAMs initial surveys and QGC's ongoing surveys the species has not been recorded within the Project area to date. It is therefore considered unlikely to occur.

Herbaceous xerothamnella - *Xerothamnella herbacea*

Herbaceous xerothamnella (*Xerothamnella herbacea*) is a sparse, sprawling herb to 30 cm tall. Herbaceous xerothamnella is found in Brigalow (*Acacia harpophylla*) dominated communities in shaded situations, often in leaf litter and in association with gilgais, on heavy, grey to dark brown clay soils. This species is known from isolated records around Theodore, Chinchilla and Goondiwindi in southern Queensland and is likely to be under-recorded.

There are no available records of the species in the Project area or in close proximity (ALA 2018). Furthermore, DoEE distribution mapping does not identify any potential or likely habitat of the species within, or in close proximity, to the Project area (DoEE, 2018h). Herbaceous xerothamnella was not recorded during BAAM field surveys or QGC's ongoing surveys to date. While the species may be associated with habitat types within the Project area, including Brigalow TEC and cleared land, there is no evidence to suggest it occurs in the region and it is considered unlikely to occur.

Collared delma – *Delma torquata*

The collared delma (*Delma torquata*) is a small legless lizard endemic to Queensland (DoEE, 2018i). The species shelters under rocks and coarse woody debris in open eucalypt forest with a shrub and tussock grass understorey (BAAM 2013). They are thought to primarily occur in land zones 3, 9 and 10, within REs 11.3.2, 11.9.10, 11.10.1 and 11.10.4.

All records of the *collared delma* have been on the soil surface and it does not appear to burrow and live underground (DoEE 2018i). The species relies heavily on microhabitat features including rocks, logs, bark, other coarse woody debris, and leaf litter for shelter (DoEE 2018i). The species was not recorded during the field survey, and there are no database records from the Project area as of 2018. There is one record of the species in the Project area surrounds, in the Expedition Range to the west (BAAM 2013). Due to agriculture in the Project area, particularly cattle grazing, it is considered unlikely that suitable microhabitat features would remain within cleared areas to sufficiently support the species, and in remnant areas where cattle have access. This is largely due to land management practices (such as clearing, stick-raking and burning of logs and timber), the lack of vegetative cover and the presence of cattle. Due to the lack of records within the Project area, or in close proximity, the extensive clearing that has occurred, and the impacts on microhabitat features this species is considered unlikely to occur.

Dunmall's snake - *Furina dunmalli*

This species is highly cryptic, extremely secretive and possibly genuinely scarce. Only a handful of records occur within any given decade. Consequently, the biology of the snake is virtually unknown. Most records appear in open forests and woodlands, particularly brigalow and woodlands growing on cracking black clay and clay loams (DoEE, 2018j). However, the species has also been recorded from dry eucalypt forests and anecdotal evidence suggests it may even occur in vine thickets.

This species was not recorded during the 2013 field survey and there are no recent database records from the Project area and its surrounds. However, this is a rarely recorded and little-known species whose habitat requirements and distribution are poorly understood. Due to the extensive disturbance in the Project area it is considered unlikely to occur.

Dulacca Woodland Snail - *Adclarkia dulacca*

The Dulacca woodland snail (family Camaenidae) is endemic to south-east Queensland, where it occurs as a small number of isolated and fragmented populations in the area between Miles and Dulacca, and south to Meandarra (Threatened Species Scientific Committee, 2016b). The species inhabits a variety of remnant and scattered habitats, such as vine thicket and *Acacia harpophylla* (brigalow) woodland patches on rocky outcrops with clay to loam soils, as well as *Eucalyptus* (ironbark) species and *Acacia shirleyi* (lancewood) woodlands on ridges (with and without rock), and *Eucalyptus woollsiana* (gum-topped box) woodland (Threatened Species Scientific Committee, 2016b).

The Dulacca woodland snail may occur in or be associated with the ‘Brigalow (*Acacia harpophylla* dominant and co-dominant)’ ecological community. The snail may also occur in the ‘Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt Bioregions’ ecological community, as well as the ‘Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions’ ecological community.

The species appears to be reliant on the presence of microhabitat features, such as logs and woody debris, for shelter as well as tree or shrub cover to maintain a suitable microclimate. The species has limited mobility and gaps in suitable habitat greatly limits the species dispersal and colonisation (Threatened Species Scientific Committee, 2016b).

Due to the prevalence of agriculture in the Project area, particularly cattle grazing, it is considered unlikely that suitable microhabitat features would remain within cleared areas to sufficiently support the species, and in remnant areas where cattle have access. This is largely due to land management practices (such as clearing, stick-raking and burning of logs and timber), the lack of vegetative cover and the presence of cattle. Furthermore, the areas of remnant vegetation that persist are largely narrow, linear strips and it is unclear if edge affects have reduced the ability of these areas to provide suitable microhabitat for *A. dulucca*. Finally, Mount Organ State Forest has been used heavily for timber production and grazing which has opened the canopy and likely affected the microclimate and suitability for the species. There are no records of the Dulacca woodland snail within the Project area, or in close proximity, and Dulacca and Miles, where its recognised population occurs, are approximately 50km south. The Project area is immediately north of the DoEE species distribution. Due to the lack of evidence of the species occurring in the Project area, it is considered unlikely to occur.

FIGURE 4.3 POTENTIAL HABITAT RECOGNISED WITHIN THE PROJECT AREA FOR BELSON'S PANIC GRASS (HOMOPHOLIS BELSONII)

FIGURE 4.4 POTENTIAL HABITAT RECOGNISED WITHIN THE PROJECT AREA FOR KOALA (PHASCOLARCTOS CINEREUS)

FIGURE 4.5 POTENTIAL HABITAT RECOGNISED WITHIN THE PROJECT AREA FOR SOUTH-EASTERN LONG-EARED BAT (NYCTOPHILUS CORBENI)

4.4 Migratory species protected under International agreements

During the desktop assessment (including PMST results and other sources), 8 listed migratory species were identified as known, likely or potential to occur within the Project area. A likelihood of occurrence assessment was undertaken for each species using known habitat requirement information, location of available species records and field survey information. ATTACHMENT C summarises the results of the likelihood of occurrence for each species. Those species identified as having a known, likely or potential likelihood of occurrence are summarised in Table 4-6.

TABLE 4-6: MIGRATORY SPECIES KNOWN, LIKELY OR WITH POTENTIAL TO OCCUR WITHIN THE PROJECT AREA

Scientific Name	Common Name	Status
Species known to occur		
Apus pacificus	fork-tailed swift*	Migratory
Hirundapus caudacutus	white-throated needletail	Migratory
Species likely to occur		
Calidris acuminata	sharp-tailed sandpiper*	Migratory
Gallinago hardwickii	Latham's snipe, Japanese snipe*	Migratory
Plegadis falcinellus	glossy ibis*	Migratory
Species with potential to occur		
Myiagra cyanoleuca	satin flycatcher	Migratory
Rhipidura rufifrons	rufous fantail	Migratory
**Associated with water bodies*		
Species unlikely to occur		
Rostratula australis	Australian painted snipe	Migratory, Endangered

4.4.1 Migratory bird habitat

The Project area contains about 233 ha of seasonal wetland habitat, comprising 0.2% of the total area. Four of the migratory species recorded as known or likely to occur in the Project area are strongly associated with water bodies. Some of these species may also occur on existing artificial water bodies or, in some cases, in temporary water bodies, such as flooded paddocks following heavy rain events. The two species with potential to occur (satin flycatcher and rufous fantail) utilise woodland habitats.

Species and habitat descriptions of threatened species known, likely, potential or unlikely to occur within the Project area are provided below.

KNOWN

Fork-tailed swift – *Apus pacificus*

The fork-tailed swift (*Apus pacificus*) is a non-breeding visitor to all states and territories of Australia (DoEE, 2018k). The species is widespread but scattered in coastal areas from 20° S latitude, south to Brisbane and in much of the south south-eastern region. The species is more widespread west of the Great Divide and is commonly found west of the line joining Chinchilla and Hughenden. The species is found to the west between Richmond and Winton, Longreach, Gowan Range, Maraila National Park and Dirranbandi. The species is rarely found further west to Windorah and Thargomindah. In Australia, the species occurs mostly over inland plains but sometimes above foothills or in coastal areas. They mostly occur over dry or open habitats, including riparian

woodland and tea-tree swamps, low scrub, heathland or saltmarsh. Large flocks often precede or follow low pressure systems as they cross the country in search of food (DoEE, 2018k).

The fork-tailed swift was recorded by the field survey undertaken by BAAM (2013) and is predicted to occur on an annual basis. This species is an aerial species with little interaction with the terrestrial environment and therefore it is considered the Project area does not represent an 'important habitat'.

White-throated needletail – *Hirundapus caudacutus*

The white-throated needletail (*Hirundapus caudacutus*) distribution is widespread over eastern and south-eastern Australia from the islands in Torres Strait and the tip of Cape York south to Tasmania (DoEE, 2018l). In eastern Australia, it is recorded in all coastal regions of Queensland and NSW, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains. Most white-throated needletails spend the non-breeding season in Australasia, mainly in Australia, and occasionally in New Guinea and New Zealand. The species has been recorded roosting in trees in forests and woodlands, both among dense foliage in the canopy or in hollows (DoEE, 2018l). The species breeds in wooded lowlands and sparsely vegetated hills, as well as mountains covered with coniferous forests (DoEE, 2018l).

The white-throated needle-tail was not recorded by the field survey undertaken by BAAM (2013) but was recorded by QGC during field surveys in Mount Organ State Forest. It is therefore known to occur. This species is an aerial species with little interaction with the terrestrial environment and therefore it is considered the Project area does not represent 'important habitat'.

LIKELY

Sharp-tailed sandpiper - *Calidris acuminata*

Preferred habitat for the sharp-tailed sandpiper (*Calidris acuminata*) is coastal and inland areas, preferring non-tidal fresh or brackish wetlands (DoEE, 2018m). This species is the most commonly recorded sandpiper in inland wetlands.

The sharp-tailed sandpiper was not recorded by the field survey undertaken by BAAM (2013), or during QGC surveys to date, but is identified as being likely to occur as an occasional visitor to the Project area.

Latham's snipe - *Gallinago hardwickii*

Latham's Snipe (*Gallinago hardwickii*) has been recorded along the east coast of Australia from Cape York Peninsula through to south-eastern South Australia. In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies) (DoEE, 2018n.). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity.

Latham's Snipe was not recorded by the field survey undertaken by BAAM (2013), or during QGC surveys to date, but is identified to have a likely occurrence within the Project area as a visitor to wetlands.

Glossy ibis - *Plegadis falcinellus*

The Glossy Ibis (*Plegadis falcinellus*) is a large bird. The preferred habitat for this species includes terrestrial wetlands, preferring inland freshwater wetlands with abundant aquatic flora (DoEE, 2018o).

The Glossy Ibis was not recorded by the field survey undertaken by BAAM (2013), or during surveys by QGC, although this species was identified as being likely to occur on suitable waterbodies throughout the Project area.

POTENTIAL

Satin Flycatcher - *Myiagra cyanoleuca*

The satin flycatcher (*Myiagra cyanoleuca*) is a small to medium-sized bird. The preferred habitat for this species includes eucalypt forest, especially wet sclerophyll. The satin flycatcher is often found in gullies and along watercourses (DoEE, 2018p).

The satin flycatcher was not recorded by the field survey undertaken by BAAM (2013) or during surveys by QGC but was identified to have the potential to be a rare visitor to the Project area.

Rufous fantail - *Rhipidura rufifrons*

The rufous fantail (*Rhipidura rufifrons*) is a small to medium active bird. The preferred habitat for this species includes moist habitats, including closed forests, coastal scrubs, mangroves and along watercourses and gullies, and urban/rural areas during mid-year migration (DoEE, 2018q).

The rufous fantail was not recorded by the field survey undertaken by BAAM (2013), or during surveys by QGC to date, but was identified to be a potential visitor to the Project area.

UNLIKELY

Australian painted snipe – Rostratula australis

This species is addressed above in Section 4.3.4 as it listed as endangered and migratory.

4.5 Water Resources

4.5.1 Surface Water

Environmental values for aquatic ecology were described by Hydrobiology Pty Ltd in 2012 as part of the Environmental Authority application (in accordance with the QLD *Environmental Protection Act 1994*) for the first phase of the Surat Basin Acreage Development Project area. This study is provided in ATTACHMENT D and was reviewed by ERM in 2018 for validity and reliability. The report is considered current and suitable for the purposes of this impact assessment.

Catchment description

The Project area is in the Upper Dawson catchment of the Dawson River sub-catchment of the Fitzroy River drainage basin. The Upper Dawson catchment contains extensive stream networks such as the Dawson River, Canal Creek, Mud Creek, Juandah Creek, Eurombah Creek and Horse Creek (see Figure 4-6). Apart from the Dawson River, these streams are largely ephemeral or intermittent.

The State of the Rivers: Dawson River and Major Tributaries Report (Department of Primary Industries Resource Management, 1995) found the Dawson catchment's overall condition to be moderate to poor. This was confirmed by the field survey with animal grazing the most common detrimental influence on stream and riparian attributes. Cropping, mining and stock water extraction activities as well as road structures (bridges, culverts,

fords, and ramps) were the other major disturbance factors. Collectively, these activities have contributed to widespread degradation of the riparian zone with clearing of natural vegetation and the invasion of exotic species observed adjacent to watercourses.

Key observations of the overall surface water environment with respect to existing activities, are that: erosion and sedimentation due to agricultural activities (in particular, grazing) is impacting on stream flow and water quality; and aquatic habitats are generally in poor condition.

Wetlands

No internationally important wetlands are located within or near the Project area.

Two high ecological significance (HES) wetlands are located within the Project area, one on a tributary of Eurombah Creek, adjacent to Taroom Rd at the western edge of the Project area, and one on Horse Creek towards the middle of the Project area. In addition, one High Ecological Value (HEV) wetland (HEV# 2142), has been identified approximately 5 km north of the Project area on Paddy's Creek, a small tributary of the Dawson River, which has its headwaters within the Project area. These HES and HEV wetlands are not MNES but Matters of State Environmental Significance and provided for context. See Figure 4-7.

Springs and Groundwater Dependent Ecosystems (GDEs)

No springs supporting species or communities protected by the EPBC Act (EPBC springs) are found within the Project area. EPBC springs have been identified in the region surrounding the Project area – see Figure 4-8. Potential impacts to those springs are managed under the Joint Industry Plan for Springs Monitoring and Management (JIP), and Queensland Government Spring Impact Management System (SIMS).

Other known GDEs, and ecosystems which are potentially groundwater dependent, exist within the Project area and the surrounding region. These include ecosystems that may rely on the surface expression of groundwater, including wetland-type communities and Horse Creek, which is considered a 'watercourse spring' (OGIA, 2016), and ecosystems that may rely on the subsurface presence of groundwater. The latter includes all vegetation ecosystems, which are present mostly to the south and southwest of the Project area, and to a lesser extent to the north. Permanent flow in the Dawson River is sustained by alluvial aquifers, which maintains baseflow during dry periods.

Flooding

There is limited available information on flooding within the Project area and so in order to understand how design rainfall and run-off events affect river flows, a rainfall run-off model was developed. Peak flows calculated by the WBNM model at various road crossings are presented in Table 4-7. The selected locations are of hydraulic significance and reflect key access and evacuation routes within the Project area.

The peak flows calculated by the WBNM were used to create a 1% Annual Exceedance Probability (AEP) flood extent. The flood extent indicates how the 1% AEP event generated bank full or near bank full levels in all of the main watercourses. In some areas, water spilled beyond creek banks and was conveyed via adjacent floodplains. Modelled flood extents have been used to inform infrastructure locations associated with the existing operations, as described in the Surat Basin Constraints Planning and Field Development Protocol. The same procedure will be used to locate infrastructure for the present development.

