Alfredson Project

Environmental Protection and Biodiversity Conservation Act Referral
Aquatic Matters of National Environmental Significance

Prepared for:

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Contents

Tables

Maps

Summary

frc environmental was commissioned by Origin Energy Resources Ltd (OER) on behalf of Australia Pacific LNG Pty Limited to assess potential impacts to aquatic ecosystems associated with the proposed development of the southern portion of Petroleum Lease (PL) 1011 known as the Alfredson Project (the Project). The Project adjoins the existing Condabri development area which is covered under EPBC controlled action approval 2009/4974. This assessment will be used to support a referral under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Specifically, frc environmental was requested to advise if activities associated with the Project are likely to have significant direct or indirect impacts on Matters of National Environmental Significance (MNES) under the EPBC Act, in so far as those matters relate to aquatic ecology and surface water resources.

Assessment of impacts to groundwater resources and groundwater dependent ecosystems is presented in the hydrogeological report, and is included with this referral.

This report presents the detailed impact assessment in relation to aquatic MNES against the Significant Impact Guidelines, including relevant background information to support the assessment.

The aquatic MNES relevant for this assessment are the Murray cod and surface water resources.

Watercourses within the Project footprint area have low aquatic ecological values, low value for human users of water, high levels of existing disturbance, and do not support habitat for, or populations of, MNES species. Watercourses within the Project footprint area therefore are of low quality and low value to aquatic ecology.

Sources of potential impact on aquatic MNES associated with activities of the Project include:

- well construction and operation
- pipeline and access track crossings of watercourses, and
- the construction and operation of other infrastructure, which may include temporary workforce accommodation, laydown areas, stock pile and storage areas, and communications systems.

Due to the proposed locations of wells, no direct impacts to aquatic MNES have been identified. Pipeline and crossings of watercourses for access tracks may have the following direct impacts to aquatic MNES:

- impacts to fauna passage (e.g. raised bed profile after construction is complete; installation of barriers during construction)
- impacts (barriers) to low flows
- localised sedimentation of watercourses associated with construction works (including trenching, track construction) within a watercourse
- localised increases in turbidity and suspended solids in surface water associated with construction within a watercourse
- loss of bank stability after constructing, resulting in bank erosion and loss of bank habitat
- loss of bed habitat at the crossing location, and
- localised loss of riparian vegetation.

Development wells, pipeline and access track crossings of watercourses, and construction and operation of other infrastructure may have the following indirect impacts to aquatic MNES:

- localised sedimentation of watercourses associated with runoff from cleared well leases / disturbed watercourse banks
- localised increases in turbidity and suspended solids in surface water associated with runoff from cleared well leases / disturbed watercourse banks
- contamination of watercourses from spills of hydrocarbons and chemicals from vehicles and machinery used during lease preparation, drilling, installation and operation of the well / construction of pipeline and access tracks over watercourses, and
- introduction of aquatic weeds to watercourses via contaminated machinery and vehicles.

Mitigations proposed to reduce the risk of impact of the Project include:

- implementation of sediment and erosion control plans
- adherence to applicable Australian Standards and codes of practice relating to chemical and fuel use
- adherence to applicable Queensland codes of practice relating to fisheries, and
- construction during dry periods where practicable.

The significant impact assessment showed that there are no significant impacts to the aquatic MNES (i.e. Murray cod or surface water resources) associated with direct or indirect impacts of the Project.

1 Introduction

frc environmental was commissioned by Origin Energy Resources Ltd (OER) on behalf of Australia Pacific LNG Pty Limited to assess potential impacts to aquatic ecosystems associated with the proposed development of the southern portion of Petroleum Lease (PL) 1011 known as the Alfredson Project (the Project; Map 1.1). The Project adjoins the existing Condabri development area which is covered under EPBC controlled action approval 2009/4974. This assessment will be used to support a referral under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

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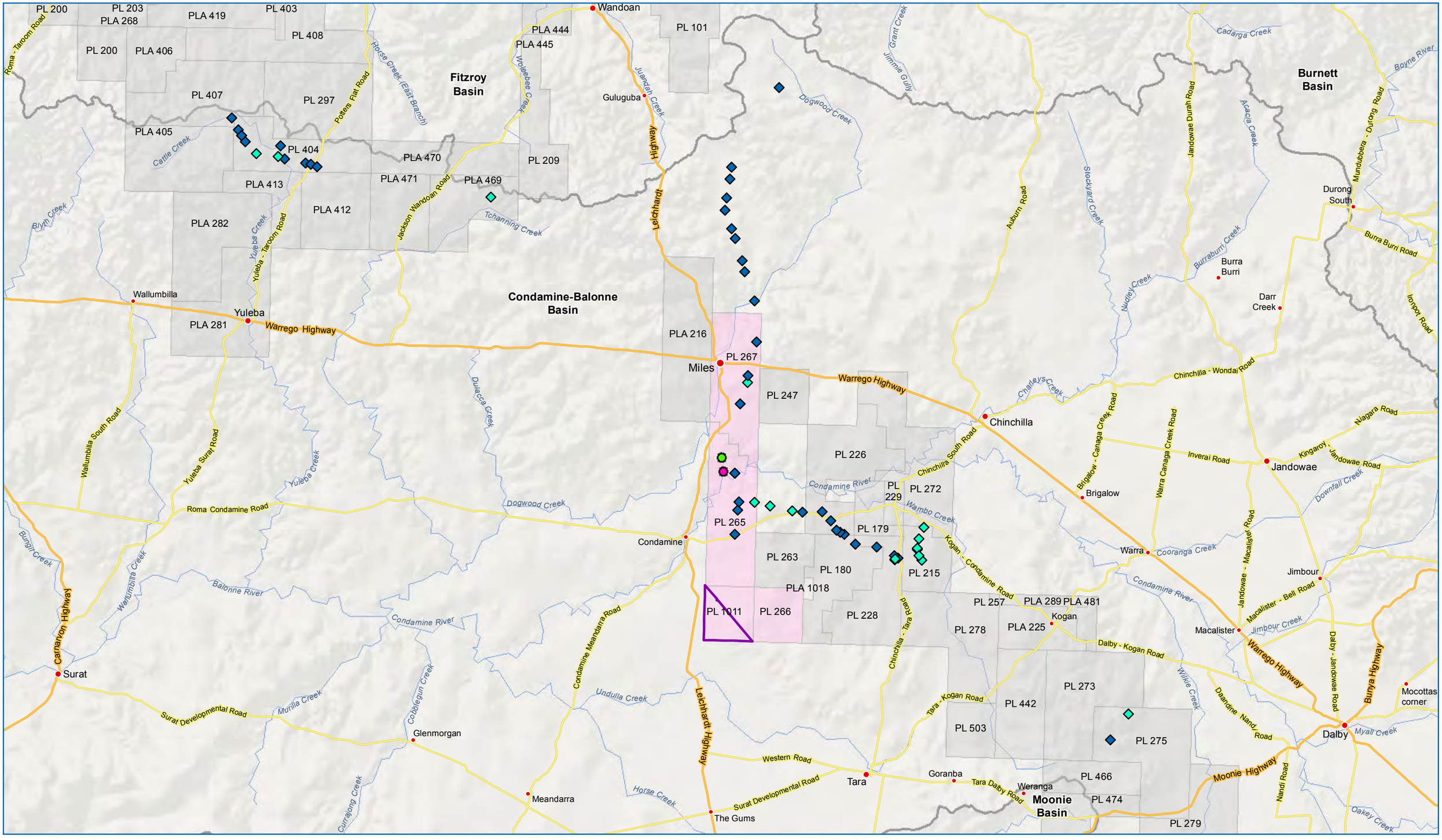
Assessment of impacts to groundwater resources and groundwater dependent ecosystems is presented in the hydrogeological report (Klohn Crippen Berger 2017).

This report presents the detailed impact assessment in relation to aquatic MNES against the Significant Impact Guidelines, including relevant background information to support the assessment.

The following terms are used in the report to describe spatial extents:

- Project study area – Petroleum Lease 1011 (PL1011) and the Condamine River downstream of the Condabri Water Treatment Facility (CR-CWTF)
- Project footprint area – the area within PL1011 that will actually be developed, and
- Regional Assessment Area – the wider Condamine Catchment (Map. 1.1)



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EPBC Aquatic Ecology Assessment

Map 1.1: Regional Assessment Area, showing aquatic survey sites and the Alfredson Project Area

SOURCES

Document Path: Y:\Projects\2016\161001_QR_Condabri_EPBC\Mapping\Workspaces\1.1_Project_Study_Area_A0_17-02-07.mxd

LEGEND

- Project footprint area (Alfredson Block Boundary)
- Condabri Central Release Location
- Condabri WTF
- Petroleum Lease / Authority to Prospect (DNRM)
- Condabri Development Area

Sampling Sites in Regional Assessment Area

- Full Survey
- Habitat Survey
- Basin
- Watercourse

Road Network

- Highway
- Main Road

N

SCALE

0 5 10 20 30
Kilometres

Scale: 1:600,000 @ A3

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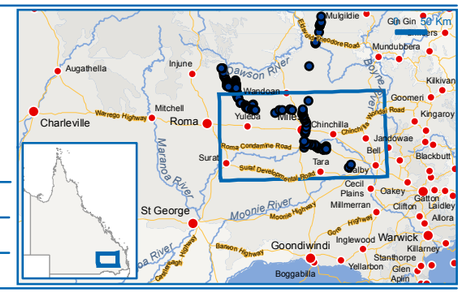


2 Methods

2.1 Desktop Approach

A desktop study was used for impact assessment, drawing on:

- our previous work in the area, including:
  - APLNG Aquatic Values Survey, including the Condabri Lateral Pipeline (frc environmental 2011)
  - Aquatic Values Assessment for the Talinga-Condabri Pipelines (frc environmental 2012c)
  - Aquatic Values Assessment for the Ruby and Orana Pipelines (frc environmental 2012b)
  - Aquatic Values Assessment: Orana-Talinga Pipeline (frc environmental 2012a)
  - Aquatic Values Surveys for the Western High Pressure Gas Network pipelines, including the Combabula Spur pipeline (frc environmental 2012a)
  - an assessment of bed-level crossing designs for OER within the Project study area (frc environmental 2013b)
  - Aquatic Values Monitoring Report for the APLNG Project, including pipelines in the Eastern High Pressure Gas Network (frc environmental 2015)
- our knowledge of aquatic habitats of the Condamine River, and of the flora and fauna associated with those habitats
- other aquatic ecological studies commissioned by ORE (e.g. recent annual reports for the Talinga and Condabri Central Water Treatment Facility Receiving Environment Monitoring Program (NRA 2016a; b), and
- a thorough review of available literature.

The Aquatic Values Surveys used:

- full assessment of aquatic ecology at 36 representative sites (Map 1.1), and
- assessment of aquatic habitat only at 13 representative sites (Map 1.1).