FIGURE 4-6: WATERCOURSES

FIGURE 4-7: REFERABLE WETLANDS

FIGURE 4-8: DISTRIBUTION OF EPBC LISTED SPRINGS

TABLE 4-7: PEAK FLOWS CALCULATED BY WBNM MODEL

Model result location	Contributing upstream sub area	1 % AEP (m^3/s)
Mt Organ Creek at Bundi Road crossing	Sub45	47
Horse Creek at Bundi Road crossing	Sub14b	380
Horse Creek at Kabunga Road crossing	Sub30	458
Horse Creek at Yeovil Road crossing	Sub47	493
Canal Creek at Burradoo Road crossing	Sub41	134
Unnamed tributary #1 crossing Roma Taroom Road.	Sub38	59
Unnamed tributary #2 crossing Ryals Road	Sub31	41
Unnamed tributary #3 crossing K Road	Sub28	69

Surface Water Use

Reflecting the ephemeral nature of the watercourses in the Project area, surface water use is limited. Existing studies have however identified the following existing water use arrangements (Northern Energy Corporation Ltd 2012):

- The nearest downstream licensed water entitlement to the Project area is from Juandah Creek at the Horse Creek confluence;
- A water entitlement for stock water is drawn from a dam on an unnamed tributary of Mud Creek; and
- Several water harvesting and irrigation licenses are located at the Juandah Creek / Dawson River confluence near Taroom.

Only the first of these water use arrangements is located within the Project area.

Existing water use in the Dawson River catchment is dominated by irrigated agriculture and stock and domestic supplies, however, there is also demand to meet urban town water supply and large scale mining. Growth in regional water demand is expected to be primarily driven by population increases associated with new mining activity. Water demand from Theodore, Moura, Banana and Baralaba is set to more than double between 2006 and 2050 (SunWater 2013).

Surface water quality objectives and indicators

Environmental values for water are the qualities that make it suitable for supporting aquatic ecosystems and human uses. The environmental values of waterways in Queensland are protected by the EPP Water. For several catchments including the Upper Dawson River (within which the Project area lies), the EPP Water identifies specific environmental values for protection and outlines water quality objectives (WQOs) to achieve a certain level of aquatic ecosystem condition. For the Upper Dawson River, the specified ecosystem condition is a ‘moderately disturbed’ aquatic ecosystem (DEHP 2017). Environmental values for the Project area are presented in Table 4-8 and are in line with the Draft Dawson River Sub-basin Environmental Values and Water Quality Guidelines (DEHP 2017).

In order to support the protection of each of the identified environmental values, the *Draft Dawson River Sub-basin Environmental Values and Water Quality Guidelines* (DEHP 2017) outlines specific limits for implementation. Table 4-9, Table 4-10 and Table 4-11 present the guidelines to be adhered to in order to meet conditions of a moderately disturbed aquatic ecosystem. These presented guidelines for aquatic ecosystems are the default and minimum guidelines that should apply to all waters. The (HEV) wetland HEVm2142 on Paddys Creek, lies approximately 5 km north of the Project area (see Table 4-9 below).

TABLE 4-8: ENVIRONMENTAL VALUES FOR THE PROJECT AREA

Environmental Value	Description
Aquatic ecosystems	The intrinsic value of aquatic ecosystems, habitat and wildlife in waterways and riparian areas, for example, biodiversity, ecological interactions, plants, animals, key species and their habitat, food and drinking water.
Stock water	Suitability of water supply for production of healthy livestock.
Human consumer	Health of humans consuming aquatic foods, such as fish, crustaceans and shellfish from natural waterways.
Visual recreation	Amenity of waterways for recreation which does not involve any contact with water. For example, walking and picnicking adjacent to waterways.
Drinking water	Suitability of raw drinking water supply. This assumes minimal treatment of water is required, for example, coarse screening and/or disinfection.
Cultural and spiritual values	Indigenous and non-indigenous cultural heritage, for example: Custodial, spiritual, cultural and traditional heritage, hunting, gathering and ritual responsibilities; Symbols, landmarks and icons (such as waterways, frogs and turtles); and Lifestyles (such as agriculture and fishing). Cultural and spiritual values of water means its aesthetic, historical, scientific, social or other significance to the present generation or past or future generations.

TABLE 4-9: WATER QUALITY GUIDELINES – CONDUCTIVITY[1]

Sub-basin Gauging station zone	Low flow threshold and 20th–50th–75th percentile (µS/cm)	High flow threshold and 20th–50th–75th percentile (µS/cm)
Gauge 130302A – Dawson River at Taroom	<9.2 m^3/s (cumecs): 240–320–400	>9.2 m^3/s (cumecs): 130–180–240
Gauge 130324A – Dawson River at Utopia Downs	<2.9 m^3/s (cumecs): 260–290–340	>2.9 m^3/s (cumecs): 130–190–260
Gauge 130376A – Eurombah Creek at Brookfield	<0.55m^3/s (cumecs): 440–710–860	>0.55m^3/s (cumecs): 180–290–420

TABLE 4-10: WATER QUALITY GUIDELINES – OTHER[1]

Parameter	Unit	Baseflow <9.2m3/s (cumecs) at gauge 130302A - Dawson River at Taroom	Event Flow >9.2m3/s (cumecs) at gauge 130302A - Dawson River at Taroom
Ammonia N	µg/L	<10–20–40	14–30–40
N (oxidised)	µg/L	<10–35–120	40–80–200
Total nitrogen	µg/L	310–595–890	1000–1300–1690
Filterable reactive phosphorus	µg/L	5–6–30	5–10–70
Total phosphorus	µg/L	22–55–130	255–460–605
Chlorophyll a	µg/L	<5	TBD
Dissolved oxygen	% sat.	85–110	TBD
Turbidity	NTU	8–35–210	150–220–450
Suspended solids	mg/L	9–20–90	100–175–370
pH	-	6.5–8.5	6.5–8.5
Sulphate	mg/L	<20-<20-<20	<20-<20-<20

[1] Note: WQGs for indicators are shown as a range of 20th, 50th and 80th percentiles to be achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. <15). For single value guidelines, medians of test data are compared against the draft guideline (refer text for more details).

TABLE 4-11: WATER QUALITY GUIDELINES – MACROINVERTEBRATES

Upper and Lower Dawson		Taxa richness	PET	SIGNAL	% tolerant taxa	% sensitive taxa	Other macro
Composite (s2)	HEV	id	id	id	id	id	id
Edge (s2)	HEV	id	id	id	id	id	id
Composite (s2)	MD	12–21	2–5	3.33–3.85	25–50%	id	id
Edge (s2)	MD	23–33	2–5	3.31–4.20	44–56%	id	id

HEV: high ecological value; SD: slightly disturbed; MD: moderately disturbed

Sources: S1: Local datasets (e.g. DSITI, FPRH); S2: scheduled WQOs; S3: QWQG guidelines and /or data; S4: ANZECC (2000) AWQG

4.5.2 Groundwater

Environmental values adopted for the Project area have been defined in the *Dawson River Sub-basin Environmental Values and Water Quality Objectives* (DEHP, 2011) for the Upper Dawson (downstream of Hutton Creek junction) and Taroom area (in plan WQ1308).

It must be noted that information provided throughout the Groundwater section of this document relates to the 'Study Area', as previously defined in QGC's Surat North Development Water Monitoring and Management Plan (Surat North WMMP), 2016 and informed by the Underground Water Impact Report for the Surat Cumulative Management Area (UWIR), 2016, prepared by the Office of Groundwater Impact Assessment (OGIA).

A Study Area has been defined and used by QGC to examine the wider water resources setting, and approximate regional scale of influence of its activities on groundwater. The Study Area includes the existing

Project area, the drainage lines north to the Dawson River and the springs on the northern margin of the Surat Basin.

Hydrogeology

The Project area is located within the Surat Basin, which forms part of the eastern Great Artesian Basin (GAB) and overlies parts of the southern Bowen Basin. Development occurs within the Surat Cumulative Management Area (declared 18 March 2011).

From youngest (shallowest) to oldest (deepest), the primary groundwater units in the region are:

- Alluvium aquifer, or Condamine Alluvium;
- Springbok Sandstone aquifer/aquitard;
- Walloon Subgroup aquifer/aquitard
- Hutton Sandstone aquifer/aquitard; and
- Precipice Sandstone aquifer.

The main geological units that will influence surface water/groundwater interactions in the Project area are the alluvium, Springbok Sandstone and the Walloon Subgroup. The Springbok Sandstone was deposited unconformably over the Walloon Subgroup and locally incises into the Walloon Subgroup. The Springbok Sandstone behaves as a very poorly yielding aquifer in some locations and as a leaky aquitard in others. There are locations where the Walloon Subgroup is in direct hydraulic contact with the overlying Springbok Sandstone.

Gas and water will be extracted from the Walloon Subgroup, which is the predominant bedrock formation in the Project area. OGIA (2016) suggest that at a basin scale, the Walloon Subgroup is an aquitard due to its overall poorly permeable nature, although locally it is a low yielding aquifer. Older underlying formations include the Hutton Sandstone and Precipice Sandstone. These formations outcrop at the surface north of the Project area.

Recharge across the region surrounding the Project area occurs typically in the south, on the Dividing Range, via direct infiltration of rainfall where permeable strata outcrop across elevated terrain. Other pathways of recharge include leakage through surficial sediments and from adjoining aquifers, and localised seepage from streams and alluvial groundwater systems. Net recharge rates range from practically zero within tight aquitard-dominated units, up to 6 mm/year within more permeable aquifers such as the Precipice Sandstone. Recharge to the Walloon Subgroup occurs through infiltration or stream leakage where the unit outcrops or is in shallow subcrop. Recharge may also occur through leakage from overlying and underlying formations.

Natural discharge from aquifers in and around the Project area occurs at springs, as baseflow to streams, vertical leakage to adjacent units, and as subsurface flow to adjoining basins. Groundwater flow within the Dawson River Catchment area is dominated by local to intermediate processes and correlates closely to surface water drainage flow direction (predominantly towards the east and north-east).

Groundwater Use

Land use in and around the Project area is predominantly livestock grazing, with some non-irrigated and irrigated cropping. Within the Project area, QGC's bore baseline assessment identified groundwater supply bores were used predominantly for stock watering and domestic supply. The Hutton Sandstone and Precipice Sandstone are the most extensively utilised aquifers, where they come close to outcrop, given consideration of the quantity of bores and volume of extraction (both allocated and assumed allocated). The Walloon Subgroup is utilised throughout the Project area for stock and domestic supply.

The Precipice Sandstone is a source for town water supply at Taroom and Wandoan. These sources are likely to account for a large proportion of the Precipice Sandstone aquifer's groundwater extraction. Alluvial aquifers are commonly used for water supply also and are restricted to the Dawson River and immediate surrounds.

The Springbok Sandstone is present as a surficial hydrogeological unit over the southern part of the Project area. This unit does not appear to be widely used for water supply, based on DNRM bore data and QGC bore baseline surveys, other than potentially for stock and domestic usage east of Wandoan.

4.6 Summary of MNES Baseline

On the basis of a review of existing records, habitat preferences and field survey of habitats, ecological communities, and species, the following MNES are known or considered likely, potentially or unlikely occurring within the Project area and are carried through to the impact assessment in the following section. No other MNES beyond those listed below are considered to be present within the Project area and thus, are not likely to be affected by the next phases of the Project.

- Threatened Ecological Communities:
  - Brigalow (*Acacia harpophylla* dominant and codominant) (Brigalow) (known)
  - Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (SEVT) (known)
  - Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions (potential)
- Threatened species:
  - Belson's panic grass (known)
  - Koala (known)
  - South-eastern long-eared bat (potential)
- Migratory species
  - Fork-tailed swift (known)
  - White-throated needletail (known)
  - Sharp-tailed sandpiper (likely)
  - Latham's snipe (likely)
  - Glossy ibis (likely)
  - Australian Painted Snipe (also Endangered, unlikely)
  - Satin flycatcher (potential)
  - Rufous fantail (potential)
- Water resources
  - Surface water (quality and quantity)
  - Groundwater (quality and quantity)

5 ASSESSMENT OF POTENTIAL IMPACTS

5.1 Threatened Species and Threatened Ecological Communities

5.1.1 Mortality

Works associated with the Project have the potential to cause injury or mortality to fauna species listed as MNES. Injury or mortality could occur as a result of a range of activities carried out within the Project area, such as:

- vehicle strikes;
- habitat loss and modification;
- entrapment in trenches or dams;
- displacement; or
- exposure to contaminants.

5.1.2 Habitat loss

Habitat for known and potential MNES within the Project area may be damaged or lost through the clearing of vegetation for construction of Project infrastructure.

The proposed action will be undertaken in an area that has already undergone substantial historical vegetation clearing and will be adjacent to some of QGC's existing Project infrastructure already approved and operational, including wells, access, gathering lines, trunklines, water storages and a field compressor station. Clearing associated with the proposed development will be avoided as far as practicable by either utilising or co-locating proposed infrastructure next to existing infrastructure (such as access tracks) and by tying-in to existing gathering lines. This will reduce the need for clearing associated with the proposed action. However, some clearing will be required, and this may impact upon EPBC Act-listed species and TECs within the Project area. The predicted clearing impacts as a result of the next stages of the development have been calculated using GIS. These results are presented in Table 5-1 and Table 5-2 below and further discussed in ATTACHMENT C and ATTACHMENT E.

The adaptive management framework within the QGC Constraints Planning and Field Development Protocol will be employed to enable siting of project infrastructure in an environmentally sensitive manner. Constraints mapping will be used to inform siting as well as pre-construction surveys to verify identified constraints and provide additional information where necessary.

The principal impact on flora and fauna will be the clearing associated with the construction phase of the Project.

TABLE 5-1: UNMITIGATED DISTURBANCE LIMIT ASSOCIATED WITH THREATENED ECOLOGICAL COMMUNITIES FOR THE NEXT PHASES OF THE DEVELOPMENT

Threatened Ecological Community	Total Area Ground-truthed within the Project area (ha)	Predicted Disturbance within the Project area (ha)	Potential for Significant Impact
TECs known to occur			
Brigalow	1067	8.8	Yes
Semi-evergreen Vine thicket	69	0	No
TECs that potentially occur			
Coolibah Black Box	644	0	No

TABLE 5-2: DISTURBANCE LIMITS TO POTENTIAL HABITAT ASSOCIATED WITH THREATENED SPECIES FOR THE NEXT PHASES OF THE DEVELOPMENT

Threatened Species	Total Area of Ground-truthed Potential Habitat within the Project area (Ha)	Predicted Maximum Disturbance (ha)	Potential for Significant Impact
Species known to occur			
Belson's Panic Grass	3128	0	No
Koala	4136	62	Yes
Species potentially occurring			
South-eastern Long-eared Bat	6243	80	No

5.1.3 Disturbance and habitat degradation

Habitat degradation for flora and fauna species listed as MNES could result from a number of Project-related activities across the Project area, including:

- Dust generated by vehicle movement and construction works;
- Noise and light pollution;
- Further decline in water quality;
- The spread and invasion of pest flora and fauna species; or
- Exposure to contaminants.

A further decline in water quality could result from unplanned discharges of sediment-laden water, sanitary wastewater or contaminated water. Accidental spillage of sanitary wastewater could increase the occurrence of algal blooms within waterways due to its nutrient-rich composition. However, camps will not be located within 100 m of a watercourse; therefore the risk of an impact occurring will be low.

If exotic flora species are not managed, the Project has the potential to increase their abundance and facilitate their dispersal which may have negative economic and social effects for the Project area as well as negative impacts on native vegetation, habitat and biodiversity. Mechanisms of potential weed dispersal from Project activities may be associated with:

- Movement of equipment and machinery, particularly machinery sourced from adjacent regions; and
- Ground disturbance, such as grading, removal and relocation of topsoil.

Project-related activities have the potential to increase the abundance of pest fauna species through introduction, availability of increased food and water resources and habitat modification. This could lead to increased competition with, and potential predation of, MNES species, as well as habitat degradation.

5.1.4 Habitat fragmentation

Vegetation clearance has the potential to impact upon intact corridors connecting the landscape. These corridors facilitate the movement of species and enable the maintenance of genetic diversity among populations. Clearing of vegetation during construction activities will have the potential to cause habitat fragmentation. Clearing within corridors has the potential to isolate populations, reduce movement, reduce resources available to populations or reduce genetic diversity within isolated populations.

5.1.5 Edge effects

Edge effects occur where Project activities encroach on the perimeter of a vegetation community. The extent, structural complexity and type of disturbance at the perimeter of the community determines the degree to which ecosystem function is affected, particularly the extent to which the community can continue to provide viable habitat. Changes resulting from edge effects include:

- Modified composition and structure of the community (as perimeter plants are exposed to different light conditions and the drying effects of wind);
- Refuge loss (as fauna species withdraw deeper into the community); and
- Invasion by exotic and native flora and fauna species.

5.1.6 Alteration of ecological processes

The potential exists for the alteration of ecological processes to occur within the Project area due to Project works, and other factors such as fire frequency, extent and intensity and surface water flow conditions.

Construction and operational activities associated with Project works have the potential to increase the risk of ignition and fire if not conducted in an appropriate manner and in accordance with applicable procedures. Furthermore, clearing will alter the natural burning patterns via artificially created firebreaks along access roads and gathering Right of Ways (RoWs).

Increased erosion and surface water flow disturbance may result from ground clearance, physical obstructions and increased run-off due to ground compaction. This flow disturbance and altered water quality could impact on vegetation communities and fauna, particularly EPBC Act-listed migratory species around natural wetlands.

5.2 Migratory Species

No significant impact to any EPBC Act listed migratory species is predicted due to the referral area's highly disturbed nature and the limited potential for important populations to occur. Of the eight migratory species identified as known, likely,or potentially occurring in the Project area, two (fork-tailed swift and white-throated needletail) are almost exclusively aerial and will not be impacted by the proposed development.

Four species (Sharp-tailed sandpiper, Latham's snipe, Glossy ibis and Australian Painted Snipe) are reliant on wetland habitats. The Project area contains about 233 ha (0.2 % of total Project area) of seasonal wetland habitat and does not support any significant populations of wetland migratory species. QGC will avoid disturbance to wetlands as a high priority developmental control and all potential disturbance will be assessed in accordance with the Constraints Planning and Field Development Protocol which will be implemented (refer Section 3.4). Impacts on migratory species habitat (specifically wetlands and their associated ecosystems) will be limited as wells and other infrastructure cannot be located near wetlands due to flooding risk. In the unlikely event that disturbance near wetlands is unavoidable, mitigation measures will be developed to minimise the potential impact and will be included in the relevant Significant Species Management Plan.

The final two migratory species, satin flycatcher and rufous fantail, can only be determined as potentially occurring as there are no records in the Project area or in close proximity. These species utilise woodland habitats, but neither have been recorded in the Project region and development of the next phases of the Project will not affect the populations of these birds.

5.3 Water Resources

5.3.1 Introduction

The Projects as designed comprise the abstraction of approximately 90 GL of water from up to 1200 (existing + proposed) CSG development wells constructed into the Walloon Coal Measures. The impacts of that abstraction have already been assessed as part of the approval process for the existing Charlie Development and the Projects are included in the ongoing Queensland Government water resources management framework.

In addition, QGC has had in place approved water monitoring and management plans for its QCLNG and Surat North projects for a number of years in accordance with its Australian government approval conditions. The current approved plans[2] can be found online at: https://www.shell.com.au/about-us/projects-and-locations/qgc/environment/water-management/reports.html. This referral builds on the plans presented in the link by considering any uncharacterised, unassessed or unmanaged water assets which might be brought within the additional footprint of the development, in particular potential Groundwater Dependent Ecosystems.

5.3.2 Risk Assessment

A risk assessment of water related impacts has been carried out which considers the assessments already undertaken, management plans that are in place and any water assets which might require further assessments.

[2] Surat North Development Water Resource Monitoring and Management Plan (SNDWRMMP)

Stage 3 Water Monitoring and Management Plan (WMMP)

The risk assessment uses the causal pathways outlined in the relevant Balonne-Maranoa Bioregional assessment:

1. Subsurface depressurisation and dewatering;
2. Subsurface physical flow paths;
3. Surface water drainage; and
4. Operational water management.

Managed Risks

The following risks and impacts have already been assessed and are managed under the Approved Surat North WMMP and/or the Queensland regulatory framework.

1. Subsurface depressurisation and dewatering

Water level decline in water supply bores

Impacts on water bores are assessed and managed under the Queensland Water Act and the associated Make Good process. The 2016 UWIR simulated drawdown over the Approval area from a full-scale development (including all areas included in this Development). The bores assessed to be at risk of a >5m drawdown and assigned to QGC to manage have been investigated according to the Queensland DES Bore Assessment Guidelines and negotiation with landholders on appropriate compensation measures are underway.

Water level decline in aquifers supporting springs

EPBC spring impacts are managed under the Joint Industry Plan and the OGIA Spring Management Strategy. Potential water level decline in aquifers supporting EPBC springs has been simulated in the 2012 and 2016 Surat CMA models based on full development in the Project area i.e. the full Surat Basin Acreage Development Project. QGC has fulfilled all commitments under the JIP including establishment of a monitoring network, spring monitoring and development of conceptual models of flow to springs. The proposed projects fit within the development footprint and abstraction volumes that were proposed when the JIP was approved. Therefore, there are no additional stresses on the springs and the JIP remains applicable.

2. Subsurface physical flow paths

Preservation of aquifer isolation

QGC complies with the QLD Code of Practice (CoP) for the drilling of CSG wells. This includes measures to preserve aquifer isolation. To align with the CoP, QGC has implemented a well design for Surat CSG wells which prevents aquifer contamination and extraction of water from aquifer bearing intervals. To meet the CoP requirements, The Drilling Basis of Design – CSG Development Well (BoD) was implemented by QGC to provide standard operating procedures for the drilling of a typical Surat CSG production well. The BoD sets procedures to confirm well integrity and provide zonal isolation.

Well integrity

Well integrity is managed under the *Code of Practice for the construction and abandonment of coal seam gas wells and associated bores in Queensland*. All wells (including exploration, appraisal and storage wells) that are flowing, injecting, shut-in, normally or long-term shut-in, suspended, or temporarily abandoned are defined as operated wells and associated activities defined as Production Operations.

Hydraulic fracturing

The wells drilled as part of this Project are not planned to undergo hydraulic fracturing. However, if limited stimulation is undertaken there is a robust framework under Queensland legislation to manage and mitigate impacts.

Subsidence and connectivity

This relates to the potential for compaction to create flow paths and/or enhance aquifer connectivity. Subsidence monitoring and management over the Approval area have and will be continued to be managed under the existing management plans as outlined in the Surat North WMMP.

3. Produced water management

Water transport and storage

Any produced water will be treated at the existing approved Woleebee Creek facilities. Treated water will be managed under the existing Glebe Weir BUA (ENBU04254412/EPBC 2011/6181) and any volumes generated under this Project are already included in that approval.

There are no new ponds associated with this development.

Brine and salt management

There are no additional brine or salt management facilities included in the proposed Project. Any brine or salt tonnages are already included in existing management plans and approvals.

4. Surface Water

Direct impact through development near watercourses

QGC has in place a procedure to mitigate risk to sensitive areas through constraints on development. When confirming locations for gas-field infrastructure or petroleum activities, QGC will have regard to the environmental and social constraints at any proposed site. These constraints will be balanced against other drivers (including local geological characteristics, engineering requirements or landholder requirements for example). QGC's priorities regarding constraints are (in order):

- Avoid
- Minimise
- Mitigate & rehabilitate

Indirect depressurisation impacts

Potential impacts due to indirect depressurisation are addressed under the depressurisation pathway.

Leaks and spills

There are potential water quality impacts associated with leaks from produced water pipelines and spills from chemicals storage, hydraulic power units and other equipment. These impacts are considered unlikely given the operational controls in place to prevent leaks and spills.

5.4 Remaining risks

The following risks are then assessed further in this referral:

1. **Subsurface depressurisation and dewatering**

- Water level decline in shallow aquifers causing impacts to shallow aquifers and specifically, impacts to terrestrial GDE and aquatic ecosystems.
- Water level decline in shallow aquifers causing impacts to flow in watercourses.

The Surat North WMMP was focused around the main element of the SBAD at the time of the plan which was the 400 wells centred around Horse Creek. Therefore, the approved GDE management action contained in that plan focussed primarily on potential GDEs associated with the alluvium, channel and flood plain of Horse Creek. The extension projects include development to the south, west and north of the focus area. Therefore, this referral targeted the assessment of any other GDEs, watercourses and relevant aquatic ecological system within this footprint. Additional information associated with the Horse Creek area, collected since the WMMP, is also included.

6 PROPOSED MANAGEMENT PRACTICES

In order to reduce potential impacts on MNES, a number of mitigation and management measures have been proposed. These measures rely on the existing management measures already employed by QGC as part of the existing operations, where they have been shown to be entirely effective.

6.1 Threatened Species, Migratory Species and Ecological Communities

Management practices to limit impacts on EPBC listed species and TECs are implemented by QGC primarily through QGC's Constraints Planning and Field Development Protocol for the Surat Basin (see Section 3.4), which aids site selection and minimisation of environmental disturbance through avoidance of impacts in the first instance wherever practicable. Where impacts are unavoidable and considered greater than insignificant, QGC will utilise proven management and mitigation measures, developed and implemented on existing projects.

A key aspect of the Protocol, relating to MNES, is the implementation of pre-clearance surveys to guide final infrastructure footprints and alignments, providing opportunity for avoidance and minimising direct impacts to TECs and species core habitats.

Where EPBC listed species are detected within the vicinity of the proposed disturbance area during pre-clearance surveys, fauna spotting surveys will be managed in accordance with existing QGC Surat North Development Area Significant Species Management Plan (QCQGC-BX00-ENV-PLN-000010 included in ATTACHMENT F) for the Surat Basin (SSMP) as identified in Table 6-1. Existing and specific management plans for species not currently included in existing plans may be developed and updated, as required.

TABLE 6-1: SSMP RELEVANT TO THREATENED AND MIGRATORY FLORA AND FAUNA SPECIES KNOWN OR POTENTIAL TO OCCUR IN THE REFERRAL AREA

Scientific Name		Existing Approved SSMP Reference Number
Brigalow (*Acacia harpophylla* dominant and co-dominant)		Plan 1
Scientific Name	**Common Name**	**Existing Approved SSMP Reference Number**
Mammals		
Phascolarctos cinereus	Koala	Plan 13
Nyctophilus timoriensis (South-eastern form)	South-eastern Long-eared Bat	Plan 12
Plants		
Homopholis belsonii	Belson's Panic Grass	Plan 5

For the next phases of the Project, the management measures set out in Table 6-2 will be applied. As operational impacts on terrestrial flora and fauna are likely to be minimal, these measures are considered appropriate for both construction activities and operations.

TABLE 6-2 SPECIES AND ECOLOGICAL COMMUNITIES MANAGEMENT

Species and Ecological Communities Management	
Policy	To avoid or minimise impacts on the abundance and distribution of flora and fauna as a result of construction, operation and rehabilitation activities.
Performance criteria	Constraints Planning and Field Development Protocol implemented. Avoid, as far as practicable, clearing of TECs. Where avoidance is not practicable, minimise and mitigate residual impacts. Avoid, as far as practicable, MNES flora species and the habitat of MNES fauna. Where avoidance is not practicable, minimise and mitigate residual impacts. No unauthorised clearing of native vegetation. Permits and approvals in place for any disturbance of MNES flora and fauna species. No introduction of declared pest plants and animals as a result of gas field activities. Minimise fragmentation and isolation of native vegetation and habitat. Progressive rehabilitation is consistent with the desired land use post-decommissioning. *HSSE Risk Control Manual – Biosecurity* implemented. Note: This manual supersedes the previously applicable *Weed and Pest Management Plan*. Significant Species Management Plans implemented. Fauna Management Procedures implemented.
Implementation strategy	Continue to implement the established field development protocol (including assessment against the Constraints Protocol). Undertake clearing in accordance with EPBC Permit conditions. Minimise disturbance area to be cleared. The area to be cleared will be surveyed and marked prior to any works commencing. Any clearing within or close to watercourses or wetland vegetation communities will employ adequate erosion and sedimentation mitigation measures to ensure that potential impact to aquatic ecosystems and vegetation is minimised. Stockpile areas and haul roads are clearly defined, so that any weed infestation is appropriately managed. Stockpiles are developed in previously cleared areas, with adequate open-spaces buffers, so as not to impede vehicle and stock movement. Control fuel loads within buffer areas. Educate the workforce regarding significant and sensitive communities and species and potential impacts from unauthorised activities. Implement appropriate buffers around EPBC Act TECs, significant REs, wetlands and known populations and habitats of significant species. Linear infrastructure corridors will pass directly across, rather than along, creeks and waterways to reduce overall disturbance in riparian areas wherever possible. Leave ground layer vegetation (grasses and herbs) in situ wherever possible to assist soil stability. Establish ‘go slow zones’ (e.g. 40 km/hr) for vehicles and machinery where non-gazetted roads or tracks are located adjacent to areas of woodland, wetlands/ gilgais and rock outcrop/jump-up areas. <u>Rehabilitation</u> Rehabilitation will occur in accordance with relevant Permit conditions. Cleared vegetation may be used in rehabilitation activities where appropriate. Mulch created from cleared vegetation should be reinstated evenly across previously disturbed areas to return original topsoil nutrients to the soil and facilitate vegetative growth.

Species and Ecological Communities Management	
	Non-millable vegetation can be mulched and used in rehabilitation or soil stabilisation works, provided it is ensured that no weeds are incorporated into the mulch Traffic should be prevented from disturbing topsoil in rehabilitation areas, except where access is absolutely required for maintenance. Minimise the amount of land disturbance at any time and undertake reinstatement, stabilisation and rehabilitation in accordance with relevant Permit conditions. Following the construction phase, cleared woodland areas that are not required to remain cleared during on-going operational activities, maintenance or access will be revegetated in order to minimise the net loss of vegetative cover. Wherever possible, attempts should be made to rehabilitate the original habitat using locally native species. <u>Fauna</u> Dead trees, stags and hollow branches may be windrowed and pulled back onto the ROW during the rehabilitation stage. Where reasonably practicable, the timing of clearing operations is selected to minimise impacts on breeding species. Prevent entrapment of fauna in pipes (through night caps) and trenches (fauna ladders/ramps). Where fencing is required, the use of barbed wire fences will be negotiated with the landholder and avoided wherever reasonably practicable, particularly within areas where gliders and bats are likely to occur. Check trenches for trapped fauna before backfilling. In all areas, particularly riparian areas, where vegetation is required to be cleared, large trees that provide habitat for fauna will be avoided and retained wherever reasonably practicable. Hollow-bearing trees will be felled in a manner that reduces potential for fauna death. Felled trees will be inspected after felling and fauna will be relocated or receive assistance if injured. Fauna handlers will be suitably qualified and present to survey for and relocate fauna immediately prior to and during clearing activities (in all locations identified as containing suitable fauna habitat during the pre-clearance surveys). Consider the installation of nest boxes in areas where hollow-bearing trees must be removed and relocate large fallen logs and boulder piles to adjacent habitat to increase sheltering opportunities for displaced animals where it is not feasible to avoid such features during clearing.
Monitoring and auditing	Periodic inspections of undisturbed areas by the Environmental Advisors to identify any evidence of vegetation disturbance, edge effects, weed infestation, feral pests and fire management issues. Inspections of planned disturbances to ensure that vegetated areas and flora species to be cleared are well defined, there is no unauthorised disturbance of the surrounding habitat area, compensatory shelter is established where necessary, and an animal retrieval program is implemented where necessary. Regularly monitor health and condition of retained vegetation and habitat, and the health of known significant plant specimens/populations. Regularly monitor excavations for trapped fauna and monitor fauna mortality from vehicle strike. Rehabilitated areas will be monitored according to permit requirements.
Reporting and corrective action	The Environmental Advisor will report any incidents to the appropriate Environmental Manager as necessary: − Unauthorised disturbance of vegetation outside the defined activity areas; − Evidence of declared pest plant infestation; − Evidence of declared pest animals; − Failure to implement the Rehabilitation Framework; − Failure to implement the Significant Species Management Plan; − Unauthorised activity within a particular ecological constraints zone;

Species and Ecological Communities Management	
	− Animal retrieval program not implemented during clear and grade; − Hollow-bearing trees not felled appropriately; and − Failure to obtain necessary clearing permits. In the event of a failure to comply with relevant permit conditions, investigations will be undertaken into the cause of the incident or failure to comply, and the appropriate actions taken to overcome the problem and prevent recurrence, including review and amendment of the SSMP and Fauna Management Procedures.