Full assessment of aquatic ecology involved the survey of:

- aquatic habitat condition, based on the Australian River Assessment System (AUSRIVAS) habitat assessment protocol
- aquatic plants, assessed visually to species level, and noting growth form and percent cover of each species
- water quality, measured in the field with a calibrated hand-held water quality meter for pH, electrical conductivity, turbidity, dissolved oxygen and temperature
- macroinvertebrates, using AUSRIVAS samples from bed and edge habitat, with specimens identified in the laboratory to family level
- fish, using a combination of electrofishing, fyke nets and / or baited traps
- turtles, using baited cathedral traps, and
- other aquatic vertebrates (e.g. platypus) via field observations of habitat suitability and desktop review of Queensland Department of Environment and Heritage Protection's (EHP) wildlife on-line database.

Habitat only assessments at minor watercourses comprised the assessment of habitat and aquatic plants, as described above.

2.2 Impact Assessment

The assessment of impacts consisted of:

- a risk-based assessment, with the level of *risk* being an outcome of both the *consequence* and *likelihood* of the potential impact (Table 2.1 to Table 2.3Table 2.3), and
- specific assessment of potential impacts to aquatic MNES, including water quality of water resources, using the Significant Impact Guidelines 1.1 (DoTE 2013a) and Significant Impact Guidelines 1.3 (DoTE 2013b).

To determine the applicable aquatic MNES, the EPBC Protected Matters database was searched on 7 February 2017 (Appendix A) and the following aquatic threatened species were listed as potentially occurring within and surrounding the Project study area:

- Murray cod (*Maccullochella peelii*) (vulnerable).

All other MNES that the EPBC search identified were considered to be outside the scope of this study (i.e. not aquatic species), and are addressed in other studies supporting the EPBC referral. The literature review and our knowledge of the area also indicated that no other aquatic MNES are likely to occur in the area.

Table 2.1 Ratings used to assess the likelihood of potential impacts

Rating	Likelihood of potential impacts
High	Almost certain or high likelihood of the impact occurring; has occurred recently in a similar scenario; likely to happen commonly.
Moderate	Likely or probably could happen; would not happen very commonly.
Low	Possible but unlikely to happen; would happen rarely if at all.

Table 2.2 Ratings used to assess the consequence of potential impacts

Rating	Consequence of potential impacts
High	Catastrophic irreversible or critical long term environmental harm or loss; significant harm or loss of sensitive components of the environment; significant harm or loss of protected components of the environment, such as protected wetlands and MNES.
Moderate	Significant short-term but reversible harm of sensitive components of the environment; minor environmental harm to protected components of the environment, such as protected wetlands and MNES.
Low	Unfavourable impact with no lasting harm to the environment, excluding sensitive and protected components of the environment.

Table 2.3 Environmental risk matrix

		Likelihood		
		Low	**Moderate**	**High**
Consequence	**High**	Moderate	High	High
	Moderate	Low	Moderate	High
	Low	Low	Low	Moderate

3 Matters of National Environmental Significance of the Project Study Area - Murray River cod (*Maccullochella peelii*)

Murray cod was identified as potentially occurring in the Project study area (Appendix A). The assessment of this species was based on a desktop review of:

- Commonwealth's Department of the Environment (DoE) online *Environment Protection and Biodiversity Conservation Act* Protected Matters Search Tool
- Queensland's EHP Wildlife Online database
- Commonwealth's DoE's species profile and threats database (SPRAT)
- DoE conservation advice for Murray cod (Threatened Species Scientific Committee 2003)
- previous reports prepared by frc environmental for the Project area and surrounds (frc environmental 2011; 2012c; b; a; 2013b; 2014; 2015), and
- published scientific literature.

3.1 Description

The Murray cod is one of four species belonging to the genus *Maccullochella* in the Percichthyidae family, with all four species listed as threatened under the EPBC Act.

Murray cod is the largest freshwater fish in Australia, having been measured at up to 1.8 m in length and over 100 kg in weight, although most commonly weighed at about 10 kg (McDowall 1996b). The Murray cod has a broad head, large mouth with a rounded snout, and a concave profile. The species is predominantly light olive to dark green in colour with mottled patterning and white to cream-coloured undersides. The pectoral fins are large and rounded, and the soft dorsal, anal and caudal fins usually have distinct white to red margins.

3.2 Status Under Commonwealth and State Legislation

The Murray River cod is listed as vulnerable under the EPBC Act, and is not listed under the Queensland *Nature Conservation Act 1992*.

3.3 Distribution

The natural distribution of Murray cod encompasses major and moderate waterways (i.e. approximately 13,245 km of waterway) of the Murray-Darling Basin, from southern Queensland, through New South Wales (NSW), the Australian Capital Territory (ACT) and Victoria to South Australia, with the exception of the upper reaches of some tributaries. The species still occurs in most parts of this natural distribution (the species' current distribution) up to approximately 1000 m above sea level.

3.4 Habitat

The Murray cod utilises a diverse range of habitats from clear rocky streams, such as those found in the upper western slopes of NSW and the ACT, to slow-flowing, turbid lowland rivers and billabongs (McDowall 1996b).

Murray cod are frequently found in the main channels of rivers and larger tributaries; the species is, therefore, considered a main-channel specialist. Murray cod may also utilise floodplain anabranches and billabongs during periods of inundation (Koehn 1997; 2006; National Murray Cod Recovery Team 2010). However, rivers and major tributaries are the preferred habitat of Murray cod from late larval stages through to maturity (National Murray Cod Recovery Team 2010).

Preferred microhabitats comprise complex structural features such as large rocks, large woody debris (e.g. tree stumps and logs), and overhanging stream banks and vegetation. These physical habitat features provide Murray cod with shelter from fast-flowing water and serve as predatory ambush points for foraging, particularly during the day (Koehn 2009).

3.5 Biology

Reproduction

The Murray cod is a long-lived species, reaching sexual maturity at approximately five years of age (Threatened Species Scientific Committee 2003). Females reach maturity in the approximate range of 480–590 mm in total length and 2.1–3.9 g in weight, and males mature in the approximate range of 530–585 mm and 2.3–3.4 kg (Rowland 1998). However, rates of growth of Murray cod depend on water temperature (i.e. thermal regime), habitat and food availability, and so they vary between climatic regions (e.g. northern and southern regions of the Basin) and between rivers and impoundments

(Rowland 1998). The species' rate of growth does not vary between the sexes (Kearney & Kildea 2001).

The species has a distinct annual reproductive cycle; females develop eggs through winter until spawning in spring, which is a relatively short, well-defined period of about four to five weeks that occurs when water temperatures are 15 – 20 °C (Rowland 1998; Humphries 2005; Koehn & Harrington 2006). Murray cod have relatively low fecundity compared to many other freshwater fish (Native Fish Australia Incorporated 2007), although the timing, duration and reproductive output of spawning can vary between years (Humphries 2005; Koehn & Harrington 2006). However, as spawning activity is correlated with water temperature and day length, spawning in the northern parts of the species' distribution typically occurs from early September to mid-November. In southern areas and habitats at higher-altitudes, spawning tends to occur from early October to mid-December (Koehn & Harrington 2006; Rowland 1998).

Murray cod form breeding pairs prior to spawning and select a spawning site, which is usually a sunken log in lowland rivers, or a submerged rock in upland streams. However, Murray cod have been recorded excavating and laying eggs in depressions in clay banks. Incubation time (time from egg fertilisation to hatching) takes 3 – 13 days depending on temperature (Humphries 2005; Lintermans 2007). The spawning location is prepared (i.e. cleared of silt by 'fanning' with fins) and the females lay eggs that are then fertilised by the male. The male then guards and fans the eggs during the incubation period. After hatching, the larvae tend to remain clustered near the spawning location for 4 – 11 days, with the male parent continuing to guard them (Humphries 2005).

Recruitment success appears to be strongly linked to river flow, with good year classes in some rivers coinciding with a rise in water level or flooding at or soon after spawning (Rowland 1998; Kearney & Kildea 2001; Ye & Zampatti 2007). Recruitment success is likely to be linked to timing, duration and water quality, especially temperature, of flows, and flooding in spring appears to provide optimum conditions for survival and recruitment of larvae and juveniles in rivers (Kearney & Kildea 2001; Rowland 1998).

Diet

The Murray cod is the apex predator of major and moderate waterways of the Murray-Darling Basin (McDowall 1996a; Ye et al. 2000). While the species is largely demersal (i.e. residing towards the base of the water column close to benthic habitats), Murray cod are known to actively hunt throughout the water column between sunset and sunrise (Ye et al. 2000). The species' diet changes with age: larvae 5 – 8 mm long and approximately 8 – 10 days old feed on zooplankton, and after reaching a length of 15 – 20 mm they feed on aquatic insects (Kearney & Kildea 2001). The typical diet of mature cod includes a

wide range of native and introduced fish species, crustaceans, frogs, aquatic reptiles and water birds (McDowall 1996a; Ye et al. 2000)

Movement and Dispersal

Murray cod are generally sedentary outside the breeding season and remain within a 5 km home territory centred on a specific deep pool or large log (Koehn 2009). However, prior to spawning Murray cod may undertake substantial long-distance movements, often in an upstream direction, although migration tendencies and distances travelled varies considerably between individuals (Koehn & Harrington 2006).

Adult Murray cod are solitary and highly territorial (Koehn & Harrington 2006), although anglers have reported the capture of several similar sized Murray cod from one location, which indicates that aggregations can occur (National Murray Cod Recovery Team 2010). Following spawning, adults move back downstream and return to the same territory occupied before the spawning migration (Koehn 1997). This homing behaviour is largely unknown in other freshwater fish species and emphasises the importance of snags and connectivity along riverine channels for Murray cod (Native Fish Australia Incorporated 2007).

Larval movement, after larvae have spent sufficient time developing at the spawning site, involves active and passive drift downstream for 5 – 10 days (Humphries 2005). Larvae may drift substantial distances, and settle in riverine habitat that provides sufficient food resources and habitats for hiding from predators (Koehn 2009).

3.6 Threats

Historical Threats

Commercial overfishing was one of the primary causes of the historic decline of the Murray cod (Koehn & Harrington 2006). Total catches peaked in the early 1900s, and by the mid 1900s had declined to unprofitable levels, although commercial fishing continued in various capacities until concern about declining native fish stocks led to the closure of all commercial fisheries in 2003 (National Murray Cod Recovery Team 2010). However, the adverse effect of historical over-fishing on the population status of the species continues (National Murray Cod Recovery Team 2010).

The Queensland section of the Murray-Darling Basin has never supported a commercial Murray cod fishery (Ye et al. 2014).