6.2 Water Resources

6.2.1 Surface water

QGC has an existing Constraints Planning and Field Development Protocol for the Surat Basin which aids site selection and reduces environmental disturbance through avoiding impacts in the first instance wherever feasible. QGC has also developed and implemented a number of management and mitigation measures as part of its existing operations in Queensland. Where avoidance cannot be achieved, these proven measures will be utilised.

In some places, there may be no practicable alternative to some linear infrastructure (e.g. gathering lines and access tracks) transecting watercourses. In such cases, impacts will be minimised as far as possible by minimising the disturbance area and implementing mitigation measures such as land stabilisation and erosion prevention measures. Where this occurs, proposed activities are not considered to have a significant impact on the conservation values.

Surface water management and mitigation measures are set out in Table 6-3 below. These measures are considered appropriate for both construction activities and operations.

TABLE 6-3: SURFACE WATER MANAGEMENT

Surface Water Management	
Policy	To minimise the potential impacts associated with watercourses, wetlands, lakes and springs in accordance with the Constraints Planning and Field Development Protocol. To minimise the potential impacts associated with erosion on water quality. To prevent the direct or indirect release of contaminants that may adversely affect downstream surface water quality.
Performance criteria	Release to waters only in compliance with relevant permit conditions. No failures of sediment and erosion control techniques leading to unacceptable sediment release. Treated water for beneficial re-use is to meet specified water quality criteria tailored for the intended use and to minimise any potential environmental impacts from the intended use. Land Release Manual implemented. Soil management and mitigation measures implemented.
Implementation strategy	Implement the Constraints Planning and Field Development Protocol for management of infrastructure placement recognising watercourses, wetland, lakes and springs as high constraints. Recognise and implement the restrictions for activities associated within proximity of watercourses, wetland, lakes and springs to reduce potential sediment movement for non-lineal infrastructure.

Surface Water Management	
	Water extracted from low point drains released to land will comply with the relevant permit conditions. Sediment and erosion control Implement the mitigation controls within soil erosion and sediment control plans to reduce and control water flow across and around infrastructure. Instream works (specifically watercourses, wetlands, lakes and springs) Where lineal infrastructure is to be developed within a waterbody and/or buffer, the following methodology is undertaken: – Locate crossing points where turbulence is minimal and away from bends in streams or where two drainage lines meet where reasonably practicable. – Ensure there is no active undercutting of either bank and no dumping of sediments within the stream bed. – Minimise the extent of vegetation removal and disturbance by narrowing corridors required for construction where reasonably practicable. – Rehabilitate disturbances as soon as possible in accordance with the Rehabilitation Framework. – The clearance path will, where practical, be designed at an angle of 90 degrees to the watercourse in order to limit the extent of clearing. Clearing will be reduced to the minimum safe width required for installation. – Works in the vicinity of a watercourse, such as horizontal directional drilling, pipeline or access track construction, will be undertaken in accordance with the relevant permit and regulatory requirements. – Waterbody banks effectively reinstated to prevent scouring. – Waterbody flows and channel crossings not altered beyond what is absolutely necessary. – Crossing construction will, where practicable, be undertaken in no-flow or low-flow conditions. – Waterbody will be stabilised as required (e.g. using gabions (rock mattresses) or jute matting). – Crossings will be completed promptly in accordance with permit and regulatory requirements. – Where reasonably practicable, large trees, particularly hollow-bearing trees, will be retained. Root stock will, wherever practicable, be retained for stabilisation of the banks. – For wet crossings, water quality will be managed in accordance with relevant EA conditions. – Primary settlement and sediment control structures will be installed where required between the creek and the construction area when wet weather is expected and post-construction. – The Construction Supervisor will be vigilant of flood warnings and, where necessary, action will be taken in accordance with the Emergency Response Plan. – Any trench water will be pumped into water trucks and used for dust suppression if practical, or pumped into sediment basins away from any watercourse. – Vehicle crossings will be appropriately constructed (e.g. include rock and flume/s) to cater for existing or expected flow conditions. – Existing layers of cobbles and/or coarse gravel in the bed of the watercourse will be reinstated where appropriate.

Surface Water Management	
	– Banks will be reinstated to an appropriate slope/grade compatible with existing site conditions and soil type. – As soon as reasonably practicable, seeding will be undertaken on a disturbed embankment or slope to encourage effective soil stabilisation through vegetation growth. – Infrastructure will be located away from major river and creek systems whenever possible, in accordance with the QGC Constraints Planning and Field Development Protocol. <u>Chemical storage and contamination</u> Implement Hazardous Chemical Management Procedure. Training of staff in correct chemical use and handling and spill response procedures. Designing chemical storage and handling facilities to avoid unnecessary handling using, where possible, automated filling systems and dosing devices. Keeping Material Safety Data Sheets (MSDSs) and spill kits in the chemical storage facility. Maintenance and cleaning of vehicles will be completed at off-site facilities where possible. If on site, activities will be completed at locations where the potential for the release of contaminants to waters or stormwater systems is minimised, at a single designated maintenance area. <u>Flooding</u> Incorporate predicted climate change scenarios into design parameters when sizing infrastructure. Locate infrastructure above 100-year ARI flood level whenever practicable. Flood extent maps will be used to guide location of infrastructure away from flood-prone areas. Peak design flows will be used to check flood levels and velocity as part of design process.
Monitoring and auditing	• Routine, regular and frequent visual inspection of construction activities to determine whether the application of erosion and sediment controls is adequate. • Rehabilitated watercourses will be monitored in accordance with the Rehabilitation Framework. • Regular inspection of water pipeline infrastructure to detect breakages or leaks.
Reporting and corrective action	• The following will be reported regularly: – Compliance with erosion and sediment control measures; – Results of routine inspections. • The following are classified as incidents relating to surface water management: – Erosion and sediment control plan not implemented; – Breach in integrity of bunds; – Any temporary sediment basins demonstrating significant reduced available volume; – Significant increase in water turbidity; • Should an incident/failure to comply occur, the following corrective actions could be considered: – Repair soil erosion and sediment controls; – Repair stormwater controls; – Contain and remedy or dispose of contaminated material/s; – Clean out temporary sediment basins; and – Review the relevant plans.

6.2.2 Groundwater

To manage potential impacts to groundwater related assets, QGC has a number of response plans in place under the approved Stage 3 WMMP and the Surat North WMMP:

- Response Plan iia: If Investigation or Mitigation Trigger Values or Drawdown Limits for aquifer drawdown in relation to EPBC listed springs are exceeded.
- Response Plan iib: If Threshold Values for aquifer drawdown in relation to groundwater-producing bores are exceeded.
- Response Plan iic: If Threshold Values for groundwater contamination are exceeded.
- Response Plan iii: If Subsidence or surface deformation occurs which impacts on surface or groundwater hydrology.
- Response Plan iv: If there are Unforeseen emergency discharges.
- Response Plan v: If Investigation or Mitigation Trigger Values or Drawdown Limits for aquifer drawdown in relation to aquatic ecology are exceeded.

Each Response Plan contains investigation and management/mitigation stages depending on which particular thresholds have been exceeded and is based on the following principles:

- The investigation stage will include the targeted data collection for and evaluation of potential mitigation measures to lead to the selection of a preferred mitigation measure; and
- Exceedance of the management/mitigation threshold will trigger the implementation of that preferred mitigation measure as long as conditions have not significantly changed to negate the preferred option.

This approach recognises that there could be several years between threshold values being reached. Exceedance Response Plans will be activated following the initial notification to the Minister. Each Plan is built around a two-phased Critical Review Process with reporting to DoEE at key times.

The response plan relevant to GDEs, is Response Plan v: If Investigation or Mitigation Trigger Values or Drawdown Limits for aquifer drawdown in relation to aquatic ecology are exceeded. This Plan is in place and approved but is interim at this time. It is being further developed as data are collected and the interactions between deep and shallow systems are characterised. QGC has a commitment to deliver a revised assessment and management plan to DoEE in October 2018 under the Surat North WMMP. It is currently proposed to integrate this plan with activities OGIA are undertaking with regard to their additional responsibilities to manage GDEs within the Surat CMA.

It is envisaged that the revised response Plan v will combine State and Federal requirements into one overarching impact management plan with agreed triggers and actions. The Plan will include:

- Continued data acquisition on the Horse Creek floodplain, alluvial aquifer and riverine vegetation;
- Data acquisition on other GDEs confirmed through the development are after ground truthing;
- Characterisation of GDEs and relationship to shallow groundwater;
- Relationship between shallow and deep groundwater and potential for interaction with the gas reservoir;
- Triggers to prevent significant impacts to GDEs; and

- Identification of mitigation and management actions if impacts materialise.

7 IMPACT SIGNIFICANCE ASSESSMENT

As described in Section 5 above, the potential impacts of the Project have been assessed. This section assesses whether those impacts are significant or not under the EPBC Act.

7.1 Methodology

The Significant Impact Guidelines 1.1 (DoEE, 2013a) have been used to guide the assessment of the Project's impact significance on species and ecological communities. ATTACHMENT E contains the detailed assessments of significance against the guideline criteria for each TEC and threatened species known, likely or with the potential to occur within the Project area.

The Significant Impact Guidelines 1.1 state:

'A 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. You should consider all of these factors when determining whether an action is likely to have a significant impact on matters of national environmental significance.'

The impact assessment methodology used for this assessment aims to ensure a rigorous and consistent impact assessment throughout the Project area and to follow the DoE guidelines. QGC has developed a mitigation hierarchy based on avoidance, minimisation and mitigation (including management measures) that aims to avoid adverse impacts or reduce the magnitude of the impacts to MNES values. The *significance* of the impact for each MNES value is based on consideration of the resource *sensitivity* and *magnitude*. The category for significance is determined using the matrix presented in Table 7-1 below.

The receptor sensitivity of each of the MNES values has been reached using professional judgement based on a range of factors including: EPBC Act status, quality of the value, known distribution, its importance (on a local, national or international scale) and sensitivity to disturbances. Receptor *sensitivity* is categorised as *low, low-medium, medium, medium-high or high.*

Magnitude represents the change predicted to occur as a result of the impact. The *magnitude* is categorised as *Insignificant, Minor, Medium, Major* or *Severe. Magnitude* is a function of four impact characteristics, being the extent, duration, scale and frequency. Values for *magnitude* were reached through professional judgment of the impact characteristics based on potential impacts identified for each MNES value.

The Significant Impact Guidelines 1.3 (DoEE, 2013b) have been used to assess the significance of potential impacts on water resources. In accordance with this Guideline, an action is likely to have a significant impact on a water resource if there is a real chance or possibility that it will directly or indirectly result in:

- A substantial change in the hydrology of a water resource; or
- A substantial change in the water quality of a water resource.

Substantial change means a change that is of sufficient scale or intensity so as to reduce the current or future utility of the water resource for any purpose or would create a material risk (i.e. greater than "low risk") of such reduction in utility occurring.

Based on this definition and the relevant assessments (which include an assessment of potential cumulative impacts), the development will not have any significant impact on water resources. In most cases there is no impact and in the two cases where there is a potential impact, the impact is not considered to be significant.

TABLE 7-1 SIGNIFICANCE MATRIX

		Receptor sensitivity				
		Low	**Low-Medium**	**Medium**	**Medium-High**	**High**
Magnitude	**Insignificant**	*Insignificant*	*Insignificant*	*Insignificant*	*Insignificant*	*Insignificant*
	Minor	*Insignificant*	*Insignificant*	*Insignificant*	*Minor*	*Minor*
	Medium	*Insignificant*	*Minor*	*Minor*	*Medium*	*Medium*
	Major	*Minor*	*Medium*	*Medium*	*Major*	*Major*
	Severe	*Medium*	*Medium*	*Major*	*Major*	*Severe*

TABLE 7-2: PRE-MITIGATED AND RESIDUAL IMPACTS

MNES	Values sensitivity	Pre-mitigated impacts		Residual impacts following implementation of management measures	
		Magnitude	Significance	Magnitude	Significance
Threatened Ecological Communities					
Brigalow (*Acacia harpophylla* dominant and codominant) (Brigalow)	Medium - High	Minor	Minor	Minor	Minor
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (SEVT)	Medium	Minor	Minor	Minor	Insignificant
Coolibah – Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Medium	Minor	Minor	Insignificant	Insignificant
Threatened Species					
Flora species					
Belson's panic grass	Medium	Minor	Minor	Minor	Insignificant
Fauna species (threatened and migratory species)					
Koala	Medium	Major	Major	Medium	Minor
South-eastern long-eared bat	Low-Medium	Insignificant	Minor	Insignificant	Insignificant
Water Resources					
Surface water					
Catchment hydrology and hydraulics	Low	Minor	Insignificant	Insignificant	Insignificant
Wetlands	Low – Medium	Minor	Insignificant	Insignificant	Insignificant
Flooding	Low	Minor	Insignificant	Insignificant	Insignificant
Water quality	Low	Insignificant	Insignificant	Insignificant	Insignificant
Aquatic ecosystems	Low	Insignificant	Insignificant	Insignificant	Insignificant
Stock water	Low – Medium	Minor	Insignificant	Insignificant	Insignificant
Human consumer	Low – Medium	Minor	Insignificant	Insignificant	Insignificant
Visual recreation	Low	Insignificant	Insignificant	Insignificant	Insignificant
Drinking water	Low – Medium	Insignificant	Insignificant	Insignificant	Insignificant

MNES	Values sensitivity	Pre-mitigated impacts		Residual impacts following implementation of management measures	
		Magnitude	Significance	Magnitude	Significance
Cultural and spiritual values	Low	Insignificant	Insignificant	Insignificant	Insignificant
Groundwater					
Flow regime (volume timing, duration and frequency of water flows)	Medium - High	Insignificant	Insignificant	Insignificant	Insignificant
Recharge rates	Low – Medium	Insignificant	Insignificant	Insignificant	Insignificant
Aquifer Pressure or pressure relationships between aquifers	Medium	Minor	Insignificant	Minor	Insignificant
Groundwater table levels	Medium	Minor	Insignificant	Minor	Insignificant
Groundwater / surface water interactions	Low	Minor	Insignificant	Insignificant	Insignificant
River / floodplain connectivity	Low	Minor	Insignificant	Insignificant	Insignificant
Inter-aquifer connectivity	Low	Minor	Insignificant	Insignificant	Insignificant
Coastal processes including changes to sediment movement or accretion, water circulation patterns, permanent alterations in tidal patterns, or substantial changes to water flows or water quality in estuaries	Low	Insignificant	Insignificant	Insignificant	Insignificant
Subsidence	Low	Insignificant	Insignificant	Insignificant	Insignificant
Human or animal health or to the condition of the natural environment	Medium - High	Insignificant	Insignificant	Insignificant	Insignificant
Substantially reduce the amount of water available for human consumptive uses or for other uses, including environmental uses, which are dependent on water of the appropriate quality	Medium - High	Medium	Medium	Insignificant	Insignificant
Cause persistent organic chemicals, heavy metals, salt or other potentially harmful substances to accumulate in the environment.	Medium - High	Insignificant	Insignificant	Insignificant	Insignificant
Where local water quality is superior to Water Quality objectives, a significant worsening of local water quality	Medium - High	Insignificant	Insignificant	Insignificant	Insignificant
Water of high quality released into an ecosystem which is adapted to a lower quality of water.	Low	Insignificant	Insignificant	Insignificant	Insignificant

8 CONCLUSION

QGC considers that development of the next stages of the Surat Basin Acreage Development Project will have an impact of minor significance to MNES with the inclusion of mitigation and management measures. The proposed development does not impact World Heritage Properties, National Heritage Places, the Great Barrier Reef Marine Park, Commonwealth marine areas or Commonwealth land and it is not a nuclear action.

As discussed, the assessment presented within this report identifies impacts to one TEC and one threatened species, with a further two TECs and one threatened species that will be avoided. The remaining TECs and, listed threatened species have been identified as unlikely to occur within the Project area. The Project will also trigger assessment for impacts on water resources resulting from the development of Coal Seam Gas.

All potential impacts on MNES will be managed in accordance with QGC's Constraints Planning and Field Development Protocol and Significant Species Management Plans. Implementation of the Protocol and Plans during the next stages of the development will reduce the extent of impacts predicted here, as has occurred to date for the existing operations. Evidence of the effectiveness of this Protocol has been demonstrated through avoidance of impacts to MNES through previously approved EPBC 2013/7047. Accordingly, it is fully anticipated that all future phases of development can be undertaken in a way which reduces the impacts predicted in this assessment, particularly given the conservative footprint assumed.

With respect to water resources, impacts are already assessed and managed under the approved Surat North WMMP. The Project is not considered to directly or indirectly result in a substantial change in the hydrology or water quality of a water resource. Although a detailed site-based study is still in preparation, assessment for a greater development footprint within the Project area by OGIA (2016) did not predict any significant impact on water resources. Some additional work on potential impacts to GDEs is underway in conjunction with the revised Queensland Government framework to manage GDE impacts.

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ATTACHMENT A. *BAAM 2013*

ATTACHMENT B. *EPBC PROTECTED MATTER SEARCH REPORT*

ATTACHMENT C. *LIKELIHOOD OF OCCURENCE FOR THREATENED AND MIGRATORY SPECIES LISTED UNDER THE EPBC ACT WITHIN THE PROJECT AREA*

TABLE C-1: KNOWN OR PREDICTED OCCURRENCE OF THREATENED AND MIGRATORY SPECIES LISTED UNDER THE EPBC ACT WITHIN THE PROJECT AREA

Scientific name	Common name	EPBC Act status	Preferred habitat / Known or potential habitat within the Project area (where applicable)	Likelihood of occurrence
PLANTS				
Cadellia pentastylis	ooline	V	Found in semi-evergreen vine thickets in association with native quinine, hard alectryon (*Alectryon subdentatus),* leopard ash (*Flindersia collina),* Wilga and Queensland bottle tree (*Brachychiton rupestris)* on sandstone and basalt slopes and Currawong, Brigalow and Belah communities on undulating clay plains and low hills at altitudes 200 -500m.	**Unlikely** Known to occur within Woleebee tenement to the south, between Jackson-Wandoan Road and Gurulmundi State Forest. Not detected to date within the Project area through on the ground survey of existing and proposed infrastructure.
Denhamia parvifolia	small-leaved denhamia	V	Rare species known to occur on roadside remnants of semi-evergreen microphyll vine thickets on red soil (DSEWPaC 2008).	**Unlikely** Restricted to Queensland, from Yarraman west to Chinchilla. No records in the vicinity of the Project area.
Dichanthium setosum	bluegrass	V	The site is on the edge of the DoE 'species or species habitat may occur' species distribution. Associated with heavy basaltic black soils and red-brown loams with clay subsoil (NSW OEH 2013a). The ecological distribution of the species overlaps with three EPBC Act listed TECs that occur within the Project area: Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions, and Brigalow (*Acacia harpophylla* dominant and co-dominant).	**Unlikely** The Project area is on the edge of the species' distribution and nearest record is >100 km from the Project area.
Eriocaulon carsonii subsp. *orientaie*	salt pipewort	E	Found in active or flowing artesian mound springs or the margins of the Great Artesian Basin and on fen soils.	**Unlikely** Restricted to Queensland, north-western New South Wales and north-eastern South Australia. May occur in association with springs to the west of the Project area.
Eucalyptus beaniana	Bean's ironbark	V	Found in woodlands in association with lemon-scented spotted gum, Gympie messmate (*Eucalyptus cloeziana),* the ironbark E. *suffulgens, l*arge-fruited yellow jacket, brown bloodwood and broad-leaved white mahogany, in shallow, sandy soils on quartzose sandstone ridges.	**Unlikely** Occurs in the broader region, however suitable habitat is not present within the Project area. Not detected to date within the Project area through on the ground survey of existing and proposed infrastructure.
Homopholis belsonii	Belson's panic grass	V	Found in white box communities and Wilga woodlands on rocky hills; Belah forests in alluvial soils on flat to undulating lands; poplar box woodlands; and dry woodlands on poor soils derived from basalt at 200–	**Known** Restricted to Darling Downs region in southern Queensland to north-west slopes of northern New South

Scientific name	Common name	EPBC Act status	Preferred habitat / Known or potential habitat within the Project area (where applicable)	Likelihood of occurrence
			520m altitude. Also recorded in Brigalow, Myall and Weeping Myall communities; Mountain Coolibah communities; and on roadsides.	Wales. One record from within the Project area, however, no further records despite ongoing surveys. It is anticipated that only a small population may occur in the southern blocks of the Project area.
Tylophora linearis	slender tylophora	E	Found in dry scrublands, open forests and woodlands in association with broombush (*Melaleuca uncinata),* broad-leaved ironbark, red ironbark (*Eucalyptus sideroxylon),* white box (*E.albens),* black cypress pine (*Callitris endlicheri),* white cypress pine, bulloak (*Allocasuarina luehmannii),* hakea wattle (*Acacia hakeoides),* striped wattle (*A. lineata),* Myoporums *(Myoporum* spp.) and She-oaks *(Casuarina* spp.) at low altitudes and on sedimentary flats.	**Unlikely** Restricted to northern and central western slopes of New South Wales and near Glenmorgan in the western Darling Downs district in Queensland. Not detected to date within the Project area through on the ground survey of existing and proposed infrastructure.
Xerothamnella herbacea	herbaceous xerothamnella	E	Found in Brigalow dominated communities in shaded situations, often in leaf litter and in association with gilgais, on heavy, grey to dark brown clay soils.	**Unlikely** Recorded near Theodore and Chinchilla to the north and south of the Project area respectively. Suitable habitat present. Not detected to date within the Project area through on the ground survey of existing and proposed infrastructure.
REPTILES				
Delma torquata	collared delma	V	Open eucalypt forest with a shrub and tussock grass understorey. Soil type is usually shallow and deep-cracking or stony (Ehmann 1992; Wilson and Swan 2008). RE 11.3.2 could be an important habitat for the species but most typical habitat is Land Zone 10 in REs 11.10.1 and 11.10.1d.	**Unlikely** No database records from the vicinity of the Project area. Cryptic species that may occur in suitable habitat. Not detected to date within the Project area through on the ground survey of existing and proposed infrastructure.
Denisonia maculata	ornamental snake	V	Known to prefer woodlands and open forests associated with moist areas, particularly gilgai (melon-hole) mounds and depressions in RE Landzone 4 (DSEWPaC 2012). The most common RE in which D. maculata has been recorded is RE 11.4.3. The species is also commonly recorded in 11.4.6, 11.4.8 and 11.4.9 (DSEWPaC 2012).	**Unlikely** No database records, EPBC search only. Known to the north of the Project area (McFarland *et al.* 1999a, b).
Egernia rugosa	yakka skink	V	Variety of drier forests and woodlands (usually on well drained, coarse gritty soils) including poplar box on alluvial soils, low ridges, *Callitris* on sands, Belah (Ehmann 1992; Cogger 2000; Drury 2001; Wilson 2005). Also occur in highly degraded sites and where there are log piles and rabbit warrens (EPA 2003). Important habitat for the species includes RE 11.3.2, 11.3.3, 11.3.14, 11.4.4 and 11.9.3. Also occurs in Land Zone 5.	**Unlikely** Not recorded in Project area or immediate vicinity, records from broader region available. Generalist habitat preferences but difficult to detect. Not detected to date within the Project area through on the ground survey of existing and proposed infrastructure.

Scientific name	Common name	EPBC Act status	Preferred habitat / Known or potential habitat within the Project area (where applicable)	Likelihood of occurrence
Elseya albagula	southern snapping turtle	CE	The site is within the DoEE 'species or species habitat may occur' species distribution. Within the river system the white-throated snapping turtle prefers clear, flowing, well-oxygenated waters. White-throated snapping turtles do occur in non-flowing waters, but typically at much reduced densities.	**Unlikely** There are two Wildlife Online records of this species nearby, major watercourses within the Project area are mapped as being within the species' distribution, however suitable habitat does not occur due to the lack of permanent ponds or rivers.
Furina dunmalli	Dunmall's snake	V	Poorly known but most records appear in open forests and woodlands, particularly Brigalow and woodlands growing on cracking black clay and clay loams (Cogger *et al.* 1993). Also recorded from dry eucalypt forests and may occur in vine thickets. Occurs in Land Zones 3, 4, 5, 7, 9 and 10 but insufficiently known to identify most important REs.	**Unlikely** No database records, EPBC search only. Little known species whose habitat requirements and distribution are poorly understood. Species is highly cryptic. Not detected to date within the Project area through on the ground survey of existing and proposed infrastructure.
Rheodytes leukops	Fitzroy River turtle	V	Associated with the Fitzroy River system. Occurs in clear, fast-flowing water.	**Unlikely** One WildNet record in broader region. Not recorded in Project area. Habitat does not occur due to the lack of permanent ponds or rivers.
BIRDS				
Actitis hypoleucos	common sandpiper	M	The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. The common sandpiper has been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow, and may be steep.	**Unlikely** The common sandpiper has not been recorded at the site, the species is considered unlikely to occur due to a lack of suitable habitat.
Apus pacificus	fork-tailed swift	M	An aerial species, may occur over any habitat type, including cleared land and infrastructure.	**Known** Three WildNet records. Known to occur as an occasional visitor to the Project area, however likely to rely only on aerial food resources and not interact with the terrestrial environment.
Calidris acuminata	sharp-tailed sandpiper	M	Coastal and inland areas, preferring non-tidal fresh or brackish wetlands (Geering *et al.* 2007).	**Likely** Most commonly recorded sandpiper in inland wetlands.
Calidris ferruginea	curlew sandpiper	CE	The curlew sandpiper is a wading bird that is typically associated with intertidal mudflats in coastal areas. Additionally, this species utilises	**Unlikely**

Scientific name	Common name	EPBC Act status	Preferred habitat / Known or potential habitat within the Project area (where applicable)	Likelihood of occurrence
			coastal swamps, lakes and lagoons, as well as ponds at saltworks and sewage farms. The curlew sandpiper is less frequently recorded inland where exposed mud or sand abuts ephemeral and permanent water bodies such as lakes, dams and waterholes. The species is a non-breeding migrant in Australia.	Lack of suitable habitat and the site is outside the species' mapped distribution.
Calidris melanotos	pectoral sandpiper	M	The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. The species has also been recorded in swamp overgrown with lignum. They forage in shallow water or soft mud at the edge of wetlands (Higgins & Davies 1996).	**Unlikely** The pectoral sandpiper has not been recorded in the Project area, the species is considered unlikely to occur due to a lack of suitable habitat.
Cuculus optatus	Oriental cuckoo	M	The species is found in forest canopy, open wooded areas and orchards, often in hill country, also in coniferous forest and in birch (Betula) above the tree-line (Payne and Kirwan 2015). It is sometimes found in pure broad-leaved forests, steppe birch copses, riverside willows, and thickets. This species has an extremely large range, breeding from European Russia in the west to Japan and northern Siberia in the East. During winter, birds occur throughout Indonesia, the Philippines, Papua New Guinea and in northern and eastern Australia.	**Unlikely** The Oriental cuckoo has not been recorded within the Project area, the species is considered unlikely to occur due to a lack of suitable habitat.
Gallinago hardwickii	Latham's snipe	M	Swamp and marsh margins and in wet pasture (Pringle 1987).	**Likely** Two WildNet records in the broader region, but not within the Project area. Likely to occur as a visitor to wetlands in the Project area.
Geophaps scripta scripta	squatter pigeon (southern subspecies)	V	Occurs most commonly in grassy woodlands and open forests dominated by eucalypts (DSEWPaC 2012). Other habitats include sown grasslands, scrub and acacia growth (DSEWPaC 2012).	**Unlikely** Species has largely disappeared from local region.
Grantiella picta	painted honeyeater	V	Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. The species is a specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias and prefers mistletoes of the genus *Amyema*.	**Likely** There is one record of the species approximately 3 km from the Project area, suitable habitat may be present.
Hirundapus caudacutus	white-throated needletail	M	An aerial species, may occur over any habitat type, including cleared land and infrastructure.	**Known** Three WildNet records from the broader region and one QGC record from within the Project area. Likely to rely only

Scientific name	Common name	EPBC Act status	Preferred habitat / Known or potential habitat within the Project area (where applicable)	Likelihood of occurrence
				on aerial food resources and not interact with the terrestrial environment.
Motacilla flava	yellow wagtail	M	This species occupies a range of damp or wet habitats with low vegetation, from damp meadows, marshes, waterside pastures, sewage farms and bogs to damp steppe and grassy tundra (BirdLife International 2017). DoE mapping shows that suitable habitat for the yellow wagtail is distributed throughout Australia, with the exception of Far North QLD, southern WA and the majority of Tasmania.	**Unlikely** The Project area is within the species' distribution, however the species is considered unlikely to occur due to a lack of suitable habitat.
Myiagra cyanoleuca	satin flycatcher	M	Eucalypt forest, especially wet sclerophyll. Often in gullies and along watercourses (Higgins *etal.* 2006a).	**Potential** Not recorded in the Project area or close proximity. Potential habitat exists.
Neochmia ruficauda ruficauda	star finch (eastern subspecies)	E	Occurs in grasslands and grassy woodlands close to bodies of fresh water (DSEWPaC 2012). The woodland habitats are most commonly dominated by *Eucalyptus coolabah, E. tereticornis, E. tessellaris, Melaleuca leucadendra, E. camaldulensis* and *Casuarina cunninghamii* (DSEWPaC 2012). The species also occurs in disturbed areas such as along roadsides and in suburban areas (DSEWPaC 2012).	**Unlikely** One WildNet record (pre 1980).
Plegadis falcinellus	glossy ibis	M	Terrestrial wetlands, preferring inland freshwater wetlands with abundant aquatic flora (Pringle 1985; Marchant and Higgins 1990).	**Likely** Two WildNet records from broader area. Likely to occur on any suitable waterbody throughout the Project area.
Rhipidura rufifrons	rufous fantail	M	Moist habitats, including closed forests, coastal scrubs, mangroves and along watercourses and gullies, and urban/rural areas during mid-year migration (Pizzey and Knight 2007; Higgins *et ai.* 2006a). Most likely in REs 11.8.3, 11.9.4a and 11.9.4b.	**Potential** Not recorded in the Project area or close proximity.
Rostratula australis	Australian painted snipe	EV, M	Terrestrial shallow wetlands, ephemeral and permanent, usually freshwater but occasionally brackish. They also use inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains (Marchant and Higgins 1993). Most likely in REs 11.3.2, 11.3.25 and 11.3.27b but could also occur in gilgaied areas.	**Unlikely** No database records, EPBC search only, however likely to occur in association with permanent and ephemeral wetland areas.
Turnix melanogaster	black-breasted button-quail	V	Restricted to rainforests and forests, with preference for drier low closed forests, particularly semi-evergreen vine thicket, low microphyll vine forest, araucarian microphyll vine forest and araucarian notophyll vine forest (DSEWPaC 2012). The species can also be found in dense acacia thickets and vegetation behind sand dunes (DSEWPaC 2012). A dense	**Unlikely** No database records, EPBC search only. Habitat fragments within Project area are small and highly degraded.