Current Threats

The following are known current threats to Murray cod that interact cumulatively with other current and historical threats :

- Habitat removal, modification and degradation, such as:
  - de-snagging to assist navigation, improve water flow, mitigate floods and protect infrastructure, for example bridges, from damage due to debris jams during flooding events (National Murray Cod Recovery Team 2010)
  - vegetation clearing of, and livestock grazing in, riparian zones, which leads to bank erosion and sedimentation of benthic habitats utilised by cod for foraging and spawning.
- Barriers to movement, including dams, weirs, locks, roads, bridges, culverts, levee banks and areas of unsuitable habitat, such as cold waters or fast-flowing or turbulent waters. These barriers fragment cod habitats and populations, restrict Murray cod spawning migrations and the downstream dispersal of larvae, and impede genetic exchange. This has the potential to reduce local genetic variability through genetic drift and threatens the genetic integrity of the species (Kearney & Kildea 2001; National Murray Cod Recovery Team 2010).
- Altered river flow regimes. The construction and operation of dams, weirs, channels, pumps and other infrastructure, has resulted in the alteration of river flow regimes, including reduction of flow rates and volumes, modifications to seasonal variations in flows, including flood events, and long periods of low flows or the absence of flows (National Murray Cod Recovery Team 2010). Such altered flows have impacted the success of recruitment, and artificially low flows limit spawning migrations by adults and downstream drift of larvae. Conversely, sudden releases of large amounts of water from impoundments, which coincide with spawning and the hatching and early development of larvae, can result in larvae being flushed from nests before they are sufficiently developed to undertake the journey downstream, and often transport larvae to areas of unsuitable habitat (e.g. irrigation channels) (Humphries & Walker 2013; National Murray Cod Recovery Team 2010).
- Reduced water quality, which is often associated with flow alterations, for example:
  - In the absence of regular large flushing flows, large quantities of organic material may accumulate in regulated waterways, which can cause ‘blackwater’ to form. Blackwater is water of impacted quality containing high levels of dissolved organic carbon that can be rapidly consumed by microorganisms, sometimes leading to extremely hypoxic (low dissolved oxygen) or anoxic (devoid of oxygen) conditions in the aquatic ecosystem. This, in turn, causes

stress, and often suffocation and death, of aquatic animals in that ecosystem. Blackwater events are more common in summer when air and water temperatures are relatively high, and although blackwater events occur naturally, their occurrences are exacerbated by river regulation (King et al. 2012).

- Releases of cold water from deep impoundments (i.e. release of water from the hypolimnion in stratified impoundments) cause cold water pollution (or temperature depression), which is water commonly 10 °C (but up to 17 °C) colder than that of natural river systems, that can extend for over 100 km (sometimes up to 400 km) downstream of an impoundment. Cold water pollution typically occurs in spring and summer, and when it coincides with the late winter–spring upstream migration and spring–early summer spawning, spawning may be aborted or success greatly reduced (National Murray Cod Recovery Team 2010). Cold water pollution also significantly reduces the suitability of riverine habitat for the Murray cod to the extent that many hundreds of kilometres of waterway of the Murray Darling Basin are now largely unsuitable for the species (Threatened Species Scientific Committee 2003).
- Surface water runoff from modified catchment areas brings elevated concentrations / loads of nutrients, sediment and salts. Increased sediment smothers benthic habitats used by Murray cod for foraging and spawning, and increased nutrients may lead to eutrophication and associated hypoxic / anoxic conditions, leading to stress, and potentially suffocation and death, of aquatic animals. Sediment runoff may increase the turbidity of water, and where combined with increased salinity from runoff from salinised landscape, may have lethal or sub-lethal effects on fish especially early life history stages, although the impact of long-term effects on all life history stages are unknown (National Murray Cod Recovery Team 2010).
- Recreational fishing. The removal of a substantial number of sexually mature individuals, particularly from small or isolated Murray cod populations, is likely to adversely affect the viability of the population and may not be sustainable for some populations, leading to population crashes and potentially local extinction. There is a concern that the minimum size limit of 50 cm (total body length) in all states does not allow Murray cod to reach breeding age and breed at least once before being at risk of being removed from the population by capture by anglers (National Murray Cod Recovery Team 2010). There is a growing trend amongst anglers to practice catch-and-release, however the overall impact of this practice across the species' distribution, positive or negative, is not well known - anglers may expose Murray cod to high air and water temperatures causing them stress, or can remove or damage their

protective skin mucous lining or scales by subjecting them to prolonged or excessive rough handling, such as being handled with dry hands or placed on hot, dry or rough surfaces. When the protective skin mucus or scales are removed or damaged, Murray cod are susceptible to infections by various pathogens or parasites (National Murray Cod Recovery Team 2010).

The Murray cod supports a considerable recreational fishery throughout the northern Murray–Darling Basin in Queensland. The Murray cod is mostly targeted by recreational anglers within the Dumaresq, Macintyre, Moonie, Condamine, Balonne and Warrego Rivers and their tributaries, however the species is also occasionally reported from the Paroo River (Ye et al. 2014). Data from a recent study in the Border Rivers region of Queensland suggested that harvesting of Murray cod remains high with most fish being removed from the population within a couple of years of reaching legal size (Ye et al. 2014).

3.7 Recovery Actions

The National Recovery Plan for the Murray Cod (the plan) has the long-term objective of having self-sustaining populations of Murray cod managed for conservation, fishing and culture, and a general aim to restore native fish populations to 60% of pre-European levels after 50 years, which aligns with the objective of the Native Fish Strategy for the Murray-Darling Basin (2003–2013).

The plan identifies the need to research the species' current distribution, population status, key biological and ecological attributes, including life history and population structure, spawning cues, seasonal movements, habitats and flow requirements. The plan lists seven overall objectives for recovery:

- determine the distribution, structure and dynamics of Murray cod populations across the Murray-Darling Basin
- manage river flows to enhance recruitment to Murray cod populations
- evaluate the risks of threats and benefits of recovery options on Murray cod populations for each management unit
- determine the habitat requirements of Murray cod life stages and populations
- manage the recreational fishery for Murray cod in a sustainable manner while recognising the social, economic and recreational value of the fishery
- encourage community ownership for Murray cod conservation, and

- manage Recovery Plan implementation.

To achieve these objectives, the plan identifies 51 priority actions and 20 other actions to be undertaken by a wide range of stakeholders (National Murray Cod Recovery Team 2010), including:

- Establishment of the Murray Cod Taskforce, which has the primary function of overseeing the implementation of the national recovery plan.
- Stock enhancement programs, which are designed to enhance wild Murray cod populations such that the natural genetic composition of the wild population is achieved, rather than achieving census population size of only highly productive genetic strains of the species, which would result in lower than natural levels of genetic diversity (Bearlin & Tickel 2003). All states and territories are required to develop fish stocking or translocation guidelines for their respective jurisdictions that are consistent with the National Policy for the Translocation of Live Aquatic Organisms: Issues, Principles and Guidelines for Implementation (MCFFA 1999).
- State and territory-based management, with all jurisdictions in which the species occurs now having regulations governing Murray cod fishing, although these regulations are not consistent between the jurisdictions. These regulations include declaring closed seasons, size and bag limits, and restrictions on the use of particular fishing methods and equipment that would otherwise enable anglers to increase their catch rates or catch larger fish, such as unattended lines or various types of trap (National Murray Cod Recovery Team 2010).

3.8 Occurrence within Project Footprint Area

The nearest confirmed record of Murray cod is approximately 18 km to the west of the Project footprint area on the Condamine River (Atlas of Living Australia 2016), and the species was caught at background site CRUS3 and receiving environment site CRDS3 on the Condamine River within the scope of REMP monitoring downstream of the Condabri Water Treatment Facility (NRA 2016a; b). Minor watercourses within and surrounding the Project footprint area do not provide habitat for Murray cod.

4 Description of the Project and Potential Impacts to Aquatic Ecology

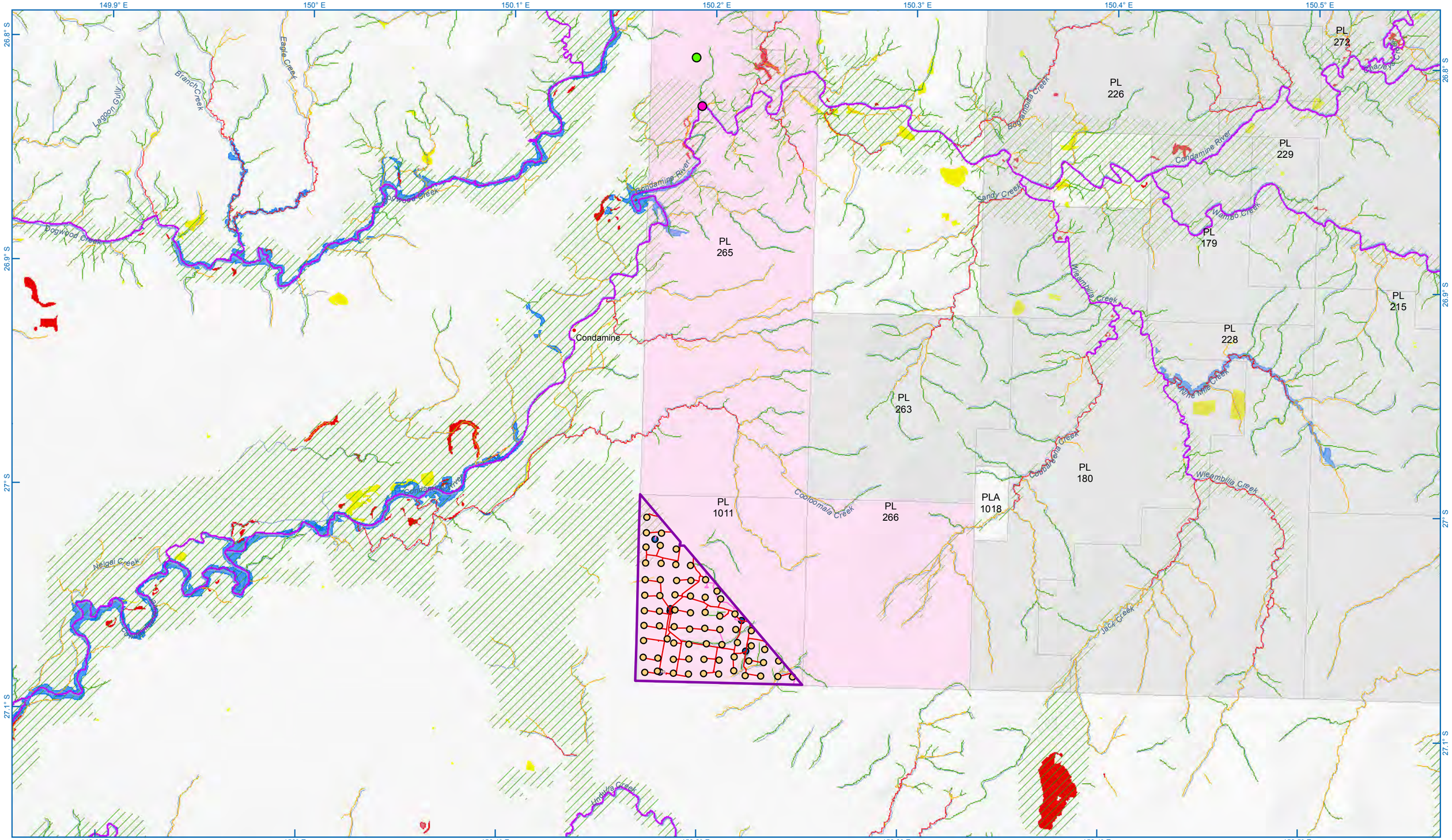
The Project will involve the progressive development of CSG infrastructure across the Project footprint area, and will include the following proposed activities (Map 4.1):

- construction and operation of 68 wells
- installation, operation and maintenance of gas and water gathering flowlines
- installation, operation and maintenance of associated supporting infrastructure (e.g. access roads, power and communication systems, laydowns, stockpiles and storage areas, and temporary workforce accommodation), and
- decommissioning and rehabilitation of infrastructure and disturbed areas.