Scientific name	Common name	EPBC Act status	Preferred habitat / Known or potential habitat within the Project area (where applicable)	Likelihood of occurrence
			shrub layer and thick litter layer are considered to be important habitat characteristics (DSEWPaC 2012).	
MAMMALS				
Chalinolobus dwyeri	large-eared pied bat	V	Little known, but may depend heavily on sandstone outcrops. It has been found roosting in disused mine shafts, caves, overhangs and disused fairy martin *Petrochelidon ariel* nests (Hoye and Schulz 2008). It also possibly roosts in the hollows of trees (Duncan *et al.* 1999). Possibly occurs in REs on sandstone, such as 11.10.1 and in areas of *Callitris* such as REs 11.3.14 and 11.3.18.	**Unlikely** No database records, EPBC search only. Generally considered unlikely to occur, however a sandstone rise that could harbour this species occurs in the south of the Project area.
Dasyurus hallucatus	northern quoll	E	A range of habitats but prefer rocky areas and eucalypt forests.	**Unlikely** No database records, EPBC search only. Low potential to occur in the southern part of the Project area.
Nyctophilus corbeni (formerly timoriensis)	south-eastern long-eared bat	V	Dry forest habitats including river red gum, open woodland, mallee, Brigalow and other arid and semi-arid habitats. It appears to be more common in box, ironbark and cypress-pine forests on sandy soils in southern Queensland (Churchill 2008; Turbill *et al.* 2008). May occur in all Land Zones, but principally in association with Land Zone 10.	**Potential** No available records within the Project area. Anabat recordings during the field survey show *Nyctophilus* genus present, but species uncertain. Far more likely to be *N geoffroyi*, Project area is within the known distribution and suitable habitat is available.
Petauroides volans	greater glider	V	The greater glider is an arboreal nocturnal marsupial, largely restricted to eucalypt forests and woodlands. It is primarily folivorous, with a diet mostly comprising eucalypt leaves, and occasionally flowers. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. The greater glider favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species.	**Unlikely** There are records of the species within or nearby to the Project area, suitable habitat may be present in the south of the Project area. This species is sensitive to clearing and landscape fragmentation and appears to require areas of remnant vegetation greater than 160km^2 to maintain viable populations (TSSC 2016) However, there are no areas of vegetation considered large enough to support a viable population within the Project area. It is uncertain if the species would persist in the smaller narrow strips of riparian vegetation. Large tracts of vegetation as found within Mt Organ State Forest has been subject to grazing, forestry and timber production removing many habitat trees and degradation of the underlying canopy.

Scientific name	Common name	EPBC Act status	Preferred habitat / Known or potential habitat within the Project area (where applicable)	Likelihood of occurrence
Phascolarctos cinereus	koala	V	Feed almost entirely on eucalypts (Martin *et al.* 2008). In the Project area most likely in REs 11.3.4, 11.3.25, 11.3.27b and 11.4.10 feeding on forest red gum and river red gum.	**Known** There is one WlidNet/Atlas of Living Australia record and one QGC scat record within the Project area.
INVERTEBRATES				
Adclarkia dulacca	Dulacca woodland snail	E	The site is on the edge of the DoEE 'species or species habitat may occur' species distribution. The species inhabits a variety of remnant and scattered habitats, such as vine thicket and *Acacia harpophylla* (Brigalow) woodland patches on rocky outcrops with clay to loam soils as well as Eucalyptus (ironbark) species and *Acacia shirleyi* (lancewood) woodlands on ridges (with and without rock), and *Eucalyptus woollsiana* (gum-topped box) woodland.	**Unlikely** No available records for this species. Know key population is approximately 50 km south. Suitable habitat may potentially be present within the Project area, but suitability is uncertain due to edge effects.
*CE = Critically Endangered, E = Endangered, V = Vulnerable, M = Migratory				

ATTACHMENT D. *AQUATIC ECOLOGY ASSESSMENT*

ATTACHMENT E. *EPBC ACT ASSESSMENT OF IMPACT SIGNIFICANCE ON NATIONALLY THREATENED ECOLOGICAL COMMUNITIES WITHIN THE PROJECT AREA*

The following Threatened Ecological Communities are currently recognised as known or potentially within the Project area:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) (Endangered under the EPBC Act).
- Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions (Endangered under the EPBC Act); and
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (Endangered under the EPBC Act).

TABLE E-1 BRIGALOW (*ACACIA HARPOPHYLLA* DOMINANT AND CO-DOMINANT)

Criteria	Assessment of impact significance
An action is likely to have a significant impact on an endangered ecological community if there is a real chance or possibility that it will:	**Description** Brigalow is the commonly accepted name for the species *Acacia harpophylla* and the vegetation in which this species is dominant or co-dominant. Brigalow is either dominant in the tree layer or co-dominant with other species such as Belah *Casuarina cristata*, other species of *Acacia,* or *Eucalyptus* species (Butler, 2007). The structure of the community ranges from open forest to open woodland with a tree layer between about 9 m in low rainfall areas to 25 m in higher rainfall areas (Butler, 2007). A prominent shrub layer is usually present often comprising vine thicket species such as *Geijera parviflora, Pittosporum angustifolium, Melaleuca bracteata, Alectryon oleofolious* subsp*. elongatus, Alectryon diversifolius, Elaeodendron australe* var*. integrifolium, Ehretia membranifolium* as well as the weed *Optuntia stricta.* Ground cover percentage is variable with typical species being *Paspalidium caespitosum, Ancistrachne uncinulata, Aristida* spp., *Enychleana tomentosa, Rhagodia spinescens, Einadia hastata,* and *Solanum parvifolium,* although *Harrisia martini** and *Bryophyllum delagoense** may be typically abundant. The Brigalow ecological community occurs roughly within the 500-750 mm annual rainfall belt with a predominance of summer rainfall (Butler, 2007). Community condition is impacted by edge effects created by massive fragmentation with invasion of declared weed species such as *Opuntia stricta* and *O. tomentosa** and *Harrisia martini** together with canopy gaps, caused by canopy dieback and senescence in the absence of recruitment (TSSC 2001a). **Distribution** The ecological community extends from south of Charters Towers in Queensland, in a broad swathe east of Blackall, Charleville and Cunnamulla, south to northern New South Wales near Narrabri and Bourke. In Queensland, it occurs predominantly within the Brigalow Belt North, Brigalow Belt South, Darling Riverine Plains and Southeast Queensland bioregions, with smaller amounts in the Mitchell Grass Downs, Mulga Lands and Einasleigh Uplands bioregions (Butler, 2007). In Queensland, a number of regional ecosystems (REs) are considered to form the Brigalow ecological community. **Community Assessment Approach** A desktop study summarised current terrestrial ecological values within the Project area to inform subsequent ground surveys and impact assessment. Data relevant to the distribution and ecology of Brigalow ecosystems was sourced through a number of

Criteria	Assessment of impact significance
	relevant and publicly available data sources and relevant literature and online sources. This was utilised in conjunction with a review of available aerial imagery and a field survey within the Project area, with a subsequent revision of certified RE mapping produced by the Queensland Department of Environment and Resource Management (DERM) to increase the resolution of available vegetation mapping and add confidence to the assessment of likely impacts to the Brigalow Ecological Community. **Community Assessment Results** Within the Project area this community is largely restricted to areas mapped as Regional Ecosystems (REs) 11.3.1, 11.5.16, 11.9.5 and 11.9.6, with some areas of RE 11.9.10 also meeting the criteria. The mapped occurrence of this community covers an area of approximately 1067 ha within the Project area. During the 2012 ground surveys, the numerous small isolated patches of the above found scattered throughout the Project area were generally in poor to very poor condition, with the ground story devoid of native species and much disturbance due to grazing. However, some of the larger patches and those adjoining other remnant vegetation were in good condition.
Reduce the extent of an ecological community.	Given its Endangered status under Commonwealth legislation, any reduction in the extent of this ecological community is a significant impact that cannot be reduced to acceptable levels through the mitigation of impacts on retained patches. Through implementation of QGC's Constraints Planning and Field Development Protocol, the proponent proposes to avoid disturbance to all Threatened Ecological Communities as a highest priority. However, some impacts to the TEC are considered likely. To avoid unintentional clearing of retained patches, clearance will be strictly controlled, with no-go areas identified within the Project area and managed through a GIS system. The Project workforce will also be educated on the location of significant/sensitive communities and potential impacts from unauthorised activities.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines.	Much of the Brigalow community in the study area is already heavily disturbed and fragmented and further, ongoing degradation through secondary impacts and fragmentation associated with the Project may result in significant, long term impacts on this ecological community. Through implementation of QGC's Constraints Planning and Field Development Protocol, the proponent proposes to avoid disturbance to all Threatened Ecological Communities as a highest priority. Through implementation of this approach the potential for increasing fragmentation can be minimised. However, some impacts to the TEC are considered likely.
Adversely affect habitat critical to the survival of an ecological community.	The Project area supports 1067 ha likely to represent the TEC. Much of the Brigalow community in the Project area has been heavily fragmented and many patches are small and/or have been invaded by pasture grasses, despite the disturbed nature, it remains an important habitat for threatened fauna. Under the Approved Conservation Advice for this TEC, all areas of Brigalow within the Project area are considered habitat critical to survival and will be avoided through implementation of QGC's Constraints Planning and Field Development Protocol as a highest priority.
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.	Impacts to surface water hydrology and water quality have been assessed as not significant for the Project. It is considered unlikely the activities to be undertaken will modify the abiotic features to the extent it would impact this community.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a	The Project is not expected to cause a substantial change in species composition of the ecological community as no burning or flora or fauna harvesting will be conducted. On site fire management practices will be implemented in accordance with relevant construction permits and method statements to prevent and manage unintentional burning.

Criteria	Assessment of impact significance
decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting.	
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: – Assisting invasive species, that are harmful to the listed 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.	The Project will not use fertilisers nor chemicals or pollutants that may come into contact with the TEC. The TEC is threatened by the incursion of invasive grasses and in the absence of mitigation measures, the Project may assist the establishment and spread of invasive species and reduce the quality of the TEC. However, pest species will be managed through a Biosecurity Manual.
Interfere with the recovery of an ecological community.	Given its Endangered status under Commonwealth legislation, any reduction in the extent of this ecological community can be considered to interfere with its recovery. Through implementation of QGC's Constraints Planning and Field Development Protocol, the proponent proposes to avoid disturbance to all Threatened Ecological Communities as a highest priority. However, some impacts are considered likely. To avoid unintentional clearing of retained patches, clearance will be strictly controlled, with go/no-go areas identified within the Project area and managed through a GIS system. The Project workforce will also be educated on the location of significant/sensitive communities and potential impacts from unauthorised activities.
Assessment conclusion	Any reduction in the extent of this ecological community has potential to be considered a significant impact in accordance with the guidelines. The estimated disturbance for the TEC is 8.8 ha and as such there is potential for a significant impact to this MNES. It should be noted however that this estimate represents an upper limit of disturbance as through implementation of QGC's Constraints Planning and Field Development Protocol further opportunities for avoidance will be available.

TABLE E-2: COOLIBAH - BLACK BOX WOODLANDS OF THE DARLING RIVERINE PLAINS AND THE BRIGALOW BELT SOUTH BIOREGIONS

Criteria	Assessment of impact significance
An action is likely to have a significant impact on an endangered ecological community if there is a real chance or possibility that it will:	An open woodland community dominated by Coolibah (*Eucalyptus coolabah)* and/or Black Box (*Eucalyptus largiflorens)*. It typically contains an understorey dominated by native grasses, with a sparse or absent shrub layer (TSSC 2011). The community occurs roughly within the 250-700 mm annual rainfall belt with a predominance of summer rainfall (TSSC 2011). Community condition is impacted by edge effects created by fragmentation with invasion of exotic shrubs and grasses, changed watercourse hydrology leading to canopy dieback and senescence in the absence of recruitment. Nevertheless, hollows of stag trees are particularly valuable habitat for fauna. The ecological community is restricted to the Brigalow Belt South and Darling Riverine Plains Bioregions (Butler, 2007). In Queensland, RE 11.3.3 corresponds with this ecological community. In the study area, some patches of RE 11.3.27 were also identified as meeting the criteria for this community. **Community Assessment Approach** A desktop study summarised current terrestrial ecological values within the study area to inform subsequent ground surveys and impact assessment. Data relevant to the distribution and ecology of this community was sourced through a number of relevant and publicly available data sources and relevant literature and online sources. This was utilised in conjunction with a review of available aerial imagery and a field survey within the study area, with a subsequent revision of certified RE mapping produced by the Queensland Department of Environment and Science (DES) to increase the resolution of available vegetation mapping and add confidence to the assessment of likely impacts to the Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions Community. **Community Assessment Results** Within the Project area this community is largely restricted to areas mapped as Regional Ecosystem (RE) 11.3.3, with some areas of RE 11.3.27 also meeting the criteria. The mapped occurrence of this community covers an area of approximately 644 ha within the study area. During the 2012 ground surveys, the instances of this community found along the major watercourses in the study area were generally in moderate to poor condition, with some areas in particular showing little signs of recruitment due to grazing. However, some of the larger patches and those adjoining other remnant vegetation were in reasonable condition. Threatened Species Scientific Committee (TSSC) Listing Advice sets condition thresholds and key diagnostic characteristics for this woodland community. The Listing Advice focuses on those remaining patches of the ecological community that are functional, relatively natural and in relatively good condition. Therefore, patches of this ecological community that do not meet these condition thresholds and key diagnostic characteristics are excluded from the national ecological community listing under the EPBC Act.
Reduce the extent of an ecological community.	Given its Endangered status under Commonwealth legislation, any reduction in the extent of this ecological community is a significant impact that cannot be reduced to acceptable levels through the mitigation of impacts on retained patches. Through implementation of QGC's Constraints Planning and Field Development Protocol, the proponent proposes to avoid any disturbance to this TEC. This is considered possible due to the limited occurrence of the TEC in the Project region. To avoid unintentional clearing of retained patches, clearance will be strictly controlled, with no-go areas identified on site and managed through a GIS system. The Project workforce will also be educated on the location of significant/sensitive communities and potential impacts from unauthorised activities.
Fragment or increase fragmentation of an ecological community, for example by	This TEC will be avoided.