The Project will not require development of gas compression facilities or water management and treatment infrastructure.

Potential impacts to aquatic MNES and surface water resources associated with the Project relate to:

- pipelines and access tracks that cross watercourses (details in Appendix B)
- drilling, installation, operation and maintenance of development wells, and
- construction of other infrastructure (e.g. temporary workforce accommodation, communication systems, laydown areas, and storage and stockpile areas).



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EPBC Aquatic Ecology Assessment

Map 4.1: Project Infrastructure in the Alfredson Project Area

SOURCES

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LEGEND

- Project footprint area (Alfredson Block Boundary)
- Wells
- Well Lease
- Flowlines (Maximum Development Case)
- Petroleum Lease / Authority to Prospect (DNRM)
- Condabri Development Area
- Other Infrastructure
- Other Infrastructure
- Other Infrastructure
- Condabri Central Release Location
- Condabri WTF
- Floodplain Area

Waterway Barrier Work

- Low
- Moderate
- High
- Major

Mapped Wetlands

- Riverine Waterbody
- Riverine RE
- Lacustrine Waterbody
- Palustrine Waterbody
- Palustrine RE
- Major Watercourse
- Minor Watercourse

N

SCALE

0 2.5 5 10
Kilometres

Scale: 1:175,000 @ A3

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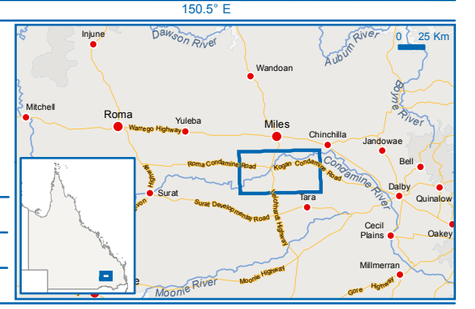


5 Aquatic Ecological Values of the Project Footprint Area and Potential Aquatic Ecological Impacts of the Project

5.1 Aquatic Ecological Values of the Project footprint Area

Aquatic Habitat Diversity and Condition

The Project footprint area contains only minor watercourses of stream order 1 and 2 that have low to moderate risk to fish passage from waterway barrier works (Map 3.1; Appendix B). There are no mapped lacustrine wetlands within the Project footprint area (Map 3.1), although it slightly intersect areas of mapped floodplain (Map 3.1). There are no mapped waters of High Ecological Value (HEV) within the Project footprint area.

Vegetation of the Project footprint area includes Brigalow (*Acacia harpophylla* dominant and co-dominant), which is a threatened ecological community, with Belson's panic (*Homopholis belsonii*), a threatened species (ERM 2016). However Satellite imagery shows that watercourses within the Project footprint area have extensively cleared riparian zones.

Minor watercourses that are intersected by the proposed development footprint within the Project footprint area have low aquatic ecological values as they are ephemeral and are typically dry. As a consequence, they do not provide habitat for threatened aquatic species, and only occasionally (i.e. in high rainfall events) provide habitat for common aquatic species (frc environmental 2011; 2012c; b; a; 2013b; 2014; 2015). The aquatic ecology assessments of the Regional Assessment area (frc environmental 2011; 2012c; b; a; 2013b; 2014; 2015) found that minor watercourses typically have low diversity and complexity of aquatic habitat due to:

- low channel diversity
- low to relatively high bank stability
- low flow habitat diversity; minor watercourses are ephemeral and dry most of the time, with temporary riffle and / or run habitat only present during significant rainfall events, and shallow isolated pools within watercourses only persisting for short periods after significant rainfall
- often cleared and / or with sparse riparian vegetation
- substrates dominated by clay and / or silt
- moderate physical habitat features such as undercut banks and boulders, and
- low diversity and cover of aquatic plants and trailing vegetation.

Minor watercourses of the Regional Assessment area are often in relatively poor condition due to past and existing land uses such as grazing and cropping, including:

- cleared catchment area and riparian zones
- cattle disturbances of bank and beds
- erosion of banks and bed, and localised sedimentation of beds, and
- presence of a range of weed species within and surrounding watercourses.

Watercourses within more heavily forested areas of the Regional Assessment Area, unlike those within the Project footprint area, are generally in better ecological condition than watercourses in cleared areas of non-remnant vegetation (frc environmental 2011; 2012c; b; a; 2013b; 2014; 2015).

Water Quality

Surface water of the Regional Assessment area was found to be of low to moderate quality (frc environmental 2011; 2012c; b; a; 2013b; 2014; 2015), with pH and electrical conductivity being variable; complying with guidelines at some sites and times but not others. Turbidity was almost always higher than the guideline and dissolved oxygen was typically lower than the guideline.

Aquatic Plants

Species richness and percent cover of aquatic plants of the Regional Assessment area are low to moderate (frc environmental 2011; 2012c; b; a; 2013b; 2014; 2015).

Rushes (i.e. *Juncus* spp.) and sedges (e.g. *Cyperus* spp.) dominated all aquatic plant communities, although other hardy emergent species (e.g. *Eleocharis* spp. and *Fimbristylis* spp.) on dry bed or bank habitat were also common (frc environmental 2011; 2012c; b; a; 2013b; 2014; 2015). Submerged and floating attached aquatic plants were very uncommon due to the ephemeral flow regime of most watercourses of the Regional Assessment Area, such as those in the Project footprint area.

No federally threatened aquatic plants have been recorded from the Regional Assessment area, although Blake's spike rush (*Eleocharis blakeana*) and fringing rush (*Fimbristylis vagans*), both listed as near threatened under Queensland's *Nature Conservation Act 1992* (NC Act), have the potential to occur in low abundance within the Regional

Assessment area (Atlas of Living Australia 2016) but are unlikely to be within the Project footprint area.

No exotic aquatic plant species were recorded in the Regional Assessment Area.

Macroinvertebrates

The macroinvertebrate communities of the Regional Assessment area were dominated by common insect species (e.g. midges, mayflies, water bugs, water beetles) and worms typical of ephemeral and highly variable watercourses of the region (frc environmental 2011; 2012c; b; a; 2013b; 2014; 2015). Minor and impacted watercourses, such as those within the Project footprint area, had lower diversity of macroinvertebrates and lower abundance of sensitive macroinvertebrate taxa than larger watercourses, because the permanent or near-permanent pools on the larger watercourses provide more suitable habitat for these species then do more temporary pools on smaller watercourses (frc environmental 2011; 2012c; b; a; 2013b; 2014; 2015).

No listed species of significance to conservation were recorded, and no exotic aquatic macroinvertebrate were recorded.

Fish

A total of eight native species of fish were recorded from the Regional Assessment area (frc environmental 2011; 2012c; b; a; 2013b; 2014; 2015; NRA 2016a; b):

- Agassiz's glassfish (*Ambassis agassizii*)
- spangled perch (*Leiopotherapon unicolor*)
- carp gudgeon (*Hypseleotris* spp.)
- bony bream (*Nematalosa erebi*)
- Australian smelt (Retropinna semoni)
- Murray rainbowfish (*Melanotaenia fluvitalis*)
- yellow belly (Macquaria ambigua), and
- Murray cod (*Macullochella peeli peeli*).

Only a sub-set of these species would be expected in minor watercourses, such as those of the Project footprint area, including carp gudgeons and spangled perch. These species

are typically common in ephemeral watercourses of the region when the watercourses hold water.

All species of fish known from the region are tolerant of harsh environmental conditions (i.e. ephemeral flow regime, limited habitat diversity and often poor water quality) (Lintermans 2007), and only one species (i.e. Murray cod) is listed as threatened under Commonwealth or State legislation.

European carp (*Cyprinnus carpio*), goldfish (*Carassius auratus*) and eastern Gambusia (*Gambusia holbrookii*) are exotic species of fish known from the Regional Assessment Area (frc environmental 2011; 2012c; b; a; 2013b; 2014; 2015).

Turtles and Platypus

Murray River turtle (*Emydura macquarii*), eastern long-neck turtle (*Chelodina longicollis*) and broad-shelled long-neck turtle (*Chelodina expansa*) are known from major watercourses of the region (frc environmental unpublished data, 2015). It is unlikely these species would occur in minor watercourses of the Project footprint area. None of these species of turtle are threatened species.

There is one record of platypus (*Ornithorhynchus anatinus*) in the Regional Assessment area, in the main stem of the Condamine River just upstream from the town of Chinchilla (Atlas of Living Australia, viewed 7 February 2017). However, the Project footprint area does not contain suitable habitat for platypus. It is very unlikely that platypus would be within or near the Project footprint area. Platypus is listed as a Least Concern species under the Queensland NC Act.

5.2 Potential Aquatic Ecological Impacts

Pipelines and Access Tracks

Proposed pipelines and access tracks cross watercourses that have been mapped as having low risk of impact to fish passage (DAFF 2013d, Appendix B). Most of the mapped watercourses within and surrounding the Project footprint area do not connect to larger watercourses (Map 3.1), and many first order streams of the Regional Assessment area have been ground-truthed as ‘drainage features’ as they do not meet the definition of watercourse under the *Water Act 2000* (frc environmental 2013a).

Pipelines will be of open trench construction, and access tracks will be constructed as bed-level crossings.

Potential Impacts

There will be no direct impacts to Murray cod because the Project footprint area does not have suitable habitat for this species. Direct impacts to surface water resources associated with pipelines and access tracks include:

- impacts to fauna passage (e.g. raised bed profile after construction is complete; installation of barriers during construction)
- impacts (barriers) to low flows
- localised sedimentation of watercourses associated with construction within a watercourse
- localised increases in turbidity and suspended solids in surface water associated with construction within a watercourse
- loss of bank stability after construction, resulting in bank erosion and loss of bank habitat
- loss of bed habitat at the crossing location, and
- localised loss of riparian vegetation.

Potential *indirect* impacts to aquatic MNES (i.e. Murray cod and surface water resources) associated with pipelines and access tracks include:

- localised sedimentation of watercourses associated with runoff from disturbed banks
- localised increases in turbidity and suspended solids in surface water associated with runoff from disturbed banks
- contamination of watercourses from spills of hydrocarbons and chemicals from vehicles and machinery used during construction of crossings, and
- introduction of aquatic weeds to watercourses via contaminated machinery and vehicles.