Criteria	Assessment of impact significance
clearing vegetation for roads or transmission lines.	
Adversely affect habitat critical to the survival of an ecological community.	No habitat is specifically listed as critical to survival of this TEC, however priority actions outlined in the Conservation Advice includes ensuring that any further minerals and energy extraction and exploration activities minimises any direct impacts to the ecological community or indirect effects on its ecological function. The TEC will be avoided through implementation of QGC's Constraints Planning and Field Development Protocol as a highest priority.
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.	Impacts to surface water hydrology and water quality have been assessed as not significant for the Project. It is considered unlikely the activities to be undertaken will modify the abiotic features to the extent it would impact this community.
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.	The Project is not expected to cause a substantial change in species composition of the ecological community as no burning or flora or fauna harvesting will be conducted. On site fire management practices will be implemented in accordance with relevant construction permits and method statements to prevent and manage unintentional burning.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: – Assisting invasive species, that are harmful to the listed 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.	The Project will not use fertilisers nor chemicals or pollutants that may come into contact with the TEC. The TEC is threatened by invasive species, particularly Lippia (*Phyla canescens*) and African boxthorn (*Lycium ferocissimum*). In the absence of mitigation measures, the Project may assist the establishment and spread of invasive species and reduce the quality of the TEC. However, pest species will be managed through a Biosecurity Manual.
Interfere with the recovery of an ecological community.	Given its Endangered status under Commonwealth legislation, any reduction in the extent of this ecological community can be considered to interfere with its recovery. Through implementation of QGC's Constraints Planning and Field Development Protocol, the Project proposes to avoid disturbance to this Threatened Ecological Communities as a highest priority. To avoid unintentional clearing of retained patches, clearance will be strictly controlled, with go/no-go areas identified on site and managed through a GIS system. The Project workforce will also be educated on the location of significant/sensitive communities and potential impacts from unauthorised activities.

Criteria	Assessment of impact significance
Assessment conclusion	Any reduction in the extent of this ecological community has potential to be considered a significant impact in accordance with the guidelines. The estimated disturbance for the TEC is <1 ha and as such there is potential for a significant impact to this MNES. However, given the predicted impact is so small, QGC proposes to avoid clearing this TEC, and therefore not have a significant impact to this MNES.

TABLE E-3: SEMI-EVERGREEN VINE THICKETS OF THE BRIGALOW BELT (NORTH AND SOUTH) AND NANDEWAR BIOREGIONS (ENDANGERED UNDER THE EPBC ACT)

Criteria	Assessment of impact significance
An action is likely to have a significant impact on an endangered ecological community if there is a real chance or possibility that it will:	**Description** This community occurs on fine-grained sedimentary rocks, on hillsides or undulating terrain. It was once widespread, but has been reduced significantly in extent due to agricultural and grazing practices (TSSC 2001b). The community occurs roughly within the 650-750 mm annual rainfall belt with a predominance of summer rainfall (TSSC 2001b). These softwood scrub communities are sheltered and fragile, with a moderate-high diversity where remnants are good quality. Broad-leaved Bottle Tree *Brachychiton rupestris* typically occurs as an emergent, along with Belah *Casuarina cristata*. Common shrubs include Red Ash *Alphitonia excelsa*, Currant Bush *Carissa ovata*, Bitter Bark *Alstonia constricta*, *Alectryon* spp. and *Croton* spp. (TSSC 2001b). Condition is strongly influenced by grazing regimes, fire, management and edge effects leading to fragmentation and invasion of exotic shrubs and grasses. **Distribution** The ecological community occurs along the drier coast and inland subcoastal belt from near Townsville in north Queensland south to the Western Slopes and Plains of northern New South Wales. In Queensland, REs 11.3.11, 11.4.1, 11.5.15, 11.8.13, 11.9.4, 11.11.18, 11.2.3, 11.8.3, 11.8.6 and 11.9.8 correspond with this ecological community. **Community Assessment Approach** A desktop study summarised current terrestrial ecological values within the Project area to inform subsequent ground surveys and impact assessment. Data relevant to the distribution and ecology of this community was sourced through a number of relevant and publicly available data sources and relevant literature and online sources. This was utilised in conjunction with a review of available aerial imagery and a field survey within the Project area, with a subsequent revision of certified RE mapping produced by the Queensland Department of Environment and Resource Management (DERM) to increase the resolution of available vegetation mapping and add confidence to the assessment of likely impacts to the listed semi-evergreen vine thicket community. **Community Assessment Results** This ecological community is analogous to areas mapped as RE 11.9.4 within the Project area. The mapped occurrence of this community covers an area of approximately 69 ha within the Project area. During the 2012 ground surveys, the small remnants of this community found in the Project area were generally in poor condition, with some areas being marginal for listing categorisation due to encroachment of grazing and exotic plants. Larger patches mapped within Mount Organ State Forest were not visited during the survey due to access constraints. These areas are likely to be in better condition than those visited during the survey.

Criteria	Assessment of impact significance
Reduce the extent of an ecological community.	Given its Endangered status under Commonwealth legislation, any reduction in the extent of this ecological community is a significant impact that cannot be reduced to acceptable levels through the mitigation of impacts on retained patches. Through implementation of QGC's Constraints Planning and Field Development Protocol, the proponent proposes to avoid disturbance to this Threatened Ecological Communities as a highest priority. To avoid unintentional clearing of retained patches, clearance will be strictly controlled, with no-go areas identified within the Project area and managed through a GIS system. The Project workforce will also be educated on the location of significant/sensitive communities and potential impacts from unauthorised activities.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines.	This TEC will be avoided.
Adversely affect habitat critical to the survival of an ecological community.	No habitat is specifically listed as critical to survival of this TEC, however priority actions outlined in the Conservation Advice includes ensuring that any further minerals and energy extraction and exploration activities minimises any direct impacts to the ecological community or indirect effects on its ecological function. The TEC will be avoided through implementation of QGC's Constraints Planning and Field Development Protocol.
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.	Impacts to surface water hydrology and water quality have been assessed as not significant for the Project. It is considered unlikely the activities to be undertaken will modify the abiotic features to the extent it would impact this community.
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.	The Project is not expected to cause a substantial change in species composition of the ecological community as no burning or flora or fauna harvesting will be conducted. On site fire management practices will be implemented in accordance with relevant construction permits and method statements to prevent and manage unintentional burning.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: – Assisting invasive species, that are harmful to the listed ecological community, to become established; or	The Project will not use fertilisers nor chemicals or pollutants that may come into contact with the TEC. The TEC is threatened by invasive species, particularly those that facilitate the incursion of fire, including buffel grass, green panic and parthenium as well as other common introduced flora. The impact of introduced fauna is unclear, however it is hypothesised that pigs may pose a threat. The Project may assist the establishment and spread of invasive species and reduce the quality of the TEC. However, pest species will be managed through the Biosecurity Manual.

Criteria	Assessment of impact significance
– 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.	
Interfere with the recovery of an ecological community.	Given its Endangered status under Commonwealth legislation, any reduction in the extent of this ecological community can be considered to interfere with its recovery. Impacts to the TEC will be avoided as a priority though implementation of QGC's Constraints Planning and Field Development Protocol. The National Recovery Plan for SEVT states five specific objectives, Objective 3 involves ensuring "best practice" management including implementation of pest management plans, fire management plans and maintaining integrity and connectivity. Implementation of QGC's Constraints Planning and Field Development Protocol will assist in maintaining integrity and current connectivity, a Biosecurity Manual will be implemented to control invasive species and overall TEC management, including measures for prevention and management of fire are outlined in the QGC Species Specific Management Plan for the Project area.
Assessment conclusion	Any reduction in the extent of this ecological community has potential to be considered a significant impact in accordance with the guidelines. The estimated disturbance for the TEC is <1 ha and as such there is potential for a significant impact to this MNES. However, given the predicted impact is so small, QGC proposes to avoid clearing this TEC, and therefore not have a significant impact to this MNES.

EPBC ACT ASSESSMENT OF IMPACT SIGNIFICANCE ON NATIONALLY VULNERABLE SPECIES IN THE PROJECT AREA

Based on the assessment of existing terrestrial ecological values, the following terrestrial species listed as Vulnerable under the EPBC Act are currently recognised as known or potential to occur within the Project area:

- Belson's Panic *Homopholis belsonii*;
- Koala *Phascolarctos cinereus*; and
- South-eastern (greater) long-eared bat *Nyctophilus corbeni* (formerly *timoriensis*).

Potentially significant impacts were identified for the Koala (*Phascolarctos cinereus*).

TABLE E-4: BELSON'S PANIC GRASS (*HOMOPHOLIS BELSONII*)

Criteria	Assessment of impact significance
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Tufted grass to 40cm tall with sparsely branched lateral branches stems and silky membranous ligules to 1.5mm long. Leaves are flat and smooth to 15cm long and 4.5mm wide. Inflorescences are compound, open, stiff panicles to 25cm long and 0.35cm wide with solitary, 2-flowered, lanceolate and dorsally compressed spikelets to 6.1mm long (Sharp and Simon 2002). Restricted to the Darling Downs region in southern Queensland to north-west slopes of northern New South Wales, this species is found in White Box *Eucalyptus albens* communities and Wilga *Geijera parviflor*a woodlands on rocky hills; Belah *Casuarina cristata* forests in alluvial soils on flat to undulating lands; Poplar Box *E. populnea* woodlands; and dry woodlands on poor soils derived from basalt at 200-520 m altitude. Belson's Panic Grass has also been recorded in Brigalow *Acacia harpophylla*, Myall *A. melvillei* and Weeping Myall *A. pendula* communities; Mountain Coolibah *E. orgadophila* communities; and on roadsides and is under threat from the clearing of native habitat for cropping and pastures, heavy grazing and trampling by domestic stock, physical disturbance by machinery, urban expansion and weed invasion (DSEWPaC 2011; Sharp and Simon 2002). **Species Assessment** Data relevant to the habitat, distribution and ecology of the species was sourced through relevant literature and online sources and a number of relevant and publicly available data sources including the Queensland Herbarium Herbrecs database, EPBC online search tool and DERM's Wildnet database. This information, together with a review of aerial photography and existing vegetation mapping by DES assisted in the prioritisation of sites for a field survey throughout the Project area during March-April 2012. Determination of significant species occurrence, including *Homopholis belsonii*, involved meander searches within each potential habitat type represented within the Project area, along with general assessment of habitat features that could potentially support this species. This species was recorded at a single location during the field survey. There have been no additional records of this species from ongoing QGC surveys.

Criteria	Assessment of impact significance
Lead to a long-term decrease in the size of an important population of a species.	A single individual of the species was recorded during the BAAM field survey. The Project area represents the northern limit of the species' range and any population discovered would therefore meet the criteria of an 'important population'. However, as there has only been one record to date it is expected that only a very small population occurs within the Project area, and only within the southern blocks. Belson's Panic Grass will be avoided using the QGC Constraints Planning and Field Development Protocol.
Reduce the area of occupancy of an important population.	The Project area represents the northern limit of the species' range and any population discovered would therefore meet the criteria of an 'important population'. Belson's Panic Grass will be avoided through the QGC Constraints Planning and Field Development Protocol
Fragment an existing important population into two or more populations.	Given that a single individual was detected during field surveys, any population is unlikely to be of a sufficient size for fragmentation to occur, and any individuals identified will be avoided.
Adversely affect habitat critical to the survival of a species.	There are no specific definitions of habitat critical to the survival of Belson's Panic Grass and no indication that the Project area supports such habitat. It is noted that the distribution of the species overlaps with the TEC Brigalow (*Acacia harpophylla* dominant and co-dominant) which occurs in the Project area and will be avoided wherever possible in accordance with the QGC Constraints Planning and Field Development Protocol. Consequently, no adverse effects to habitat critical to the survival of Belson's Panic Grass are anticipated.
Disrupt the breeding cycle of an important population.	Flowering occurs February – May and possibly November – December with fruiting in February. Seed dispersal is wind driven and the panicle (cluster of flowers/ seeds) will roll forward until an obstacle is encountered. It is expected that the Project will not cause disruption to any possible local population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The availability and quality of habitat will be maintained through implementation of appropriate techniques for the control of weeds, fire, chemical contaminants, waste and erosion and sedimentation through the implementation of the Project Environmental Management Plan and Biosecurity Manual. Habitat is therefore unlikely to be modified, destroyed, removed, isolated or decreased to an extent that the species is likely to decline.
Result in *invasive* species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	It is not likely that invasive species listed as a threat to Belson's Panic Grass, including several weed species will become established in the Project area as a result of the proposed development, particularly following implementation of QGC's Biosecurity Manual. It is noted that other chemicals and mechanisms used to control weeds may have a negative impact upon the species and will be incorporated into management plans accordingly.
Introduce disease that may cause the species to decline.	No diseases are listed as relevant to Belson's Panic Grass, however introduction of disease will be prevented and managed through QGC's Biosecurity Manual. Disease is therefore unlikely to cause the species' decline within the Project area.
Interfere with the recovery of the species.	There are no adopted or made recovery plans for this species. Threat abatement and recovery actions are included in the Conservation Advice for Belson's Panic Grass and QGC's Species Specific Management Plan for the Project area. The proposed development is unlikely to interfere substantially with the recovery of the species, subject to successful implementation of QGC's Constraints Planning and Field Development Protocol, Species Specific Management Plan and measures included in the Biosecurity Manual.

Criteria	Assessment of impact significance
Assessment conclusion	Belson's Panic Grass will be avoided and implementation of management strategies will ensure that there will be no impacts from the proposed development.

Koala (*Phascolarctos cinereus*)

The EPBC Act referral guidelines for the vulnerable koala state that decisions as to whether an action is likely to have a significant impact on the koala typically come down to two key considerations:

- Adversely affecting habitat critical to the survival of the koala; and/or
- Interfering substantially with the recovery of the koala through the introduction or exacerbation of key threats in areas of habitat critical to the survival of the koala.

Habitat Critical to the Survival of the Koala

The EPBC Act referral guidelines for the koala define habitat as 'critical to the survival of the koala' if it receives a score of five or more using the koala habitat assessment tool. Habitat within the Proposed Development Area received a score of **eight (8)** based on the guidance provided in the habitat assessment tool and is therefore considered habitat critical to the survival of the koala.

The development will remove approximately 62 ha of potential habitat critical to the survival of the koala. Based on the referral guidelines, the loss of 20 hectares or more of habitat with a score of ≥ 8 is likely to have a significant impact on koalas. Therefore, the propose development is likely to have a significant residual impact on the Koala.

TABLE E-5 KOALA HABITAT ASSESSMENT

Attribute	Description	Score
Koala Occurrence	There is one database record within the Project area dated 1987 and one approximately 7km east dated 1995. QGC surveys identified one Koala scat from Charlie block in 2015, however, there have been no direct sightings. A score of 2 has therefore been conservatively applied.	2
Vegetation Composition	The Project area has forest, woodland or shrubland with emerging trees with 2 or more known koala food tree species.	2
Habitat Connectivity	The area has been heavily cleared and fragmented. Koala habitat in the Project area is not contiguous and consists of several small patches. The only exception is Mount Organ State Forest, which is >1000 ha.	2
Key Existing Threats	There is no evidence of koala mortality from vehicle strike or dog attack. However, this could be due to the apparent low density of koalas in the area. Dogs were observed in Mt Organ State Forest in the south of the Project area during the field survey and there are two records of dogs within the Project area. Given these factors and the size of the Project area, it is possible that koala mortality has occurred as a result of these threats at some point.	1
Recovery Value	• Protect and conserve the quality and extent of habitat refuges for the persistence of the species during droughts and periods of extreme heat, especially in riparian environments and other areas with reliable soil moisture and fertility. • Maintain the quality, extent and connectivity of large areas of koala habitat surrounding habitat refuges.	1
		Total Habitat Score = 8

Recovery of the Koala

The EPBC Act referral guideline for the 'vulnerable' koala provides examples of impacts which are likely to substantially interfere with the recovery of the koala (refer to Table C.4).