Impact Mitigation

Mitigation to reduce the risk of potential impacts include the following:

- wherever possible[1], pipeline and access track crossings of watercourses will be designed and constructed in accordance with the *Sustainable Planning Act 2009* and *Fisheries Act 1994* self assessable codes for waterway barrier works to minimise impacts to fish passage:
  - the Code for Self-assessable Development: Construction and Maintenance of Bed Level Crossings WWBW01-P4 (DAFF 2013a) is applicable for access tracks
  - Section 5 of the Code for Self-assessable Development: Temporary Waterway Barrier Works WWBW02 (DAFF 2013c) is applicable to pipeline crossings through watercourses at times they hold water
- works within a watercourse will be conducted in the following order of preference:
  - conducting works when no water is present
  - conducting works in times of no flow
  - conducting works in times of flow but in a way that does not negatively impact the flow of water within the watercourse, permanently impound water or permanently divert the flow of water
- a site specific erosion and sediment control plan will be prepared and implemented during construction to minimise sedimentation off site and impacts to adjacent watercourses
- all applicable materials will be stored and handled in accordance with the relevant legislative requirements and Australian Standards including but not limited to the provisions of:
  - AS 3780:2008 – The storage and handling of corrosive substances
  - AS 1940:2004 – The storage and handling of flammable and combustible liquids
  - AS 3833:2007 - Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers
- the following key measures, amongst others described in the Australia Pacific LNG Biosecurity Management Plan (CDN/ID 8057416), will be implemented for the management of declared weeds and pests:
  - all vehicles requiring access to an ORE site or property must have a valid biosecurity hygiene declaration unless an exemption applies. Biosecurity hygiene declarations are to be issued only by an authorised inspector

[1] Where watercourse crossings do not comply with the self-assessable codes for waterway barrier works, then they will be subject to Development Approval.

- all vehicles / equipment carrying loads of high-risk materials must also have a valid biosecurity hygiene declaration for that load
- personnel must not enter areas of known weed infestation (e.g. areas fenced or signed as weed zones) without prior approval from the environmental advisor or Health, Safety and Environment advisor responsible for the area
- pre-clearance weed survey will be completed to identify declared weeds present at a site. A site specific weed management plan will be prepared if required and will outline roles and responsibilities, proposed treatment, access controls and survey results
- the construction area will be monitored for weed growth during regular inspections. In the event a weed infestation is discovered, access to the area will be restricted and weed control will be undertaken. Vehicles, equipment and visitors will be randomly spot checked to ensure conformance with the weed hygiene procedures
- reinstated areas will also be monitored for effectiveness of prevention, containment and control strategies
- in the event a biosecurity threat other than weeds is identified, the following must be completed:
  - attempt to confirm the identity of the pest where possible
  - check whether the species is listed on the notifiable pests list
  - if the pest is a notifiable pest, immediately advise the Project Delivery Environment Manager who must notify Biosecurity Queensland or the Emergency Disease Watch Hotline
  - notify landholders where required and as advised by the Environment Manager and Land Relations Advisor
  - prepare a site-specific pest management procedure outlining specific management actions to address the threat as required

· progressive rehabilitation of significantly disturbed land that is not required for ongoing petroleum activities will be undertaken and will commence within nine months following completion of works. Progressive rehabilitation will include:

- remediation of any land contaminated during construction (e.g. soils contaminated from minor hydrocarbon spills)
- reshaping all significantly disturbed land to a stable landform
- re-profiling all significantly disturbed land to original contours and re-establishing surface drainage lines

- reinstating the top layer of the soil profile
- establishing groundcover to ensure that erosion is minimised
- establishing vegetation of floristic species composition found in analogue sites
- regular maintenance and annual monitoring for at least three years, to determine the success of the rehabilitation, and
- in the event of unsuccessful rehabilitation, maintenance and monitoring will continue until it has been achieved for three years.

Risk Assessment

Watercourses within and surrounding the Project footprint area have low ecological value and do not provide habitat for MNES species; the Condamine River is sufficiently displaced from the Project footprint area to have no direct or indirect impacts associated with pipelines and access tracks, and Undulla Creek to the south of the Project footprint area is sufficiently displaced to have no direct or indirect impacts associated with pipelines and access tracks. Bed-level crossings on freshwater watercourses are considered to be minor waterway barriers by the Queensland State Government (DAFF 2013b), and all but one mapped watercourses within the Project footprint area do not appear to connect to larger watercourses (based on available Queensland Government mapping data; Map 3.1) suggesting that they may not commonly provide passage for fish. Therefore, the *consequence* of direct and indirect impacts to aquatic MNES (i.e. Murray cod and surface water resources) within and downstream of the Project footprint area associated with pipelines and access tracks is *low.*

Adherence to applicable Queensland fisheries standards will effectively mitigate potential direct impacts to aquatic fauna passage, and will not impact low flows. While some watercourse crossings may not be perpendicular (and thus not satisfy this aspect of the Queensland Government's self assessable bed level crossing waterway barrier works code WWBW01-P4), it is unlikely they will adversely impact aquatic ecology, as watercourse features that provide habitat and passage for invertebrates, fish and turtles will have been retained (e.g. depth of low flow channel, natural bed profile). Implementation of site-specific sediment and erosion control plans will effectively mitigate any localised indirect impacts to water quality (i.e. turbidity or suspended solids) and sedimentation of watercourses. Therefore, the *likelihood* of direct and indirect impacts to aquatic MNES (i.e. Murray cod and surface water resources) within and downstream of the Project footprint area associated with watercourse crossings is *low*.

The mitigated risk of direct and indirect impacts of pipelines and access tracks to aquatic MNES (i.e. Murray cod and surface water resources) within and downstream of the Project footprint area area is *low*.

Development Wells and Other Infrastructure

Development wells and other infrastructure (which may include temporary workforce accommodation, communication systems, laydown areas, and storage and stockpile areas) will be sited to avoid placement within ground-truthed watercourses. However, in some locations, due to other environmental and engineering constraints it may be required to place a well close to a ground-truthed watercourse.

Potential Impacts

Development wells and other infrastructure will not intersect any ground-truthed watercourses and consequently will not have any *direct* impacts on aquatic MNES or surface water resources.

Potential *indirect* impacts to aquatic MNES and surface water resources associated with the construction and operation of development wells and other infrastructure include:

- localised sedimentation of watercourses associated with runoff from cleared areas
- localised increases in turbidity and suspended solids in surface water associated with runoff from cleared areas, and
- contamination of watercourses from spills of hydrocarbons and chemicals, and weed propagules, from vehicles and machinery used during construction and operation phases.

Impacts associated with the potential drawdown of water on MNES are addressed in the hydrogeology report (Klohn Crippen Berger 2017).

Impact Mitigation

Mitigation to reduce the risk of potential impacts include the following:

- a site specific erosion and sediment control plan will be prepared and implemented during construction to minimise sedimentation off site and impacts to adjacent watercourses
- treated sewage from temporary workforce accommodation will be carried out in a manner so that:
  - vegetation is not damaged
  - soil quality is not adversely impacted
  - no surface ponding or runoff to waters
  - there is no aerosol or odours
  - deep drainage below the root zone of any vegetation is minimised
  - the quality of shallow aquifers is not adversely affected.
- all applicable materials will be stored and handled in accordance with the relevant legislative requirements and Australian Standards, including but not limited to the provisions of:
  - AS 3780:2008 – The storage and handling of corrosive substances
  - AS 1940:2004 – The storage and handling of flammable and combustible liquids
  - AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers
- the following key measures, amongst others described in the Australia Pacific LNG Biosecurity Management Plan (CDN/ID 8057416), will be implemented for the management of declared weeds and pests:
  - all vehicles requiring access to an ORE site or property must have a valid biosecurity hygiene declaration unless an exemption applies. Biosecurity hygiene declarations are to be issued only by an authorised inspector
  - all vehicles / equipment carrying loads of high-risk materials must also have a valid biosecurity hygiene declaration for that load
  - personnel must not enter areas of known weed infestation (e.g. areas fenced or signed as weed zones) without prior approval from the environmental advisor or Health, Safety and Environment advisor responsible for the area
  - pre-clearance weed survey will be completed to identify declared weeds present at a site. A site specific weed management plan will be prepared if required and will outline roles and responsibilities, proposed treatment, access controls and survey results

- the construction area will be monitored for weed growth during regular inspections. In the event a weed infestation is discovered, access to the area will be restricted and weed control will be undertaken. Vehicles, equipment and visitors will be randomly spot checked to ensure conformance with the weed hygiene procedures
- reinstated areas will also be monitored for effectiveness of prevention, containment and control strategies
- in the event a biosecurity threat other than weeds is identified, the following must be completed:
  - attempt to confirm the identity of the pest where possible
  - check whether the species is listed on the notifiable pests list
  - if the pest is a notifiable pest, immediately advise the Project Delivery Environment Manager who must notify Biosecurity Queensland or the Emergency Disease Watch Hotline
  - notify landholders where required and as advised by the Environment Manager and Land Relations Advisor
- prepare a site-specific pest management procedure outlining specific management actions to address the threat as required

· significantly disturbed land that is not required for ongoing petroleum activities will be progressive rehabilitated. This rehabilitation will commence in accordance with EA EPPG00853013. Progressive rehabilitation will include:

- remediation of any land contaminated during construction (e.g. soils contaminated from minor hydrocarbon spills)
- reshaping all significantly disturbed land to a stable landform
- re-profiling all significantly disturbed land to original contours and re-establishing surface drainage lines
- reinstating the top layer of the soil profile
- establishing groundcover to ensure that erosion is minimised
- establishing vegetation of floristic species composition found in analogue sites
- regular maintenance and annual monitoring for at least three years, to determine the success of the rehabilitation, and
- in the event of unsuccessful rehabilitation, maintenance and monitoring will continue until it has been achieved for three years.

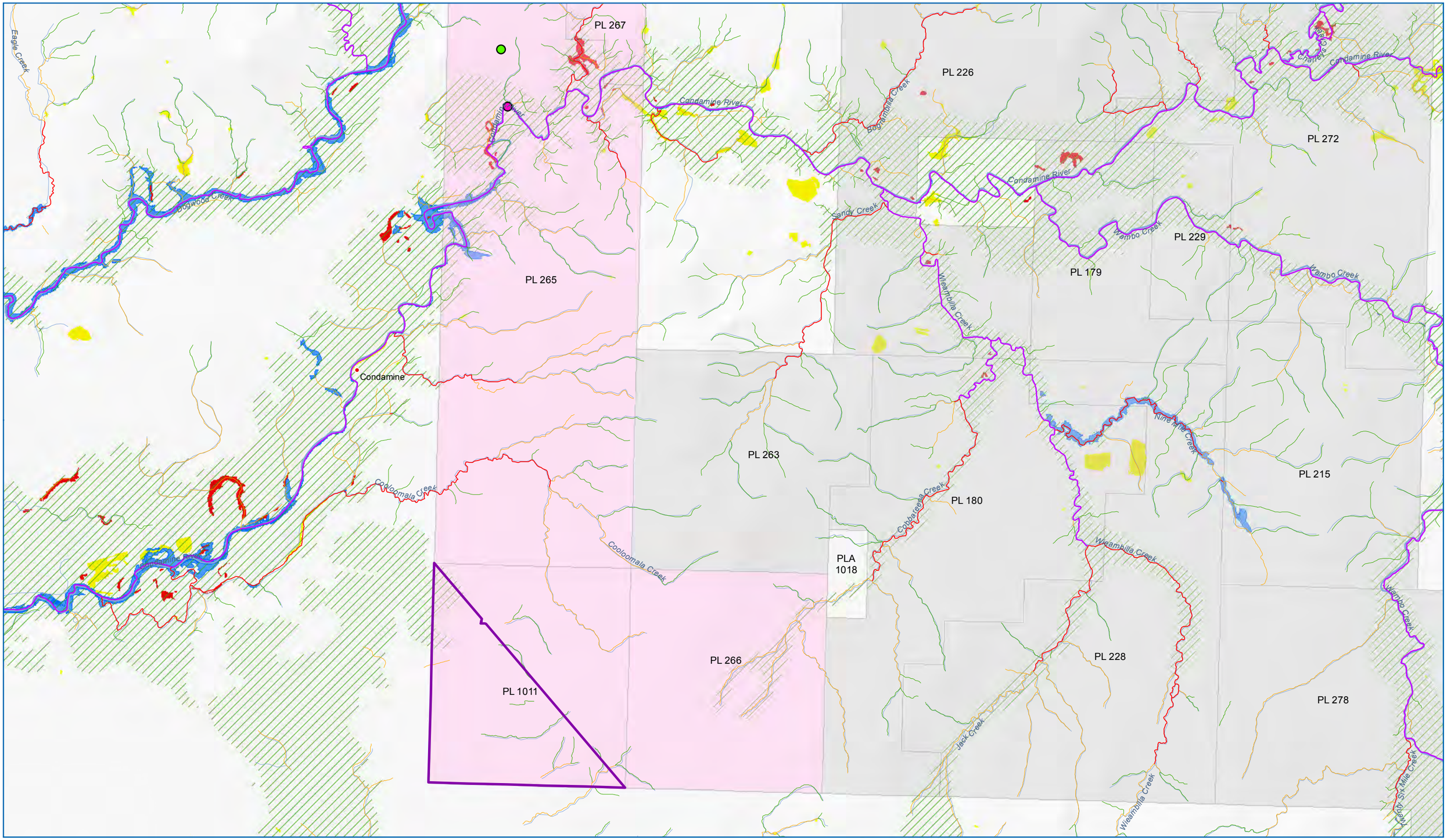
Risk Assessment

There will be no direct impacts to aquatic MNES (i.e. Murray cod or surface water resources) within or downstream of the Project footprint area associated with construction and operation of wells, as wells and other infrastructure will not be located over ground-truthed watercourses.

Watercourses within and surrounding the Project footprint area have low ecological value and do not provide habitat for MNES species; the Condamine River is sufficiently displaced from the Project footprint area to have no direct or indirect impacts associated with construction and operation of wells and other infrastructure, and Undulla Creek to the south of the Project footprint area is sufficiently displaced to have no direct or indirect impacts associated with the construction and operation of wells and other infrastructure. Disturbances throughout the Regional Assessment Area due to past and existing land uses (most notably vegetation clearing, grazing and cropping) are likely to cause more widespread impacts to water quality (i.e. turbidity, dissolved solids, nutrients) during significant rainfall events. Therefore, slight and localised changes to water quality that could result from construction and operation of wells is minor compared to changes to water quality associated with existing land uses, and will not contribute sufficient impact to result in a significant cumulative impact when considered collectively with existing impacts. The *consequence* of indirect impacts to aquatic MNES (i.e. Murray cod and surface water resources) within and downstream of the Project footprint area associated with construction and operation of wells and other infrastructure is *low*.

Appropriate sediment and erosion control plans will minimise run-off and erosion from cleared areas during the construction phase, and site remediation will ensure that potential impacts of disturbed land adjacent to watercourses are mitigated in the longer term. Refuelling stations and chemical and fuel storage facilities will adhere to applicable standards and codes of practice, which will effectively mitigate significant adverse impacts to aquatic ecosystems. The *likelihood* of indirect impacts to aquatic MNES (i.e. Murray cod and surface water resources) within and downstream of the Project footprint area associated with construction and operation of wells and other infrastructure is *low*.

The mitigated risk of direct and indirect impacts of construction and operation of wells and other infrastructure to aquatic MNES (i.e. Murray cod and surface water resources) within and downstream of the Project footprint area was assessed as *low*.



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EPBC Aquatic Ecology Assessment

Map 5.1: Environmental Features of the Alfredson Project Area

SOURCES

Document Path: Y:\Projects\2016\161001_QR_Condabri_EPBC\Mapping\Workspaces\5.1_Env_Features_17-02-07_AB.mxd

LEGEND

- Project footprint area (Alfredson Block Boundary)
- Condabri Central Release Location
- Condabri WTF
- Petroleum Lease / Authority to Prospect (DNRM)
- Condabri Development Area
- Floodplain Area

Waterway Barrier Work

- Low
- Moderate
- High
- Major

Mapped Wetlands

- Riverine Waterbody
- Riverine RE
- Lacustrine Waterbody
- Palustrine Waterbody
- Major Watercourse
- Minor Watercourse

N

SCALE

0 4.25 8.5
Kilometres

Scale: 1:150,000 @ A3

PROJECTION
Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

DATE
2017-02-07

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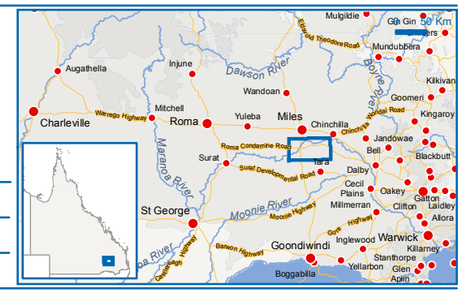

6 Assessment of Significant Impacts to Threatened Species Against the MNES Significant Impact Guidelines

6.1 The Sensitivity of the Environment that will be Impacted

Watercourses within the Project footprint area have low ecological value, are in poor condition due to existing land uses (including having extensively cleared riparian zones), and do not provide habitat for MNES species. The Condamine River is also in impacted condition due to existing water regulation, cleared riparian areas and surrounding land uses (Phillips & Moller 1994), although the river is known to support Murray cod and possibly platypus, and therefore has high ecological value. However, the Condamine River is sufficiently displaced from the Project footprint area to have no risk of impact.

Aquatic species of the region, including Murray cod, are tolerant of variable flow and water quality. Existing disturbances of the Project study area are of greater extent and magnitude than the potential impacts of the Project and include cleared riparian vegetation, and erosion of watercourse banks due to cattle access to watercourses. Existing impacts to aquatic habitat and water quality are of greater magnitude and extent than that of minor localised impacts that may occur due to the Project.

Watercourses of the Project study area are not considered to be sensitive to potential impacts of the Project with implementation of mitigation measures outlined in this document.

6.2 The Timing, Duration and Frequency of the Action and its Impacts

Subject to receiving all relevant approvals, production associated with the Project is planned to commence in March 2017.

While the installation of some access track crossings of watercourses are likely to be permanent, the gravel and natural bed material construction of the crossings, and adherence to the applicable Fisheries codes, will ensure that the potential impacts are minor. While some watercourse crossings may not be perpendicular (and thus not satisfy this aspect of the Queensland Government's bed level crossing self assessable code WWBW01-P4), it is unlikely they will adversely impact aquatic ecology, as watercourse features that provide habitat and passage for invertebrates, fish and turtles will have been retained (e.g. depth of low flow channel, natural bed profile).

Risks associated with contamination such as fuel spills and weeds from vehicles will be applicable to the life of the Project, but have low risk of impact where mitigations outlined

in this document are applied (see Section 5). Other potential impacts associated with the Project will be restricted to the construction phase.

6.3 The Total Impact that can be Attributed to the Action Over the Entire Geographic Area Affected, and Over Time

The total impact of the Project is considered to be low compared to existing impacts, such as grazing and historical vegetation clearing. Potential impacts of the proposed development are localised and of low intensity, and the local aquatic ecosystems are not sensitive to the proposed development.

6.4 Existing Levels of Impact from Other Sources

Cleared riparian vegetation and catchment areas, and cattle access to watercourses which causes bank and bed erosion, are widespread disturbances that significantly impact the ecological condition of watercourses of the Project study area and wider Regional Assessment area. Direct impacts from existing land uses include erosion of watercourse banks, and indirect impacts include changes to water quality (e.g. increased turbidity and suspended solids, and potential nutrient enrichment from cattle) and sedimentation. These existing impacts are substantially greater and more widespread than any potential impacts relating to the Project.

6.5 The Degree of Confidence with which the Impacts of the Action are Known and Understood

It is considered that potential impacts of the Project within and downstream of the Project study area have been assessed with a 'moderate to high' degree of confidence. Similar development has been completed in the Regional Assessment area. Post-construction inspection of watercourses undertaken by frc environmental following pipeline crossings of watercourses in the region (e.g. on Dogwood Creek) has demonstrated that environmental values of the watercourses were not impacted, and that habitat for aquatic species was not impacted.

6.6 Mitigation Measures

Mitigation measures are presented in detail in Sections 5, include:

- implementation of sediment and erosion control plans
- adherence to applicable Australian Standards and codes of practice relating to chemical and fuel use
- adherence to applicable Queensland codes of practice relating to fisheries, and
- construction during dry periods where practicable.

The proposed mitigation measures will control impacts to the extent that the potential risk of impact to aquatic ecosystems and aquatic MNES species is low (see Section 5).

6.7 Assessment Against the Significant Impact Criteria

The assessments below (Table 6.1) considers direct impacts (e.g. track and pipeline crossings of watercourses) and indirect impacts (e.g. runoff) to aquatic MNES.

The significant impact assessment showed that there is no significant impact to the aquatic MNES.

Table 6.1 Assessment of the Project on Aquatic MNES Species in and downstream of the Project study area.

Significant Impact Criteria	Will the action have a significant impact	Justification
Criteria specific to only vulnerable species		
Lead to a long-term decrease in the size of an important population of a species	No	Proposed development within the Project footprint area will have no direct impact on Murray cod. The population of Murray cod in the Condamine River is sufficiently displaced as to have no indirect impacts from the Project. Development within the Project footprint area will therefore not lead to a long-term decrease in the population size of Murray cod.
Criteria that apply to both endangered and vulnerable species		
Reduce the area of occupancy of the species	No	Proposed development within the Project footprint area will have no direct impact on Murray cod. The population of Murray cod in the Condamine River is sufficiently displaced as to have no indirect impacts from the Project. Development within the Project footprint area will therefore not reduce the area of occupancy of Murray cod.
Fragment an existing population into two or more populations	No	Proposed development within the Project footprint area will have no direct impact on Murray cod. The population of Murray cod in the Condamine River is sufficiently displaced as to have no indirect impacts from the Project. Development within the Project footprint area will therefore not fragment an existing population of Murray cod into two or more populations.

Significant Impact Criteria	Will the action have a significant impact	Justification
Adversely affect habitat critical to the survival of a species	No	Proposed development within the Project footprint area will have no direct impact on Murray cod. The population of Murray cod in the Condamine River is sufficiently displaced as to have no indirect impacts from the Project. Development within the Project footprint area will therefore not adversely affect habitat critical to the survival of Murray cod.
Disrupt the breeding cycle of a population	No	Proposed development within the Project footprint area will have no direct impact on Murray cod. The population of Murray cod in the Condamine River is sufficiently displaced as to have no indirect impacts from the Project. Development within the Project footprint area will therefore not disrupt the breeding cycle of Murray cod.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No	Proposed development within the Project footprint area will have no direct impact on Murray cod. The population of Murray cod in the Condamine River is sufficiently displaced as to have no indirect impacts from the Project. Development within the Project footprint area will therefore not modify, destroy, remove, isolate or decrease the availability or quality of habitat of Murray cod to the extent that the species is likely to decline.