The proposed works are considered unlikely to substantially interfere with the recovery of the koala because:

- The Constraints Planning and Field Development Protocol, which aids site selection will be implemented to minimise environmental disturbance of habitat critical to the survival of the koala in the first instance wherever practicable;
- Koalas are likely present in the locality in low densities and no koalas were observed during field surveys;
- The development will not substantially increase the risk of dog attack to the koala; and
- The risk of vehicle strike is considered low, due to low traffic volumes, predominately daylight hour travel and restricted speeds during construction on access tracks.

TABLE E-6: ASSESSMENT OF IMPACTS TO RECOVERY OF THE KOALA

Criteria	Discussion	Criteria triggered?
Impacts which are likely to substantially interfere with the recovery of the koala may include one or more of the following:		
Increasing koala fatalities in habitat critical to the survival of the koala due to dog attacks to a level that is likely to result in multiple, ongoing mortalities.	Dogs are known to occur in the Project area and wild dogs are known to use tracks to move through woodland environments. The development utilises existing infrastructure wherever possible but will involve the establishment of some additional access tracks and pipelines. The development will aim to avoid habitat critical to the koala through implementation of the Constraints Planning and Field Development Protocol. The increased risk to koalas from access of wild dogs to these tracks is unlikely to be of a level that would result in multiple, ongoing mortalities.	No
Increasing koala fatalities in habitat critical to the survival of the koala due to vehicle-strikes to a level that is likely to result in multiple, ongoing mortalities.	Access tracks created for the Project will not support high volumes of traffic, and speed restrictions will apply. The works undertaken are unlikely to increase koala fatalities due to vehicle strike to a level that would result in multiple, ongoing mortalities.	No
Facilitating the introduction or spread of disease or pathogens for example Chlamydia or *Phytophthora cinnamomi*, to habitat critical to the survival of the koala, that are likely to significantly reduce the reproductive output of koalas or reduce the carrying capacity of the habitat.	It is unlikely that contact with koalas would be required during the operational period and would not result in any additional stress being placed on any resident koalas. It is therefore unlikely that the development would lead to the spread of diseases or pathogens relevant to the koala.	No
Creating a barrier to movement to, between or within habitat critical to the survival of the koala that is likely to result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the koala.	The koala referral guidelines state that artificial barriers may include infrastructure (such as roads, rail, mines, large fences etc.) without effective koala passage measures, or developments that create treeless areas more than 2 km wide. The development will not create a treeless area more than 2 km wide, and due to the low levels of vehicle traffic during operation of the tracks, the tracks are not considered to create a barrier to movement to the koala.	No
Changing hydrology which degrades habitat critical to the survival of the koala to the extent that the carrying capacity of the habitat is reduced in the long-term.	The Constraints Planning and Field Development Protocol which aids site selection and reduces environmental disturbance through avoiding impacts in the first instance wherever feasible. In some places there may be no practical alternative for some linear infrastructure in which case impacts will be minimised and proposed activities are not considered to have a significant impact on hydrology.	No

TABLE E-7: SOUTH-EASTERN LONG-EARED BAT (*NYCTOPHILUS CORBENI*)

Criteria	Assessment of significance
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	This species was formerly considered to be *Nyctophilus timoriensis* which is no longer considered to occur in Australia. It has since been described as *N. corbeni* (Parnaby 2009). This species occurs in a variety of dry forest habitats including river red gum *Eucalyptus camaldulensis*, open woodland, mallee, Brigalow *Acacia harpophylla* and other arid and semi-arid habitats. It appears to be more common in box, ironbark and *Callitris* forests on sandy soils on the western slopes of New South Wales and southern Queensland (Churchill 2008; Turbill *et al.* 2008). It roosts in tree hollows or under bark (NPWS 2003). It is a little known species that is rarely caught (Churchill 2008) and resolution of Anabat call recordings to species level is not currently possible for the genus *Nyctophilus*. **Species Assessment** Data relevant to the habitat, distribution and ecology of the species was sourced through relevant literature and online sources and a number of relevant and publicly available data sources including the Queensland Museum's fauna database, EPBC online search tool and DES's Wildnet database. This information, together with a review of aerial photography and existing vegetation mapping by DES assisted in the prioritisation of sites for a field survey throughout the Project area during March-April 2012. Determination of the occurrence of *Nyctophilus corbeni* involved an Anabat detection program (for presence of *Nyctophilus* spp. in general) and checking under bark in suitable habitats, along with general assessment of habitat features that could potentially support this species. There is one QM record outside of the Project area and *Nyctophilus* sp. was recorded from four locations during the Anabat survey. While each of the Anabat records is likely to represent *N. geoffroyi*, a more common species, the possibility that one or more of these records represents *N. corbeni* is not able to be discounted. The species is considered to be potential to occur, however, due to the degraded nature of the Project area only relatively small areas of suitable habitat are likely to be present.
Lead to a long-term decrease in the size of an important population of a species. Reduce the area of occupancy of an important population. Fragment an existing important population into two or more populations.	There is no information currently available regarding important populations of this species and there are no known records from the Project area. While the species may be present in the Project area, the habitat present is not considered to be extensive or of high quality and it is unlikely to support a large and significant population. Habitat in surrounding areas such as Belington hut and Barakula state forests are far more likely to support large, significant and viable populations. The Project area has already been significantly degraded and fragmented with no large areas of remnant vegetation remaining. While Mount Organ is the largest patch in the Project area it is small when compared to the extensive areas associated with National Parks and other state forests in the region. Therefore, the proposed activities are considered unlikely to lead to a long-term decrease in the size, area of occupancy or fragmentation of an important population.
Adversely affect habitat critical to the survival of a species	The availability of suitable roosting habitats is essential for the conservation of the species. The species is known to use a wide range of vegetation types, including vegetation with dense shrub layers and brigalow patches. The Project area is not considered to contain habitat critical to the survival of the species and is not expected to support significant populations. While indicative habitat will be impacted as part of

Criteria	Assessment of significance
	the development, suitable tree hollows will be identified during pre-clearance surveys and avoided wherever possible. Habitat critical to survival is therefore not expected to be affected, subject to avoidance measures.
Disrupt the breeding cycle of an important population.	As outlined above, the Project area is not expected to support an important population of the species. There is little information regarding the species' reproductive biology, however breeding is likely to be seasonal with pregnant and lactating females previously captured in November.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Suitable habitat and microhabitat features will be avoided as far as possible through QGC's Constraints Planning and Field Development Protocol. The Project will not entail broad scale clearing. Construction activities will utilise appropriate techniques for dust suppression and the control of weeds, fire, chemical contaminants, waste and erosion and sedimentation through the implementation of the Project Environmental Management Plan. Any habitat remaining for the species is likely to be of low quality and is not considered critical to supporting the species. Project activities are not expected to further decline the quality of the habitat.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	Information regarding the impact of invasive species is lacking, however no invasive species are expected to become established within the Project area, subject to the effective implementation of measures outlined in QGC's Biosecurity Manual.
Introduce disease that may cause the species to decline.	No diseases are listed as having potential to cause the species' decline, however disease will be controlled through implementation of QGC's Biosecurity Manual.
Interfere substantially with the recovery of the species.	There are no adopted or made recovery plans for this species. Conservation actions outlined in the Conservation Advice document that are directly applicable to the proposed development include protection of hollow bearing trees, control of invasive species and management of fire. If the species is not located during detailed pre-clearance surveys or if direct or indirect impacts to recorded specimens can be avoided, the proposed development is not expected to interfere substantially with the recovery of the species, subject to the successful implementation of appropriate development controls in relation to retained habitat.
Assessment conclusion	The residual impact to the species is assessed as 'insignificant', subject to the successful implementation of appropriate development controls in relation to retained habitat.

EPBC ACT ASSESSMENT OF IMPACT SIGNIFICANCE ON LISTED MIGRATORY SPECIES IN THE PROJECT AREA

Based on the assessment of existing terrestrial ecological values documented in the main report, the following terrestrial species listed as Migratory under the EPBC Act are currently recognised as known, likely or potential to occur within the Project area:

- Fork-tailed swift *Apus pacificus*;
- Sharp-tailed sandpiper *Calidris acuminata*;
- Latham's snipe *Gallinago hardwickii*;
- White-throated needletail *Hirundapus caudacutus*;
- Glossy ibis *Plegadis falcinellus*;
- Satin flycatcher *Myiagra cyanoleuca*; and
- Rufous fantail *Rhipidura rufifrons*.

White-throated needletail and fork-tailed swift have been recorded within the Project area and/or are predicted to occur on an annual basis. Both are aerial species for which the Project area does not represent 'important habitat' and no impacts are expected due to the proposed action as these species forage over a wide variety of land use, including human infrastructure and large waterbodies. As such, these species have not been assessed for significance of impact in the table below.

Latham's Snipe and the sharp-tailed sandpiper are listed under the EPBC Act Policy Statement 3.21 Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (2017), and have been assessed against the requirements accordingly. The remaining migratory species have been assessed under the Matters of National Environmental Significance Significant Impact Guidelines 1.1 for listed migratory species.

TABLE E-8: ASSESSMENT OF IMPACT SIGNIFICANCE ON LISTED MIGRATORY SPECIES IN THE PROJECT AREA

Criteria	Assessment of significance
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:	
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate	The Project area contains approximately 233 hectares of seasonal wetland habitat, a substantial portion of which may be considered as 'potential habitat' for migratory species. Given their migratory habits, the ephemeral nature of food and habitat resources, and the extent of habitat across their range, it is likely that the existing resources within the Project area would be utilised by most of the species listed here, as discussed hereunder.

Criteria	Assessment of significance
an area of *important habitat* for a migratory species.	Most of the species recorded for the Project area are strongly associated with waterbodies. Natural waterbodies are a significant, though seasonally dynamic, component of the Project area. Some of these species may also occur on the artificial waterbodies present or, in some cases, in temporary waterbodies, including flooded paddocks, created by heavy rain events. Through implementation of QGC's Constraints Planning and Field Development Protocol, the proponent proposes to avoid disturbance to wetlands as a high priority developmental control. In cases where disturbance is unavoidable, detailed pre-clearance surveys will be undertaken to determine whether any migratory species occur within the vicinity of the proposed disturbance. Those wetland species for which specific potential impacts need to be considered are discussed individually, along with those migratory species that do not inhabit wetland areas. • **Sharp-tailed Sandpiper** This species is an occasional visitor to the region. They occur on a variety of wetlands, including freshwater wetlands (Geering *et al*. 2007) and in flooded paddocks (Higgins and Davies 1996). Pasture subject to inundation is likely to be modified by the Project and may be utilised by the species, however, the Project area is not considered to be important habitat for this species under the EPBC Act industry guidelines for shorebirds. • **Latham's Snipe** This species prefers substantial cover and is likely to occur annually in the Project area provided that the wetlands contain water and vegetation cover. The Australian Painted Snipe occurs in terrestrial shallow wetlands, both ephemeral and permanent, usually freshwater but occasionally brackish. They also use inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains (Marchant and Higgins 1993). Latham's Snipe occurs in swamp and marsh margins and in wet pasture (Pringle 1987). Pasture subject to inundation is likely to be modified by the Project and may be utilised by the species, which generally occupy flooded meadows in addition to other habitats. 'Important habitat' is specifically defined for this species under the EPBC Act industry guidelines for shorebirds and includes habitats previously identified as internationally important for the species, or areas that support at least 18 individuals. The Project area has not been considered an internationally important site, however there are records of the species in the region and the use of the Project area by more than 18 individuals cannot be discounted. The Project area may therefore conservatively be considered an important habitat for Latham's Snipe. Substantial modification to relevant habitat will be avoided through the Constraints Planning and Field Development Protocol. The project may involve some crossings of watercourses, but impacts to wetlands are considered unlikely and will not result in a substantial modification, destruction or isolation of these habitats. • **Satin Flycatcher** This species may be an occasional, transient visitor to the Project area. Within the Project area they would generally occur in moist, forested habitats, and along watercourses and gullies. The proposed action is expected to have minimal effects on any local population of these species and no important habitat will be modified, destroyed or isolated. • **Rufous Fantail** This species may be an occasional visitor to the Project area. Within the Project area they would generally occur in moist, forested habitats, and along watercourses and gullies. The proposed action is expected to have minimal effects on any local population of these species and no important habitat will be modified, destroyed or isolated.

Criteria	Assessment of significance
	Construction activities will utilise appropriate techniques for the control of weeds, pest animals, fire, chemical contaminants, waste and erosion and sedimentation through the implementation of the Project Environmental Management Plan and Biosecurity Manual. Environmental flows and runoff quality will also be managed in accordance with relevant State policies.
Result in invasive species that are harmful to the migratory species becoming established in an area of *important habitat* for the migratory species.	The Project area is not identified as an important habitat for migratory species, with the possible exception of Latham's Snipe. However, construction activities will utilise appropriate techniques for the control of weeds, pest animals, fire, chemical contaminants, waste and erosion and sedimentation through the implementation of the Project Environmental Management Plan and Biosecurity Manual. Environmental flows and runoff quality will also be managed in accordance with relevant State policies. No impacts to potentially important habitat for Latham's Snipe are expected conditional on the successful implementation of Management Plans.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an *ecologically significant proportion* of the *population* of a migratory species.	There are no survey data currently available for wetlands in the Project area to provide a quantitative estimate of the proportion of populations of migratory species utilising the wetland source. Through implementation of QGC's Constraints Planning and Field Development Protocol, the proponent proposes to avoid disturbance to wetlands as a high priority developmental control. In cases where disturbance is unavoidable, detailed pre-clearance surveys will be undertaken to determine whether any migratory species occur within the vicinity of the proposed disturbance. Those wetland species for which specific potential impacts need to be considered are discussed below, along with those migratory species that do not inhabit wetland areas. • **Sharp-tailed Sandpiper** This species is expected to be a regular nonbreeding visitor to the Project area (it breeds in the northern hemisphere). The proposed action is anticipated to have minimal effects on this species, subject to the successful implementation of appropriate development controls in relation to retained habitat, and no serious disruption to the lifecycle of any ecologically significant proportion of the population is anticipated to occur. • **Latham's Snipe** Latham's Snipe breeds in the northern hemisphere. The proposed action is expected have minimal effects on this species, subject to the successful implementation of appropriate development controls in relation to retained habitat, and no serious disruption to the lifecycle of any ecologically significant proportion of the population is anticipated to occur. • **Glossy Ibis** Glossy Ibis occurs in association with shallow wetlands and temporarily flooded grasslands and could potentially breed in the Project area. Nevertheless, the proposed action is expected have minimal effects on this species, subject to the successful implementation of appropriate development controls in relation to retained habitat, and no serious disruption to the lifecycle of any ecologically significant proportion of the population is anticipated to occur. • **Satin Flycatcher** In the Project area Satin Flycatcher may transiently visit the moister, forested habitats. It breeds mostly in south-eastern Australia. Much of the area expected to be impacted for the Project is currently cleared pasture and is considered unsuitable for this species. Serious disruption to the lifecycle of any ecologically significant proportion of the population is not anticipated to occur. • **Rufous Fantail** In the Project area Rufous Fantail would generally occur in the moister, forested habitats. Much of the area expected to be impacted for the Project is currently cleared pasture and is considered unsuitable for this species. Serious disruption to the lifecycle of any ecologically significant proportion of the population is not anticipated to occur.

Criteria	Assessment of significance
Assessment conclusion	No important habitats as defined under the Matters of National Environmental Significance Significant impact guidelines 1.1 and Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species occur in the Project area with the possible exception of Latham's Snipe. Similarly, there is no evidence to suggest that ecologically significant proportions of populations of migratory species occur within the Project area. The residual impact of the proposed action for the above migratory species is assessed as 'insignificant', subject to the successful implementation of appropriate development controls in relation to retained habitat.

ATTACHMENT F. *RELEVANT SSMPS*