Significant Impact Criteria	Will the action have a significant impact	Justification
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	No	Weeds are a relatively common element of disturbed areas of the Project area and Regional Assessment area, however no exotic aquatic plant species were recorded from the area. Therefore the risk of spreading weeds that directly impact aquatic ecosystems is low. Furthermore, OER adhere to a strict weed wash-down protocol for all vehicles and machinery, which further reduces the risk of spreading weeds, including weeds that may reduce the ecological condition of the Condamine River, and therefore may indirectly impact Murray cod. Carp, goldfish and eastern Gambusia are known from the Condamine River. The Project will not influence the distribution or abundance of these pest fish species. Furthermore, fish are not able to disperse without direct surface water connection between locations, and no artificial direct surface water connection between sites will be made by the Project. The Project will not result in establishment or increase in population size of invasive species that are harmful to MNES.
Introduce disease that may cause the species to decline	No	The proposed development is very unlikely to introduce a disease that will cause Murray cod to decline.
Interfere with the recovery of the species.	No	Proposed development within the Project footprint area will have no direct impact on Murray cod. The population of Murray cod in the Condamine River is sufficiently displaced as to have no indirect impacts from the Project. Development within the Project footprint area will therefore not interfere with the recovery of Murray cod.

7 Assessment of Significant Impacts to Water Resources Against the Significant Impact Guidelines

This assessment considers only water quality of surface water resources. The assessment of impacts to groundwater resources, including interconnectivity of aquifers, is presented in the groundwater report (Klohn Crippen Berger 2017).

7.1 Sensitivity, Value and Quality of the Water Resource

Sensitivity of Surface Water Resources

Watercourses within the Project footprint area have low ecological value, are in poor condition due to existing land uses (including having extensively cleared riparian zones), and do not provide habitat for MNES species. The Condamine River is also in a degraded condition due to existing water regulation, cleared riparian areas and surrounding land uses (Phillips & Moller 1994), although the river is known to support Murray cod and possibly platypus, and therefore has high ecological value. However, the Condamine River is sufficiently displaced from the Project footprint area to have no risk of impact.

Aquatic species of the region, including Murray cod, are tolerant of variable flow and high turbidity of water. Existing disturbances of the Project study area are moderate and include cleared riparian vegetation, and erosion of watercourse banks due to cattle access to watercourses. Existing impacts to aquatic habitat and water quality will be of greater magnitude and extent than minor localised impacts that may occur due to the Project.

Watercourses (i.e. surface water resources) of the Project study area are not considered to be sensitive to potential impacts of the Project with implementation of mitigation measures outlined in this document .

Value of Surface Water Resources

The value of a water resource includes both the value for aquatic ecosystems and value for third party users of water. Values or utility of water may be described on the basis of the type of service that is provided to third party users of water, including ecosystems (Table 7.1).

The value or utility of surface water resources to human third party users of watercourses within the Project footprint area is low, and the use of surface water by aquatic

ecosystems in watercourses within the Project footprint area is likely to opportunistic in response to heavy rainfall, as they are ephemeral. Furthermore, mapped watercourses within the Project footprint area are not connected by mapped watercourse channels to larger watercourses, and therefore, may support aquatic biota very infrequently. Watercourses in the Project footprint area therefore have low value as aquatic ecosystems

Table 7.1 Assessment of Values of Surface Water Resources within the Project footprint area

Service	Example	Assessed level of value
Provisioning services	Use by other industries Use as drinking water	low
Regulating service	Climate regulation Stabilisation of coastal ecosystems	low
Cultural services	Recreation Tourism Education	low
Supporting services	Maintenance of aquatic ecological function	low

Quality of Surface Water Resources

Watercourses of the Project footprint area have low aquatic ecological values, low value for human users of water, high levels of existing disturbance, and do not support habitat for, or populations of, MNES species. Watercourses of the Project footprint area therefore are of low quality.

7.2 Scale of Impact

Intensity and Magnitude of Impacts to Surface Water Resources

Cleared riparian vegetation and catchment areas, and cattle access to watercourses which causes bank and bed erosion, are existing widespread disturbances that significantly impact the ecological condition of the watercourses in the Project study area and wider Regional Assessment area. Direct impacts from existing land uses include erosion of watercourse banks, and indirect impacts include changes to water quality (e.g. increased turbidity and suspended solids, and potential nutrient enrichment from cattle) and sedimentation. These existing impacts are substantially greater and more widespread than any potential impacts relating to the Project.

The intensity and magnitude of potential impacts of the Project on water quality of surface water resources is considered low. It is unlikely that potential impacts of the Project would contribute sufficient impact to result in a significant cumulative impact when considered collectively with existing impacts.

Duration of Impacts to Surface Water Resources

Most anticipated impacts of the Project to the surface water resources will be of short duration (i.e. be associated with only the construction phase, and / or associated with high rainfall events). However, the duration of some potential impacts of the Project is longer-term, for example some access tracks that cross watercourses are likely to be permanent. However, both short- and long- term potential impacts to surface water resources will have no short- or long- term adverse consequences for surface water resources (see Section 5).

Geographic Extent of Impacts to Surface Water Resources

The geographical extent of the potential impact of the Project on surface water resources within and downstream of the Project study area is small and of low risk to aquatic ecology (see Section 5).

7.3 Beneficial Impacts

No significant beneficial impacts of the Project are likely.

7.4 Cumulative Impacts

Watercourses within the Project footprint area are highly disturbed, have low ecological values and low values as a water resource for human users. Direct and indirect impacts to these watercourses from proposed development associated with the Project will not cause significant cumulative impact. The Condamine River is sufficiently displaced from the Project footprint area that indirect impacts are very unlikely (see Section 5); thus, there will no cumulative impacts to the Condamine River from development within the Project footprint area.

7.5 Avoidance and Mitigation Measures

Mitigation measures are presented in detail in Section 5, but include:

- implementation of sediment and erosion control plans
- adherence to applicable Australian Standards and codes of practice relating to chemical and fuel use
- adherence to applicable Queensland codes of practice relating to fisheries, and
- construction during dry periods where practicable.

The proposed mitigations will effectively control impacts to the extent that potential risks of impact to water resources associated with the Project are low (see Section 5).

7.6 Assessment of Significant Impacts

It is considered that potential impacts of the Project within and downstream of the Project study area have been assessed with a 'moderate to high' degree of confidence. Similar development has been completed in the Regional Assessment area. Post-construction inspection of watercourses undertaken by frc environmental following pipeline crossings of watercourses in the region (e.g. on Dogwood Creek) has demonstrated that environmental values of the watercourses were not impacted, and that habitat for aquatic species was not impacted.

Development within the Project footprint area will have no implications relating to water plans pursuant to Queensland *Water Act* 2000.

The potential impacts of the Project (see Sections 5 and 6) are collectively assessed against the Significant Impact Criteria:

- the assessment of significant impacts to the hydrology of surface water resources is presented Table 7.2, and
- the assessment of significant impacts to water quality of surface water resources is presented in Table 7.3.

No significant impacts to the water quality of surface water resources are likely (see also Klohn Crippen Berger 2017).

Table 7.2 Assessment of Significant Impacts on Hydrological Characteristics of Surface Water Resources for the Project.

Significant Impact Criterion	Significant impact likely	Justification
Changes in water quantity, including timing of variation in water quantity that would significantly reduce the current or future utility of the water resource to third party users or the environment	No	Water resources within the Project footprint area have low value and low utility for third party users and the environment. Therefore, development within the Project footprint area will not cause changes in water quantity, including the timing in variation of quantity, that would significantly reduce the current or future utility of water resources for third party or environmental users.
Changes in the integrity of hydrological or hydrogeological connections that would significantly reduce the current or future utility of the water resource to third party users or the environment	No	Water resources within the Project footprint area have low value and low utility for third party users and the environment. Therefore, development within the Project footprint area will not have a significant impact on water resources that have utility for third parties or the environment. The Project will not cause changes in the integrity of hydrological connections that would significantly reduce the current or future utility of water resources for third party or environmental users. Assessment of changes to hydrogeological and groundwater connections is presented in the Hydrogeology Report (Klohn Crippen Berger 2017).
Changes in extent of water resource that would significantly reduce the current or future utility of the water resource to third party users or the environment	No	Water resources within the Project footprint area have low value and low utility for third party users and the environment. Therefore, development within the Project footprint area will not have a significant impact on water resources that have utility for third parties or the environment. The Project will not cause changes in the extent of a water resource that would significantly reduce the current or future utility of water resources for third party or environmental users.

Table 7.3 Assessment of Significant Impacts on Water Quality of Surface Water Resources for the Project.

Significant Impact Criterion	Significant impact likely	Justification
There is a risk that the ability to achieve relevant water quality objectives would be materially compromised, and as a result the action:		Natural water quality of watercourses of the Regional Assessment Area often do not achieve regional water quality guidelines (Section 3; frc environmental 2013a). While the Project may cause minor and localised changes to turbidity and suspended solids of watercourses within the Project footprint area, these will be minor and have no adverse impacts to aquatic ecology. Therefore, the Project will not increase the risk of achieving water quality guidelines.
i. creates risks to human or animal health or to the condition of the natural environment as a result of the change in water quality	No	The Project will have minor influence on some water quality parameters, including turbidity and suspended solids of watercourses within the Project footprint area at times when they hold water, but will not influence water quality as it relates to human or animal health.
ii. substantially reduces 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	No	The Project will not reduce the amount of surface water available for human consumptive uses or environmental uses.
iii. causes persistent organic chemicals, heavy metals, salt or other potentially harmful substances to accumulate in the environment	No	The mitigated risks to water quality associated with the operation of vehicles and machinery are low (see Section 5). Thus, the Project will not lead to the accumulation of harmful substances in the environment.
iv. seriously affects the habitat or lifecycle of a native species dependent on a water resource,	No	The Project will not seriously affect the habitat or life cycle of any species dependent on a surface water resource, as risks of the Project to aquatic ecosystems are low (see Section 5).

Significant Impact Criterion	Significant impact likely	Justification
v. causes the establishment of an invasive species (or the spread of an existing invasive species) that is harmful to the ecosystem function of the water resource	No	The Project will not cause the establishment of an invasive species that could be harmful to water resources. OER adheres to a strict weed wash down procedure for vehicles and machinery, thus existing weeds of the region will not be spread by the Project. The Project will not facilitate the spread of exotic fish, because no direct connections between surface water resources will be constructed.
There is a significant worsening of local water quality (where current local water quality is superior to local or regional water quality objectives)	No	Not applicable because current water quality of surface water resources within the Project study area and surrounds is not superior to regional or State water quality guidelines (Section 3; frc environmental 2013a).
High quality water is released into an ecosystem which is adapted to a lower quality of water	No	Not applicable.

8 Conclusions

The aquatic MNES relevant for this assessment are the Murray cod and surface water resources.

8.1 Activities in the Project Footprint Area

Watercourses within the Project footprint area have low aquatic ecological values, low value for human users of water, high levels of existing disturbance, and do not support habitat for, or populations of, MNES species. Watercourses within the Project footprint area therefore are of low quality and low value.

Sources of potential impact on aquatic MNES associated with activities of the Project include:

- well construction and operation
- pipeline and access track crossings of watercourses
- the construction and operation of other infrastructure, which may include temporary workforce accommodation, laydown areas, stock pile and storage areas, and communications systems, and

Due to the proposed locations of wells, no direct impacts to aquatic MNES have been identified. Pipeline and access track crossings of watercourses may have the following direct impacts to aquatic MNES:

- impacts to fauna passage (e.g. raised bed profile after construction is complete; installation of barriers during construction)
- impacts (barriers) to low flows
- localised sedimentation of watercourses associated with construction works (including trenching, track construction) within a watercourse
- localised increases in turbidity and suspended solids in surface water associated with construction within a watercourse
- loss of bank stability after constructing, resulting in bank erosion and loss of bank habitat
- loss of bed habitat at the crossing location, and
- localised loss of riparian vegetation.

Development wells, pipeline and access track crossings of watercourses, and construction and operation of other infrastructure may have the following indirect impacts to aquatic MNES:

- localised sedimentation of watercourses associated with runoff from cleared well leases / disturbed watercourse banks
- localised increases in turbidity and suspended solids in surface water associated with runoff from cleared well leases / disturbed watercourse banks
- contamination of watercourses from spills of hydrocarbons and chemicals from vehicles and machinery used during lease preparation, drilling, installation and operation of the well / construction of pipeline and access tracks over watercourses, and
- introduction of aquatic weeds to watercourses via contaminated machinery and vehicles.

8.2 Impact Mitigation Measures

Mitigations proposed to reduce the risk of impact of the Project include:

- implementation of sediment and erosion control plans
- adherence to applicable Australian Standards and codes of practice relating to chemical and fuel use
- adherence to applicable Queensland codes of practice relating to fisheries, and
- construction during dry periods where practicable.

8.3 Assessment of Impact of the Project on Aquatic MNES

The significant impact assessment showed that there is not a significant impact to the aquatic MNES (i.e. Murray cod and surface water resources) associated with direct or indirect impacts of the Project.

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Appendix A EPBC PMST Results

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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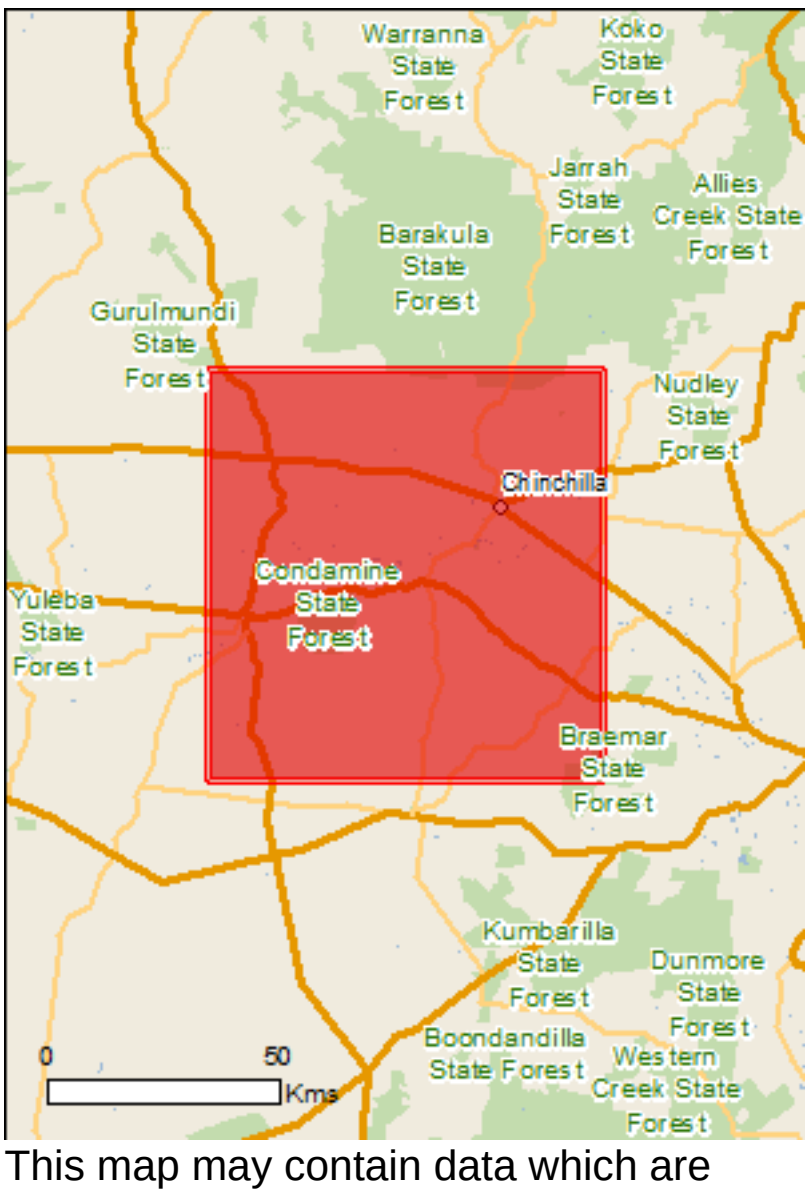

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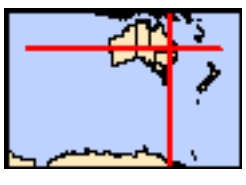

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	38
Listed Migratory Species:	10

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	17
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	28
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Banrock station wetland complex	1200 - 1300km
Narran lake nature reserve	300 - 400km upstream
Riverland	1100 - 1200km
The coorong, and lakes alexandrina and albert wetland	1300 - 1400km

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	Community likely to occur within area
Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland	Critically Endangered	Community likely to occur within area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area
Weeping Myall Woodlands	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat may occur within area
Poephila cincta cincta Southern Black-throated Finch [64447]	Endangered	Species or species

Name	Status	Type of Presence
		habitat may occur within area
[Rostratula australis](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Fish		
[Maccullochella peelii](#) Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Mammals		
[Chalinolobus dwyeri](#) Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
[Dasyurus hallucatus](#) Northern Quoll, Digul [331]	Endangered	Species or species habitat may occur within area
[Nyctophilus corbeni](#) Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat known to occur within area
[Petauroides volans](#) Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
[Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)](#) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
[Pteropus poliocephalus](#) Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Other		
[Adclarkia cameroni](#) Brigalow Woodland Snail [83886]	Endangered	Species or species habitat known to occur within area
[Adclarkia dulacca](#) Dulacca Woodland Snail [83885]	Endangered	Species or species habitat known to occur within area
Plants		
[Acacia lauta](#) Tara Wattle [4165]	Vulnerable	Species or species habitat known to occur within area
[Cadellia pentastylis](#) Ooline [9828]	Vulnerable	Species or species habitat likely to occur within area
[Calytrix gurulmundensis](#) [24241]	Vulnerable	Species or species habitat likely to occur within area
[Denhamia parvifolia](#) Small-leaved Denhamia [18106]	Vulnerable	Species or species habitat likely to occur within area
[Dichanthium queenslandicum](#) King Blue-grass [5481]	Endangered	Species or species habitat may occur within area
[Dichanthium setosum](#) bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
[Eucalyptus argophloia](#) Queensland White Gum, Queensland Western White Gum, Lapunyah, Scrub Gum, White Gum	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence
[19748]		within area
Eucalyptus virens [10181]	Vulnerable	Species or species habitat likely to occur within area
Homopholis belsonii Belson's Panic [2406]	Vulnerable	Species or species habitat may occur within area
Homoranthus decumbens a shrub [55186]	Endangered	Species or species habitat known to occur within area
Philotheca sporadica Kogan Waxflower [64944]	Vulnerable	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Tylophora linearis [55231]	Endangered	Species or species habitat may occur within area
Westringia parvifolia [4822]	Vulnerable	Species or species habitat likely to occur within area
Xerothamnella herbacea [4146]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Anomalopus mackayi Five-clawed Worm-skink, Long-legged Worm-skink [25934]	Vulnerable	Species or species habitat may occur within area
Delma torquata Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area
Denisonia maculata Ornamental Snake [1193]	Vulnerable	Species or species habitat may occur within area
Egernia rugosa Yakka Skink [1420]	Vulnerable	Species or species habitat known to occur within area
Furina dunmalli Dunmall's Snake [59254]	Vulnerable	Species or species habitat known to occur within area
Tympanocryptis condaminensis Condamine Earless Dragon [87888]	Endangered	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat known to occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Anseranas semipalmata		
Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Cuculus saturatus		
Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Chinchilla Rifle Range	QLD

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Acacia nilotica subsp. indica Prickly Acacia [6196]		Species or species habitat may occur within area
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Parthenium hysterophorus Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-26.50493 150.06188,-26.50493 150.82269,-27.21061 150.82269,-27.21061 150.06188,-26.50493 150.06188

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix B Details of Watercourse Crossings within PL1011

Table B1 Details of Watercourse Crossings within the Project footprint area.

Crossing type	Description	Fish passage	Longitude	Latitude	Stream order	Watercourse name	Regional Ecosystem Code
Flowline	Gathering Network ROW	Moderate	150.222329	-27.07489988	2	Unnamed	non-remnant
Flowline	Gathering Network ROW	Low	150.2281066	-27.07185525	1	Unnamed	non-remnant
Flowline	Gathering Network ROW	Low	150.2222025	-27.06984755	1	Unnamed	non-remnant
Flowline	Gathering Network ROW	Low	150.2242917	-27.06437395	1	Unnamed	non-remnant
Flowline	Gathering Network ROW	Low	150.2190211	-27.05996842	1	Unnamed	non-remnant
Flowline	Gathering Network ROW	Low	150.2178416	-27.04861397	1	Unnamed	non-remnant
Flowline	Gathering Network ROW	N/A	150.1869415	-27.02770285	1	Unnamed	non-remnant
Flowline	Gathering Network ROW	N/A	150.1876518	-27.02768963	1	Unnamed	non-remnant
Flowline	Gathering Network ROW	N/A	150.1952355	-27.02872351	1	Unnamed	non-remnant
Other Infrastructure	Stand Alone Access Track	Low	150.2407432	-27.07183753	1	Unnamed	non-remnant
Other Infrastructure	Stand Alone Access Track	Low	150.2112363	-27.0636318	1	Unnamed	non-remnant
Other Infrastructure	Extra Work Space	Low	150.2407122	-27.07175976	1	Unnamed	non-remnant
Other Infrastructure	Extra Work Space	Low	150.2240897	-27.06483472	1	Unnamed	non-remnant
Flowline	Gathering Network ROW	Moderate	150.222329	-27.07489988	2	Unnamed	non-remnant